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ORIGINAL ARTICLE

Ecological distribution and population densities of raptors in the inner and outer zone of a Central European city

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Five raptor species were recorded as breeding in the city of Wrocław (293 km^2) during the years 2002-2010: *Falco tinnunculus* (2.4 pairs per 10 km^2), *Buteo buteo* (4.1 pairs/10 km^2 of wooded area), *Accipiter gentilis* (3.1 pairs/10 km^2 of wooded area), *Accipiter nisus* (1.6 pairs/10 km^2 of wooded area), *Circus aeruginosus* (0.2 pairs per 10 km^2). All these species have increased in numbers over the last 20-30 years, both in the inner and outer zone of the city. *Falco tinnunculus* is a well-established raptor in the inner part of the city, while *Accipiter nisus, A. gentilis, Buteo buteo* started to infiltrate to the inner zone. In the last 70 years, a few cases of nesting were recorded for four other raptor species in Wrocław: *Milvus migrans, Milvus milvus, Pernis apivorus* and *Falco subbuteo,* but none of them was recorded in the inner zone of the city. Abundant and stable food supply (small mammals, columbids, corvids and small passerine birds), and freely available nesting and perching sites may contribute to this success.
Key words: population density; urban ornithology; Wrocław; *Falco tinnunculus; Buteo buteo; Accipiter gentilis; Accipiter nisus; Circus aeruginosus*

Introduction

Raptors are often regarded as associated with natural areas, such as mountains, primeval forests, lake-lands and extensive wetlands (Newton, 1979). Some of them, however, may become well-adapted to highly transformed environments, such as farmlands and cities (Rutz, 2003, 2006; Papp, 2011). In European cities, the following raptor species have become common residents: lesser kestrel (*Falco naumanni*), common kestrel (*Falco tinnunculus*), and peregrine (*Falco peregrinus*) (Bauer & Berthold, 1997; Bird, Varland & Negro, 1996; Chace & Walsh, 2004; Hager, 2009; Love & Bird, 2000; Poppelton, 2016). Those are species associated with rocks as natural nesting sites. They have successfully adopted buildings and other man-made structures as nesting sites, and find in cities rich and easily available food resources, such as insects, rodents and columbids (Chace & Walsh, 2004). In recent years also the Eurasian sparrowhawk *Accipiter nisus* (Berces, 2007; Biaduń, 2006; Janiszewski, Wojciechowski & Markowski, 2010; Peske, 1994) and the goshawk *Accipiter gentilis* (Wurfess, 1999; Rutz, 2001; Henken, 2002; Solonen, 2008) are becoming increasingly urbanized over larger parts of Europe. It has been suggested that some urban raptors, such as the peregrine falcon or common kestrel may even serve as source populations in a metapopulation context (Kauffman, Frich & Linthicum, 2004).

Most other raptor species are associated with old stands of deciduous or mixed forests, wetlands or lake-lands. In Central Europe, such habitats have been greatly reduced and continue to disappear from the landscape. As a result, many raptor species associated with such habitats are in decline over larger parts of Europe. The Bird Directive (79/409/EEC) adopted by the E.U. Member States ensures the protection of some of them, e.g. white-tailed fish eagle *Haliaaetus albicilla*, marsh harrier *Circus aeruginosus*, black kite *Milvus migrans*, and red kite *Milvus mlivus.* However, many others remain threatened due to habitat loss/transformation.

In some large cities, some semi-natural stands of forest fragments and wetlands do still survive, either in the form of parks in inner zones, or communal forests and wetlands or polders on the peripheries. In general, such forests and wetlands are, however, regarded as suboptimal, or even marginal habitats for raptors, because their vegetation structure is usually simplified and their patch size too small to accommodate most species belonging to this group, which have extensive home ranges.

The aim of this study was to estimate numbers of raptor species in the city of Wrocław, where forest habitats and wetlands are relatively well-preserved. For each species, population densities in the inner zone were compared with those in the outer zone of the city, as to determine the impact of urbanization on the raptor community. An attempt is also made to determine the resilience of the raptor community to urbanization.

Study area

The city of Wrocław (SW Poland) within its administrative boundaries has a surface area of 293 km^2, and a human population of c. 640 000 (in 2004). The city is situated in the large Odra Valley, where four other smaller rivers (Oława, Ślęża, Bystrzyca, and Widawa) join the Odra river. There are extensive grasslands and wetlands along these rivers.
In 2004, arable land comprised 44.8% of the total surface area of the city, whereas 5.6% were covered by forests and wooded areas, 3.4% by water, 9.8% by roads, 18.7% by built-up areas, 3.7% by gardens, 6.1% by recreational areas, and 1.3% by wastelands (data from the city government). Marshlands and meadows comprise together 6.6% (Fig. 1-4).

