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## BREEDING BIRD ASSEMBLAGE IN A MOSAIC OF URBANIZED HABITATS IN A CENTRAL EUROPEAN CITY

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**Breeding Bird Assemblage in a Mosaic of Urbanized Habitats in a Central European City. Kopij, G.** — There is a lack of data on the population densities of birds breeding in a mosaic of typical urbanized habitats. This study was undertaken to partly fulfil this gap in our knowledge. Counts were conducted in 2008 by means of simplified territory mapping method in a fragment (1197 ha) of a large Central European city (Wrocław, SW Poland). In total, 50 bird species were breeding in the study area in 2008. The House Sparrow *Passer domesticus*, Common Swift *Apus apus* and Rock Dove comprised about 3/5 of all breeding pairs. The other group of species, each one with a density between 6 and 13 pairs per 100 ha, included seven species, namely the Starling, *Sturnus vulgaris*, Greenfinch, *Carduelis chloris*, House Martin, *Delichon urbica*, Tree Sparrow, *Passer montanus*, Great Tit, *Parus major*, Blue Tit, *Parus caeruleus*, and Jackdaw, *Corvus monedula*. They comprised together about 1/5. The remaining 40 species nested in a density between 0.1 and 3.5 pairs per 100 ha. The most numerous feeding guild were granivores (53.8%) and insectivores (37.9%). Birds nesting on buildings comprised together 74% of all breeding pairs. For a few species (*Luscinia megarhynchos*, *Saxicola torquata*, *Corvus cornix* and *Turdus pilaris*) an increase in their numbers in the last three decades has been evidenced.

**Key words:** urban ecology, community ecology, population densities, population trends.

### Introduction

Most studies on avian assemblages in Central European towns and cities are limited to very small homogenous areas, such as parks, allotment gardens, or small suburb residential areas (e. g. Luniak, 1981; Luniak et al., 2001; Biadun, 2012; Kopij, 2008, 2010, 2014 a, b; Kopij, Zendwalewicz, 2009; Tomiałojc, 2007, 2011; Dombrowski, 2014). Although for common passerines breeding in such habitats, the size of the study plots was large enough to calculate population densities and dominance, for most non-passerines and less common passerines, especially semi-colonial and ecotone species, such plots were too small to generate such parameters (Kopij, 2014). There is a lack of data on the population densities of these species breeding in much larger areas, comprising a mosaic of typical urbanized habitats, such as residential areas, industry areas, parks, gardens, cemeteries, etc. This study was undertaken to partly fulfil this gap in our knowledge. A relatively large plot was selected, which well-represented mosaic of habitats in Central European cities.

### Study area

The study area comprised the Krzyki district in the city of Wrocław, SW Poland (fig. 1). The borders of the study area are as follow: Borowska, Peronowa, Dworcowa and Podwale streets to the west, Oławska str. to the north, Oława River to the east, and the railway to the south. The surface of the study area is 1197 ha.

The study area comprises a mosaic of urbanized habitats: block-buildings estate with 5-storied and lower buildings (c. 33% of the total study area); block-building estate with buildings 6–11 storied (c. 22%); industrial area (c. 15%); allotment gardens and other timbered areas (c. 10%); railways with the central railway station (c. 12%); agriculture lands (c. 8%) (Guziak, 2002). It is, therefore, a mosaic of typical urbanized habitats, which predominate in most Central European cities.

To the north and west, the study area borders to densely built-up areas of the city centre; to the east — the Oława river valley with numerous trees and shrubs, and to the south — loosely built-up residential area, with some wastelands (fig. 1).

The study area was incorporated into Wrocław city in 1904. Before, it was a rural area, with numerous fragmented forests, arable grounds, meadows and villages.

## Methods

Counts were conducted in 2008 using a simplified version of the territory mapping method (Bibby et al., 2012). As in other urban studies (Luniak et al., 2001; Otto, Witt, 2002; Kopij, 2005, 2007), the whole study area was surveyed four times in the breeding season, once in each month. Since the study area was relatively large, two days were spent on counting in each month: 27–28 April, 24–25 May, 15/18 June and 1–7 July 2008.