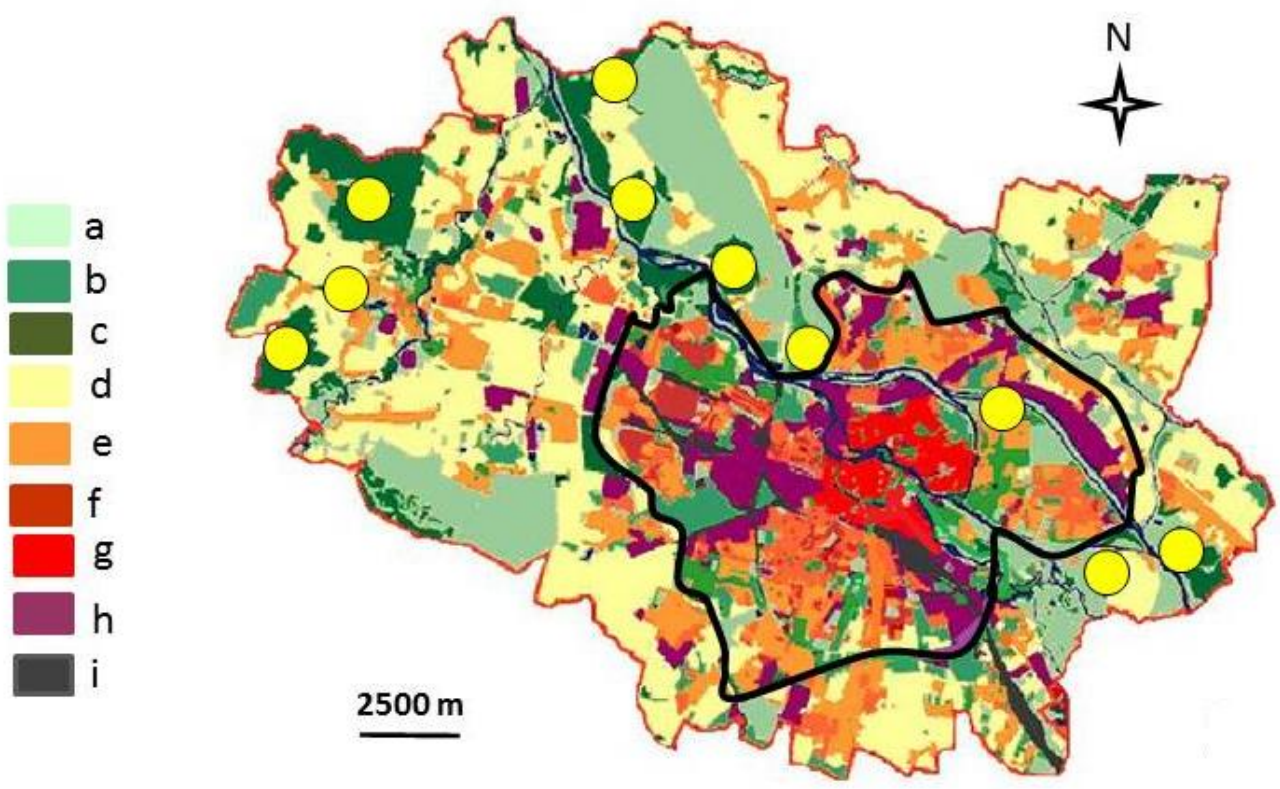

Fig. 1. Distribution of goshawk breeding pairs in the city of Wrocław during the years 2002-2010. The black continuous line indicates the border between inner and outer part of the city. a – grassy areas, b – parks, c – woods, d – arable grounds, e – loosely built-up areas, f – block built-up areas, g – densely built-up areas, h – industry areas, i – railway.

There are 13 forests in Wrocław, with a total surface area of 2286 ha. Most of these forests are dominated by *Tilo-Carpinetum* stands, but forests situated in the western part (Mokrzański, Rędziński) are composed mainly of pines *Pinus sylvestris*. In total, there are 44 parks in Wrocław, with a total surface of 781 ha. The biggest parks are: Szczytnicki (120 ha), Tysiąclecia (90ha), Zachodni (75 ha), Grabiszyński (48 ha) and Wschodni (30 ha). Six other parks range in surface size from 10 to 29 ha, and the remaining are between 2 and 10 ha. Small afforested areas are scattered all over the city, especially in SE part. So, all timbered areas occupy in Wrocław c. 3200 ha, i.e. 11% of the total surface area of the city.
From ecological point of view man-modified landscape can be classified as rural (agriculture and sylviculture) and urban (Bird et al., 1996). In this study, two zones were distinguished in the urban landscape of the city of Wrocław: outer and inner (Fig. 1-4). The inner zone comprises roughly 1/3 of the whole city area. The zones differed in the proportion of densely built-up, open and afforested areas. In the inner zone of the city, most area is occupied by densely built-up areas, in the outer zone, by open and afforested areas. In the outer zone of the city afforested areas occupies 2380 ha, in the inner part – 820 ha. The inner zone is regarded as urban in this paper. Although the outer zone cannot be regarded as urban area, it may be defined as wildlife/urban interface or rural end in the urbanization gradient (Chace & Walsh, 2004). Breeding recorded in that zone is not regarded in this paper as a sign of urbanization.
The climate of Wrocław is temperate, slightly warmer than the neighbouring areas. The mean annual temperature is 9.7˚C, with the monthly mean of the coldest month (January) -0.5˚C, and the warmest month (July) 19.9˚C. Mean annual precipitation is 548 mm. Mean annual humidity is 76%. There are on average 158 days with rains per year, and 1670 hours with sunny weather per year. The snow cover lasts on average 35 days per year (Smolnicki & Szykasiuk, 2002; Bryś & Bryś, 2010).

Methods

Urbanization is regarded as expanding of a species into inner city zone. The expansion is demonstrated by an increase in breeding population density along an urban gradient (Bird et al., 1996), and is usually facilitated with the breeding performance higher in urban habitats than in rural or/and natural habitats. Considering this, species living in urban environment can be regarded as urban avoiders, suburban adaptable and urban exploiters (Blain, 1996). Urbanization refers to urban exploiters, i.e. species favoured by urbanization.

A simplified version of territory mapping method (Bibby, Burgess & Hill, 2012) has been employed to plot on maps occupied territories of all raptors, except for the common kestrel. All habitats within the administrative boundaries of Wrocław (Fig. 1-4) were surveyed four times in breeding seasons.

First survey was carried out in April, second in May, third in June and fourth in July. Different parts of the city were surveyed in different years. Some of them were covered by Kopij (2004, 2005, 2007, 2008, 2010, 2014a, 2014b, 2014c, 2016b, 2016c). All parts were covered within the period from 2002 to 2010.

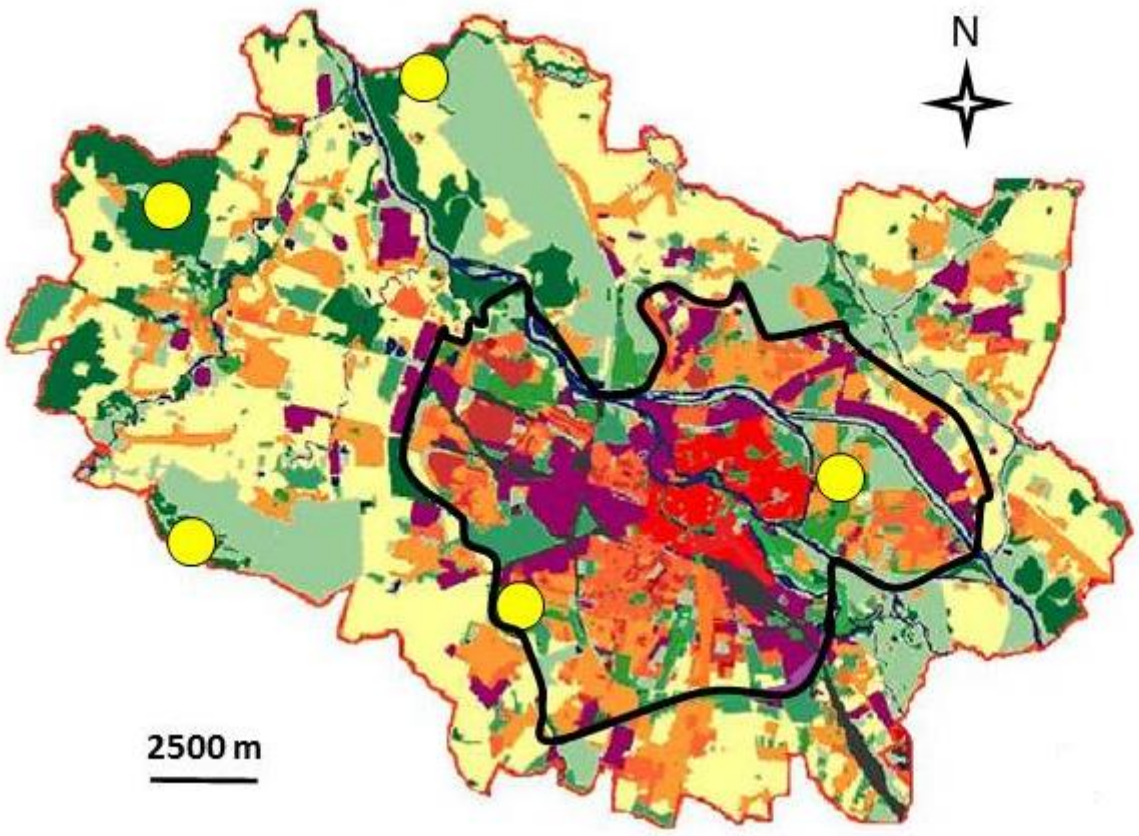

Fig. 2. Distribution of Eurasian sparrowhawk breeding pairs in the city of Wrocław during the years 2002-2010.