Counts were conducted in the morning between 6 and 11, under sunny and windless weather. The number of the Magpie, *Pica pica* (L., 1758), Hooded Crow, *Corvus cornix* L., 1758, and Rook, *Corvus frugilegus* L., 1758, were determined by counting their occupied nests.

Since the purpose of the study was to estimate population densities of most breeding non-passerine and less common passerine species, the following species were excluded from counts: Rock Dove, *Columba livia* forma *urbana* Gmelin, 1789, Common Swift *Apus apus* (L., 1758), House Martin, *Delichon urbica* (L. 1758), House Sparrow, *Passer domesticus* L., 1758, Tree Sparrow, *Passer montanus* (L., 1758), Starling, *Sturnus vulgaris* L., 1758, Great Tit, *Parus major* L., 1758, Blue Tit, *Parus caeruleus* L., 1758, Greenfinch, *Carduelis chloris* (L., 1758), and Jackdaw, *Corvus monedula* (L., 1758). Their numbers were only roughly estimated.

## Results and discussion

In total, 50 bird species were recorded as breeding in the study area in 2008. The House Sparrow, Common Swift and Rock Dove comprised about 3/5 of all breeding pairs (table 1). They were associated with buildings as nesting sites. The other group of species, each one with a density between 6 and 13 pairs per 100 ha, included seven species, namely the Starling, Greenfinch, House Martin, Tree Sparrow, Great Tit, Blue Tit, and Jackdaw. They comprised together about 1/5 of all breeding pairs (table 1). The remaining 40 species (fig. 2–15) nested in a density between 0.1 and 3.5 pairs per 100 ha and comprised the remaining 1/5 of all breeding pairs (table 1).

Relatively common were the following species: Pheasant, *Phasianus colchicus* (fig. 12), Nightingale, *Luscinia megarhynchos* (fig. 9), Redstart, *Phoenicurus phoenicurus* (fig. 8), Icterine Warbler, *Hippolais icterina* (fig. 15), Whitethroat, *Sylvia communis* (fig. 2), Golden



Fig. 1. Location of the study area (surrounded with a broken line) in the city of Wrocław: A — borders of the study area; B — rivers; C — main roads; D — loosely built-up areas; E — densely built-up areas.

**Table 1. Breeding bird assemblage in a mosaic of urbanized habitats in Wrocław (1197 ha) in 2008. Numbers of dominant species were only roughly estimated**

| Species   | Number of pairs | Pairs/100 ha | Dominance, % |
|---|-----------------|--------------|--------------|
| <i>Passer domesticus</i> L., 1758                     | 500–1000        | 62.6         | 21.99        |
| <i>Apus apus</i> (L., 1758)                           | 500–1000        | 62.6         | 21.99        |
| <i>Columba livia</i> forma <i>urbana</i> Gmelin, 1789 | 500–1000        | 62.6         | 21.99        |
| <i>Sturnus vulgaris</i> L., 1758                      | 100–200         | 12.5         | 4.40         |
| <i>Carduelis chloris</i> (L., 1758)                   | 100–200         | 12.5         | 4.40         |
| <i>Delichon urbica</i> (L., 1758)                     | 100–200         | 12.5         | 4.40         |
| <i>Passer montanus</i> (L., 1758)                     | 50–100          | 6.3          | 2.20         |
| <i>Parus major</i> L., 1758                           | 50–100          | 6.3          | 2.20         |
| <i>Parus caeruleus</i> L., 1758                       | 50–100          | 6.3          | 2.20         |
| <i>Corvus monedula</i> (L., 1758)                     | 50–100          | 6.3          | 2.20         |
| <i>Streptopelia decaocto</i> (Fivaldszky, 1838)       | 42              | 3.5          | 1.23         |
| <i>Phoenicurus ochruros</i> (S. G. Gmelin, 1774)      | 38              | 3.2          | 1.11         |
| <i>Luscinia megarhynchos</i> (Brehm, 1831)            | 31              | 2.6          | 0.91         |
| <i>Pica pica</i> (L., 1758)                           | 27              | 2.3          | 0.79         |
| <i>Sylvia communis</i> Latham, 1787                   | 26              | 2.2          | 0.76         |
| <i>Turdus merula</i> L., 1758                         | 25              | 2.1          | 0.73         |
| <i>Columba palumbus</i> (L., 1758)                    | 23              | 1.9          | 0.67         |
| <i>Serinus serinus</i> (L., 1766)                     | 21              | 1.8          | 0.62         |
| <i>Acrocephalus palustris</i> (Bechstein, 1798)       | 19              | 1.6          | 0.56         |
| <i>Corvus cornix</i> L., 1758                         | 15              | 1.3          | 0.44         |
| <i>Phoenicurus phoenicurus</i> (L., 1758)             | 14              | 1.2          | 0.41         |
| <i>Phylloscopus collybita</i> (Vieillot, 1817)        | 14              | 1.2          | 0.41         |
| <i>Carduelis carduelis</i> (L., 1758)                 | 14              | 1.2          | 0.41         |
| <i>Fringilla coelebs</i> L., 1758                     | 12              | 1.0          | 0.35         |
| <i>Hippolais icterina</i> (Vieillot, 1817)            | 10              | 0.8          | 0.29         |
| <i>Sylvia curruca</i> (L., 1758)                      | 9               | 0.8          | 0.26         |
| <i>Phasianus colchicus</i> (L., 1758)                 | 8               | 0.7          | 0.23         |
| <i>Gallinula chloropus</i> (L., 1758)                 | 7               | 0.6          | 0.21         |
| <i>Phylloscopus trochilus</i> (L., 1758)              | 6               | 0.5          | 0.18         |
| <i>Acrocephalus arundinaceus</i> (L., 1758)           | 6               | 0.5          | 0.18         |
| <i>Oriolus oriolus</i> (L., 1758)                     | 5               | 0.4          | 0.15         |
| <i>Anas platyrhynchos</i> (L., 1758)                  | 5               | 0.4          | 0.15         |
| <i>Acrocephalus scirpaceus</i> (Hermann, 1804)        | 4               | 0.3          | 0.12         |
| <i>Lanius collurio</i> L., 1758                       | 3               | 0.3          | 0.09         |
| <i>Sitta europaea</i> L. 1758                         | 3               | 0.3          | 0.09         |
| <i>Cuculus canorus</i> (L., 1758)                     | 3               | 0.3          | 0.09         |
| <i>Muscicapa striata</i> (Pallas, 1764)               | 3               | 0.3          | 0.09         |
| <i>Falco tinnunculus</i> L., 1758                     | 2               | 0.2          | 0.06         |
| <i>Saxicola torquata</i> (L., 1766)                   | 2               | 0.2          | 0.06         |
| <i>Turdus pilaris</i> L., 1758                        | 2               | 0.2          | 0.06         |
| <i>Phylloscopus sibilatrix</i> (Bechstein, 1793)      | 2               | 0.2          | 0.06         |
| <i>Hirundo rustica</i> (L., 1758)                     | 1               | 0.1          | 0.03         |
| <i>Dendrocopos major</i> (L., 1758)                   | 1               | 0.1          | 0.03         |
| <i>Corvus frugilegus</i> L., 1758                     | 1               | 0.1          | 0.03         |
| <i>Fulica atra</i> L., 1758                           | 1               | 0.1          | 0.03         |
| <i>Carduelis cannabina</i> (L., 1758)                 | 1               | 0.1          | 0.03         |
| <i>Podiceps cristatus</i> (L., 1758)                  | 1               | 0.1          | 0.03         |
| <i>Aegithalos caudatus</i> (L., 1758)                 | 1               | 0.1          | 0.03         |
| <i>Erithacus rubecula</i> L., 1758                    | 1               | 0.1          | 0.03         |
| <i>Locustella naevia</i> (Boddaert, 1783)             | 1               | 0.1          | 0.03         |



Fig. 2. Distribution of occupied territories of *Sylvia communis*.