Each seen or heard individual was plotted on the map 1: 10000. Special attention was paid to birds performing territorial and/or breeding behaviour. At least two records of such bird at the same site, made in, at least, a two-week-interval, were assumed as representing an occupied territory. An occupied territory is also assumed when an occupied nest was found or a pair showing breeding or territorial behaviour was recorded even once, but in an optimal habitat and well in their breeding season. A breeding pair was regarded as urbanized if nesting was recorded in the inner zone of the city.

Differences in the number of breeding pairs between the outer and inner zone were tested using the x^2-test.

Maps were generated to show the distribution of breeding pairs of all species under the study. The distribution is shown on the background of habitats (as in Smolnicki & Szykasiuk, 2002) in the city of Wrocław, to shed light on their habitat preferences.

Results

In total, five raptor species were recorded as breeding in the city of Wrocław during the years 2002-2010. Except for the marsh harrier, all were recorded both in the inner and outer zone. (Table 1; Fig. 1-4).

The common kestrel was by far the commonest species, followed by the common buzzard. The goshawk and Eurasian sparrowhawk are still scarce in Wrocław.

The marsh harrier numbers, have markedly changed over the years. The highest numbers were 13 breeding pairs, but in some drier years, the numbers decreased to merely five pairs. However, the marsh harrier nested only in the outer zone.

Table 1. Numbers and density of raptors in the city of Wrocław during the years 2002-2010.

Species	Number of pairs	Crude density [pairs/10 km^2 of total surface area]	Ecological density [pairs/10 km^2 of wooded area]	Dominance
Eurasian sparrowhawk	5	0.2	1.6	4.2
Goshawk	10	0.3	3.1	8.3
marsh harrier	7	0.2	-	5.8
common buzzard	32	1.1	10.0	26.7
common kestrel*	64-67	2.2-2.3	-	55.0

* - based on Kopij et al. (2009)

Most goshawk territories were located in the Odra river valley (Fig. 1), while those of the Eurasian sparrowhawk were quite evenly distributed over the city (Fig. 2). The marsh harrier was only recorded in the sewage farm in the north-west and in the irrigation fields in the east (Fig. 3).

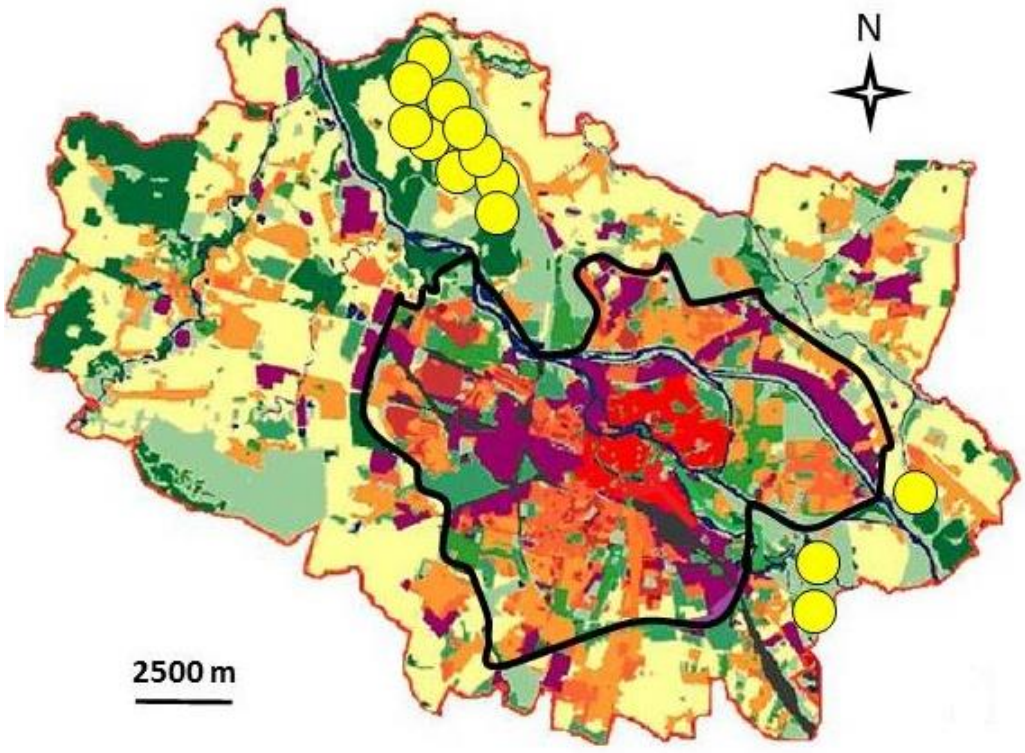

Fig. 3. Distribution of marsh harrier breeding pairs in the city of Wrocław during the years 2002-2010.