Fig. 3. Distribution of occupied territories of *Sylvia curruca*.

Oriole, *Oriolus oriolus* (fig. 12), Marsh Warbler, *Acrocephalus palustris* (fig. 7), Serine, *Serinus serinus* (fig. 4), and Goldfinch, *Carduelis carduelis* (fig. 14). They occurred mainly in some wastelands along railway and timbered banks in Oława Valley. Both areas are located on the periphery of the city.

On the other hand, unexpectedly low densities of the following other species were recorded: Chaffinch, *Fringilla coelebs* (fig. 13), Blackbird, *Turdus merula* (fig. 6), Spotted

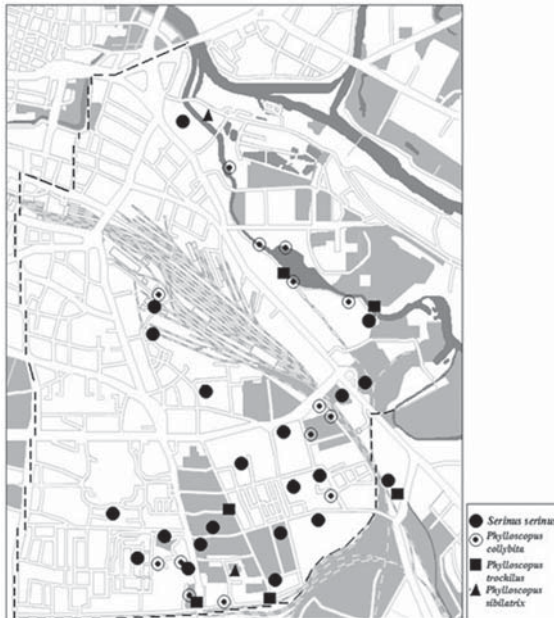


Fig. 4. Distribution of occupied territories of *Serinus serinus*, *Phylloscopus collybita*, *P. trochilus* and *P. sibilatrix*.

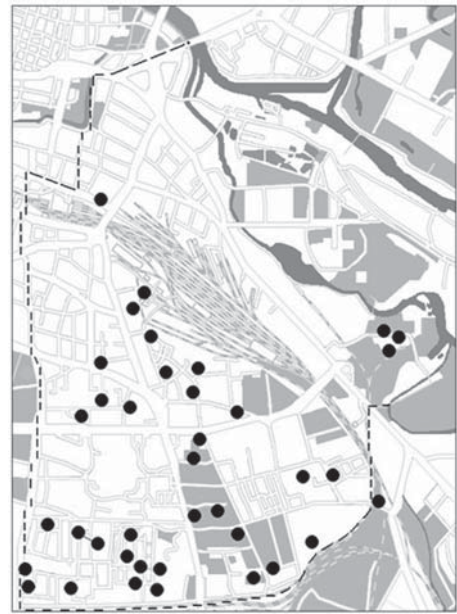


Fig. 5. Distribution of occupied territories of *Phoenicurus ochruros*.

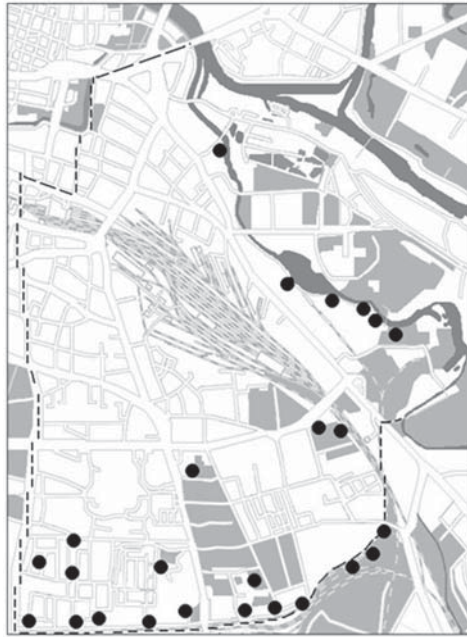


Fig. 6. Distribution of occupied territories of *Turdus merula*.

Flycatcher, *Muscicapa striata* (fig. 15), Common Kestrel, *Falco tinnunculus* (fig. 15), Barn Swallow, *Hirundo rustica* (fig. 15), and Robin, *Erithacus rubecula* (fig. 15).

Species such as the Marsh Warbler, Red-backed Shrike, *Lanius collurio*, Grasshopper Warbler, *Locustella naevia*, and Cuckoo, *Cuculus canorus*, are indicators of rests of semi-natural habitat (Kopij, 2014). In this study, the species were represented by 26 pairs (i. e. 2.2 pairs per 100 ha), which indicate that the semi-natural habitats are still well-preserved. With further city development, density of these species will inevitably decrease, and they may finally disappear altogether.

The numbers of the Magpie (fig. 10), Pied Crow (fig. 10), and House Redstart, *Phoenicurus ochruros* (fig. 5) could have been underestimated in this study. Also data on the population densities of the most common species should be taken with a precaution, as they were only roughly estimated.

Some of the species recorded in this study as relatively common, namely the Serine, Icterine Warbler, Willow Warbler, Pied Flycatcher (Bauer, Berthold 1997), have virtually disappeared from urbanized habitats of West-Central European cities (Kopij, 2014). Reasons for this are unknown. On the other hand, species which are common in West European cities, such as Dunnock, *Prunella modularis*, or Wren, *Troglodytes troglodytes* were not recorded at all as breeding residents in this study. They are, however, expected to occupy some habitats in this area in the near future.

The most numerous feeding guild were granivores (53.8 %) represented by 10 species. House Sparrow and Rock Dove alone comprised 44 %. The second most numerous feeding guild were insectivores (37.9 %) represented by 30 species, including the Common Swift with 22 %. Frugivores were represented by two species and comprised 4.4 %. Other feeding guilds were represented by eight species and comprised together 3.8 %.

Although birds nesting on buildings were represented by eight species only, they comprised together 74 % of all breeding pairs. Only three species, namely the House Sparrow, Rock Dove and Common Swift contributed 66 %. Those species nesting on trees and shrubs were more numerous than species nesting on/in buildings ( $n = 21$ ), but they comprised only 12.4 %. Hole-nesting species ( $n = 8$ ) constituted a similar proportion

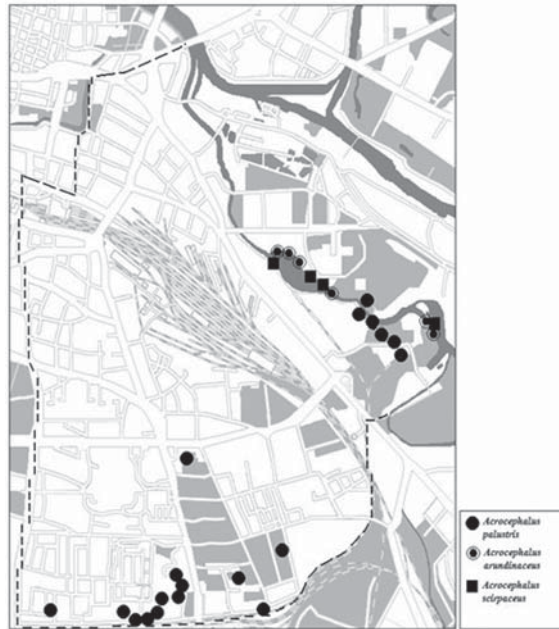


Fig. 7. Distribution of occupied territories of *Acrocephalus palustris*, *A. Arundinaceus* and *A. scirpaceus*.