Over the years 2002-2010, its numbers markedly fluctuated in the former area from one to five pairs depending on the local water regime and human disturbances. The common buzzards concentrated in the north-west and eastern part of the city, where there are some larger forests (Fig. 4). Only the common kestrel density was much higher in the inner than in the outer zone of the city (Table 2). Both the crude and ecological density of the Eurasian sparrowhawk was higher in inner than in outer zone (0.2 vs. 0.1 pairs per 1000 ha, and 2.4 vs. 1.3 pairs per 1000 ha of wooded area, respectively). In the inner zone, the Eurasian sparrowhawk was recorded as nesting in urban parks, surrounded by densely built-up areas, close to the city centre. Both the crude and ecological density of the goshawk and common buzzard was much higher in the outer than in inner zone (Table 2). The marsh harrier was recorded as breeding only in the outer zone (Fig. 3, Table 2).

Table 2. Comparison of the numbers (N) of occupied territories and crude population density (Cn – pairs/10 km^2 of total surface area) of raptors in the outer (c. 193 km^2) and inner (c. 100 km^2) zone of the city of Wrocław.

Species	Outer zone		Inner zone		x^2-test	P
	N	Dc	N	Dc		
Eurasian sparrowhawk	3	0.2	2	0.2	-	-
goshawk	9	0.5	1	0.1	6.4	>0.05
marsh harrier	7	0.4	0	0.0	13.0	>0.01
common buzzard	28	1.5	4	0.4	18.0	>0.01
common kestrel*	20	1.0	45	4.5	9.6	>0.01

* - based on Kopij et al. (2009)