(11.6 %). Other nesting guilds were much smaller. Eleven species nested in herbaceous vegetation (1.8 %) and two species on the ground (0.4 %).

Unfortunately, no complex quantitative studies on bird assemblages were ever conducted in the study area. Such data were collected only for a few species, namely: Tawny Owl, *Strix aluco* (Rachel et al., 2002), Long-eared Owl, *Asio otus* (Rachel et al., 2002), Nightingale (Marszałek, 1992), Stonechat, *Saxicola torquata* (Dyrzcz et al., 1991), and Rook (Czapulak, Betleja, 2002).

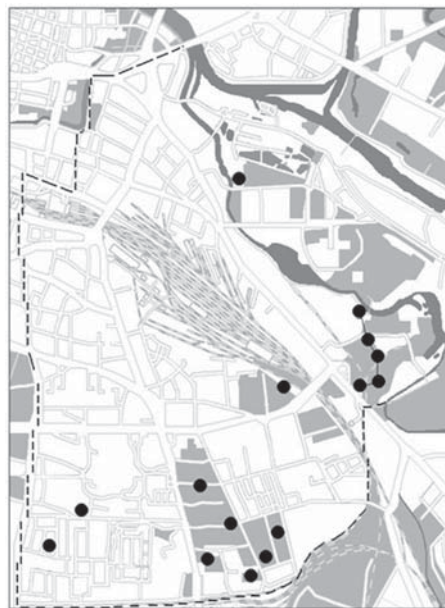


Fig. 8. Distribution of occupied territories of *Phoenicurus phoenicurus*.

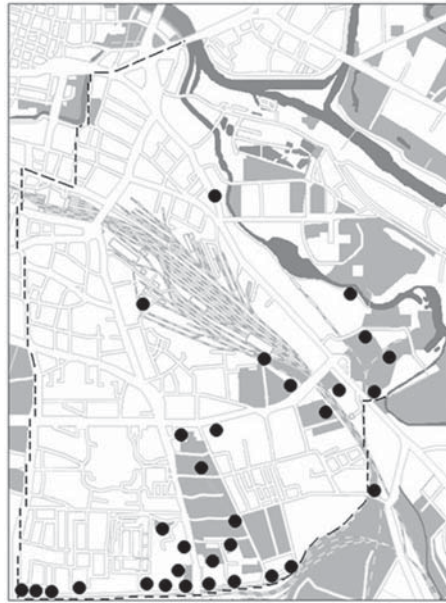


Fig. 9. Distribution of occupied territories of *Luscinia megarhynchos*.

In 1990, 9–10 pairs of the Nightingale were recorded (Marszalek, 1992), while in 2008, 31 pairs were counted (this study). On the other hand, only one Rook nest was recorded in 2008, while there were two colonies, one with more than 100 nests and the other with 50–100 nests, in 1987–1988 (Czapulak, Betleja, 2002). In 1995, single pairs of the Tawny Owl and Long-eared Owls were recorded in the study area (Rachel et al., 2002). Although they were not recorded in 2008, they could have passed undetected, as counts were not conducted during the night.

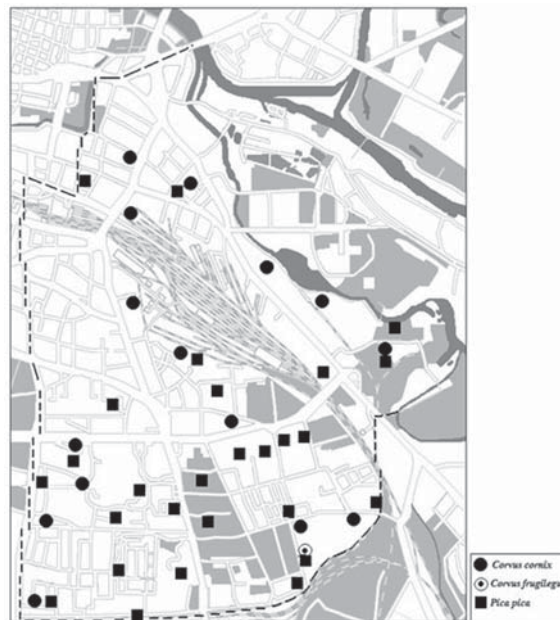


Fig. 10. Distribution of occupied territories of *Corvus cornix*, *C. frugilegus* and *Pica pica*.