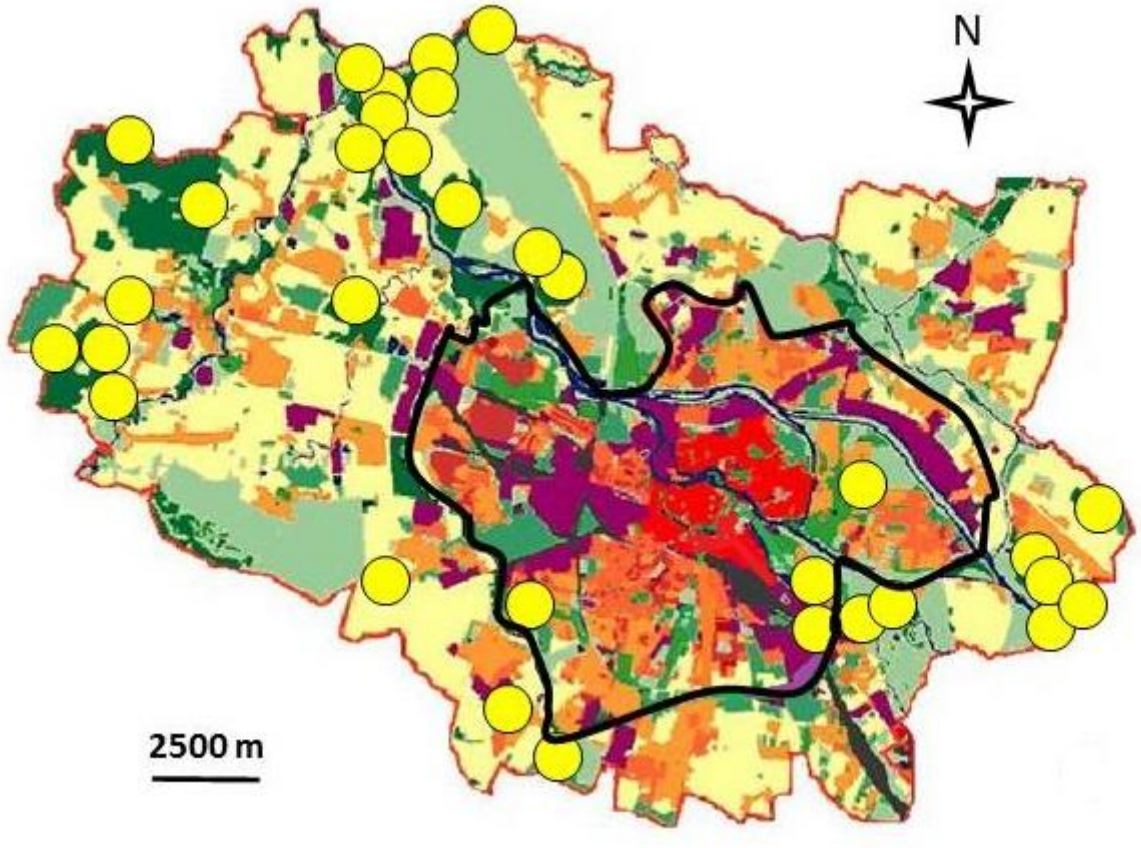

Fig. 4. Distribution of common buzzard breeding pairs in the city of Wrocław during the years 2002-2010.

In the last 70 years, a few cases of nesting were recorded for four other raptor species in Wrocław, namely the black kite, red kite, honey buzzard, and hobby *Falco subbuteo* (Szarski, 1955; Lontkowski, Okulewicz & Drazny, 1988; Dyrcz, Grabiński, Stawarczyk & Witkowski, 1991; Słychan, 1996; Orłowski, Martini & Martini, 2006).

Discussion

Raptors are becoming increasingly urbanized worldwide (Rutz , 2006; Papp, 2011) as living conditions (mainly availability of food and nesting sites) are more favourable in the city than in non-urban environment (Love & Bird, 2000; Rutz, 2006). This urbanization is evidenced by increasing population size, parallel increase in reproductive performance, extending diurnal activity and breeding season, and reducing migratory ability (Chamberlain et al., 2009). Urbanization favours a few raptor species but discriminate most others. It tends to favour those raptors which are comparatively small and prey mainly on rodents, columbids, corvids or small passerines; and those which can adapt buildings and other man-made structures and exotic trees as nesting sites. In the Holarctic Region, the following raptor species were recorded as well-adapted to urban environment: red-shouldered hawk *Buteo lineatus*, broad-winged hawk *Buteo platypterus*, red-tailed hawk *Buteo jamaicensis*, Harri's hawk *Parabuteo unicinctus*, Eurasian sparrowhawk, goshwak (urbanizing only in Europe), Japanese sparrowhawk *Accipiter gularis*, Cooper's hawk *Accipiter cooperii*, common kestrel, lesser kestrel, American kestrel *Falco sparverius*, peregrine, and Mississippi kite *Ictinia mississippiensis* (Chace & Walsh, 2004; Solonen, 2008; Hager, 2009; Poppelton, 2016). It is interesting to note that in the Nearctic Region the *Buteo* species are well-adapted, while most *Accipiter* species are not adaptable to urban environment. However, the reverse is true in regard to the Palearctic Region. The common buzzard, so numerous in the rural areas, is absent in the inner zone of most Polish and other European cities (Bird et al., 1996), while *Accipiter* species are well-adapted to live in urban areas all over Europe (Bird et al., 1996; Solonen, 2008; Papp, 2014).

The same species recorded in Wrocław were recorded as breeding in Łódź, a city of the same surface area size as Wrocław (293 km^2) and similar proportion of wooded areas (Janiszewski et al., 2009). In Warsaw, beside those five raptor species, three other were recorded as very rare breeding resident (1-3 pairs each): honey buzzard *Parnis apivorus,* hobby *Falco subbuteo* and peregrine (Luniak, Kozłowski, Nowicki & Plit, 2001). However, Warsaw is much bigger city (494 km^2) than Wrocław (293 km^2) and study period was extended over longer time in Warsaw than in Wrocław.

The commonest raptor species in Wrocław was the common kestrel (Kopij et al., 2009). Most of the 64-67 breeding pairs recorded in 2005-2007 nested in the built-up areas in the inner part of the city (Table 2). So, this species strongly preferred the inner zone (Table 2). It was more common in Wrocław than any other city investigated in Poland. However, during the years 1978-87, it nested in Wrocław at a much lower (30 pairs per 293 km^2) density (Dyrcz et al., 1991) compared to 2002-2010 (this study). In Warsaw, c. 60 pairs per 494 km^2 were recorded, including 40 pairs per 100 km^2 of the inner city (Luniak et al., 2001). In Łódź, c. 40 pairs, including c. 15 p. in the inner city (Janiszewski et al., 2009). Since a rapid increase of the common kestrel was recorded in the last few decades in Polish urbanized habitats (Kopij et al. 2009), the data from Warsaw were probably much

lower in 1986-1990 than twenty years later. The common kestrel appears to be even more numerous in other big European cities, for example in Hamburg it breeds in a density of 20.1 pairs per 100 km^2 (Mitschke & Baumung, 2001), Berlin 23-33 (Otto & Witt 2002), Paris 40-55 (Malher, Lesaffre, Zucca & Coatmeur, 2010) and Vienna 60-96 pairs per 100 km^2 (Sumasgutner, Krenn, Duesberg, Gaspar & Gamauf, 2013). In cities, the common kestrel can greatly benefit from abundant nesting sites (church towers, water towers, tall block buildings), stable and abundant food supply (small rodents and some passerines) and lack of natural predators.