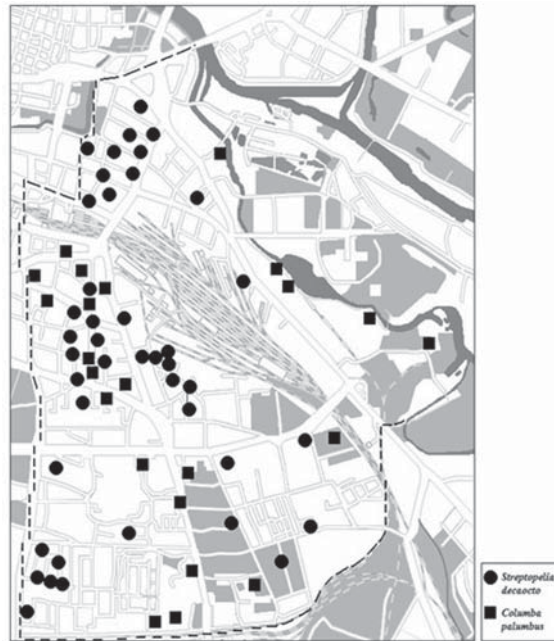


Fig. 11. Distribution of occupied territories of *Streptopelia decaocto* and *Columba palumbus*.

During the years 1978–1987, the Stonechat was not recorded as breeding species in the study area (Dyrz et al., 1991), while 2 pairs nested there in 2008 (this study). Also the Hooded Crow and the Fieldfare, *Turdus pilaris*, are relatively newcomers in the study area. The former species began to breed probably in the early 1980's, while the latter one probably in the late 1990's.

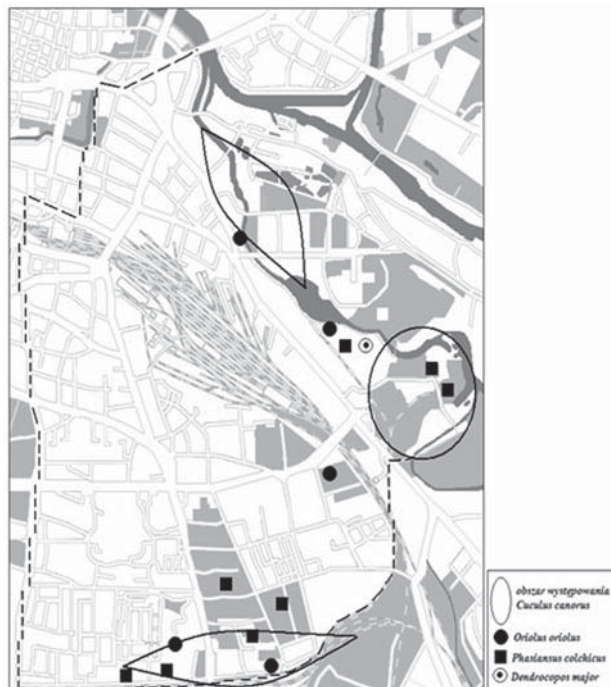


Fig. 12. Distribution of occupied territories of *Cuculus canorus*, *Oriolus oriolus*, *Phasianus colchicus* and *Dendrocopos major*.