The second commonest raptor species in the city of Wrocław was the common buzzard (4.1 pairs per 10 km^2 of wooded area). Most pairs nested in larger woods in the outer zone. It clearly avoids the inner zone (Fig. 4, Table 2). In Łódź, the ecological density was similar (4.6 pairs), but in Warsaw it was much lower (0.8-1.7). It is relatively large food specialist, and as such has limited ability to adapt to urban environment (Poppelton, 2016). It is strongly associated with an ecotone zone, i.e. forest/arable field borders (Cramp, 1979; Newton, 1979). There is a lack of such ecotone in the inner zone of most cities and this may further exclude the species to live in urban areas. The lack of larger arable fields in a proximity to its territory seems to be more important in this regard than the presence of forests, as it is known to breed in farmlands (e.g. in southern Opole Silesia) totally devoid of even smallest patches of forests (G. Kopij, own observ.). Both the common kestrel and common buzzard are partial migrants and urban habitats may provide them conducive environment for overwintering at their breeding range, so the tendency for residency throughout the year may increase with the increase of urbanization in those two raptor species.

The goshawk is a classic example a shy forest raptor which has been regarded as sensitive to human disturbance and avoiding cities, being recorded only on its peripheries (Newton, 1979). In Wrocław, its breeding density was, however, quite high, 3.1 pairs per 10 km^2 of wooded area, much higher than that recorded in Warsaw (0.7-1.0), but like that recorded in Łódź (2.8). During the years 1978-1987, only three pairs of the goshawk were recorded in outer zone of Wrocław (Dyrcz et al., 1991). Therefore, over about 20 years, a three-fold increase in its density was recorded in wooded areas in this city. It is also important to point out, that the numbers of goshawk, as well as many other forest species in 1978-87 (Dyrcz et al., 1991) were greatly underestimated in some regions. The increase of the goshawk is, therefore, probably not so drastic as the comparison may show. In addition, only one out of 10 pairs was recorded in the inner zone of the city. Therefore, this increase cannot be regarded as a sign of urbanization. It should be also pointed out that the increase in goshawk breeding pairs recorded in the outer zone of the city of Wrocław is paralleled by a similar increase recorded in rural areas in SW Poland (Kopij, 2006, 2012, 2016a).

From the Fig. 1, it is however clear that the goshawk infiltrates into the inner zone of Wrocław city along the Odra river valley. Its appearance and subsequent increase in urban areas across Europe has been evidenced in Cologne (Würfess, 1999), Hamburg (Rutz, 2003, 2004, 2006), Berlin (Hanken, 2002), and Helsinki (Solonen, 2008). It may greatly benefit from the abundant and stable food supply in larger cities. It has been documented that in such habitat, its diet consists mainly of columbids, corvids and some abundant passerines, specifically the feral pigeon *Columba livia f. domestica*, wood pigeon *Columba palumbus*, magpie *Pica pica*, blackbird *Turdus merula*, and starling *Sturnus vulgaris* (Rutz, 2003, 2004). These are abundant indeed, even super abundant species in most urban areas across Europe, including Wrocław and other Polish cities (own observ.). In forests outside cities there is usually more intense wood harvesting than in forests in urban areas. Wood harvesting may disturb its strong territorial behaviour, forcing it to constantly change its territories (Solonen, 2008). The goshawk does not suffer so much direct human persecution in urban as it does in rural areas (own observ.) and this was often attributed as the main reason for its decline in last decades (Newton, 1979). Its living conditions appear, therefore, much more favourable in the city than in non-urban environments (Rutz, 2006). Avian reproductive performance reflects adaptability to habitat, and it has been shown that goshawk has higher breeding success in urban than in neighbouring rural areas (Solonen, 2008). In urban areas it may, however, require larger forests, as its home range in such environment was determined as 863 ha (Rutz, 2006). There is a lack of larger forests in many inner city zones, including Wrocław. A suitable nesting tree is essential prerequisite for breeding (Solonen, 2008), and in some urban areas such trees may not be available (but in Wrocław such trees are common). The goshawk may also suffer poisoning from residual pesticides applied to control columbids (Chace & Walsh, 2004).