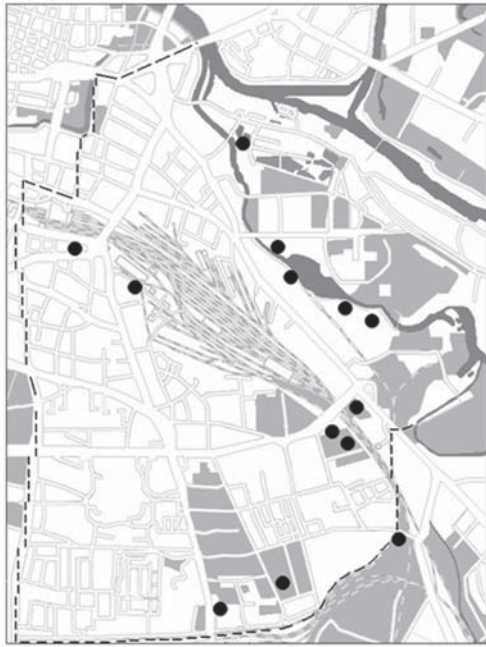


Fig. 13 Distribution of occupied territories of *Fringilla coelebs*.

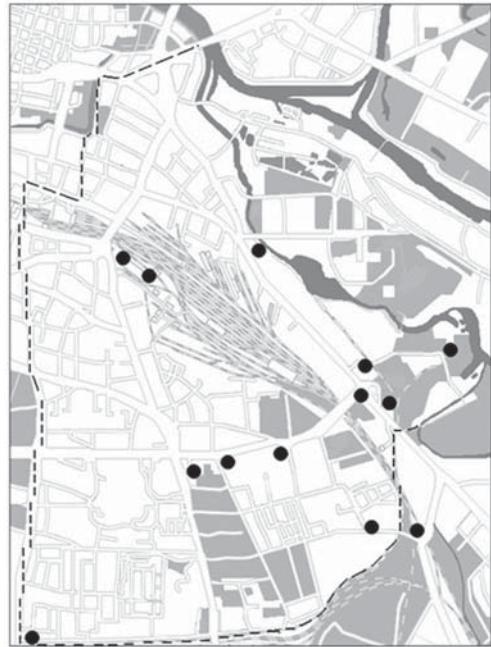


Fig. 14. Distribution of occupied territories of *Carduelis carduelis*.

In conclusion, it should be stressed that the breeding bird assemblage is relatively diverse. However, only 12 species (24 % of all species) composed almost 90 % of all breeding pairs, while the remaining 38 species nested in densities each one below 3 pairs per 100 ha. The assemblage had a similar proportion of granivores and insectivores.

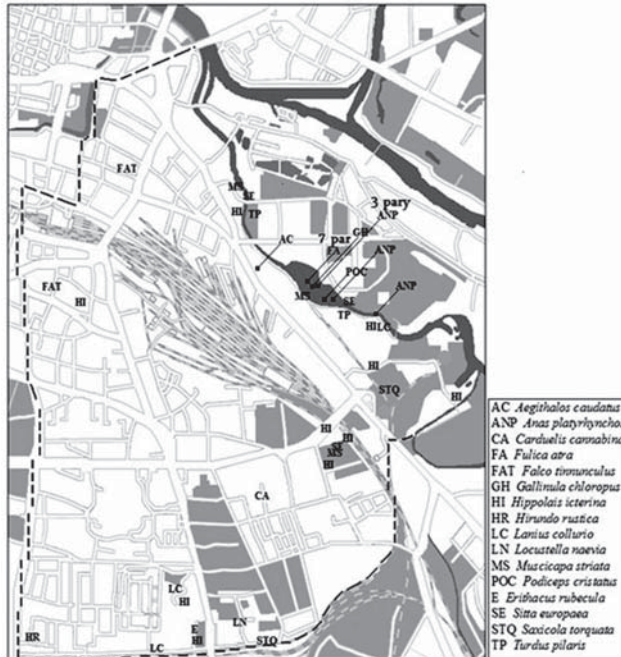


Fig. 15. Distribution of occupied territories of 16 rare species.

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