The Eurasian sparrowhawk is still rare breeding species in Wrocław, with 1.6 pairs per 10km^2 of wooded area, a density higher than that recorded in Warsaw (0.3-1.0; Luniak et al., 2001), but much lower than that recorded in Łódź (4.6) according to Janiszewski et al. (2009, 2012). Dyrcz et al. (1991) did not record this species in Wrocław. There is, therefore, evident increase in its numbers over the last 20 years in this city. Such increase has also been evidenced in Łódź from 13 pairs in 2000, to 34 pairs in 2010 (Janiszewski et al., 2012), and in Lublin from 4 pairs in 2002, to 6 pairs in 2005 (Biaduń, 2006). Although the status of the Eurasian sparrowhawk's urban population is understudied in Poland (Janiszewski et al., 2012), its infiltration to urban areas in some Polish cities is evident. In Prague, it is now well-established breeding raptor, with 120 pairs (including 90 pairs in the inner zone), recorded in the 1990's (Peske, 1994). Similarly, in Budapest, there is a stable breeding population of c. 200 pairs, where the species begun to breed 20 years earlier (Berces, 2007).

Like the goshawk, the Eurasian sparrowhawk may also benefit from abundant and stable food supply in urban areas (passerines). The avian species richness is usually lower in urban than in rural areas, but the reverse is often true regarding the overall breeding density, where avian communities are totally dominated by a few, often introduced, species (Chace & Walsh, 2004). In urban gradient, the peak of avian diversity is found in areas of moderate disturbance in so called wildlife/urban interface or in suburbs (Chace & Walsh, 2004). Such areas often form a ring of so called green belt around the city centre, and it is in that belt that Eurasian sparrowhawk are expected to reach the highest population density. The Eurasian sparrowhawk may also benefit from forest fragmentation, increased land-cover heterogeneity, high perching sites availability, and relatively low natural predation (Poppelton, 2016).

The marsh harrier reached much higher density (7 pairs, i.e. 0.4 pairs per 10 km^2 of whole area) in Wrocław than in Warsaw (0.02-0.04 pairs per 10 km^2; Luniak et al., 2001) and Łódź (0.2 pairs per 10 km^2; Janiszewski et al., 2012). During the years 1978-

87, 2-4 pairs were recorded in Wrocław, which indicate an increase over the last 20 years. However, up to 10 pairs nested in the 1990's in the sewage farm situated in the north-western part of the city (Słychan, 1996). It, however, avoids the inner zone of the city (Fig. 3, Table 2). It is a relatively large raptor species which requires marshlands in its territory. Such habitats are usually not available in the inner city zones. In Wrocław, marshlands are situated only in the outer zone, in north-west and eastern part of the city. Both areas are occupied by the marsh harrier, but its number fluctuated there in the last 20 years depending on the local water regime. Increasing numbers of the marsh harrier have been recorded in the rural areas in SW Poland (Kopij, 2006, 2012), and a similar general tendency was recorded in the outer zone of the city of Wrocław.
In rural areas in SW Poland, the same raptor species nested in densities usually lower than those recorded in the city of Wrocław in the same period (Table 3). This may further indicate that there are more favourable living conditions in and around large cities than in non-urban areas.

Table 3. Population densities of raptors in Wrocław and outside the city during the years 2002-2010.

Region	Area (km^2)	Forests (km^2)	Population density (pairs/10 km^2)					Source
			B.b.	A.g.	A.n.	C.a.	F.t.	
Wrocław city	293	23	10.0	3.1	1.6	0.2	2.3	This study
Grądy Odrzańskie	35	15	10.0	1.8	0.0	0.6	0.0	Kopij 2015
Niemodlin Land	300	120	4.2	0.5	0.1	0.5	0.0	Kopij 2016a
Grodków Land	584	71	7.0	1.0	0.4	0.1	0.1	Kopij 2006
Nysa Land	720	15	39.3	4.0	0.0	0.2	0.2	Kopij 2012

Explanations: B.b. – *Buteo buteo,* A.g. – *Accipiter gentilis,* A.n. – *Accipiter nisus.* C.a. – *Circus aeruginosus, F.t. – Falco tinnunculus.* For F.t. and C.a. crude density is given, whereas for B.b., A.g. and A.n. ecological density is calculated as number of pairs per 10 km^2 of wooded area.

In conclusion, it should be stressed that the common kestrel is for long time a well-established breeding species in Wrocław, with a sizable and increasing breeding population in the inner zone. The Eurasian sparrowhawk began to infiltrate the inner zone, while the goshawk and common buzzard shows first symptoms of such infiltration. The marsh harrier does not show any such symptoms, though it occurs in the outer zone only. A few other raptor species were recorded as occasionally breeding, and only in the outer zone of the city. The city of Wrocław benefits the urbanizing raptor species, providing them abundant and stable food, nesting and perching sites. I suggested further increase in the numbers of the Eurasian sparrowhawk, goshawk, and common kestrel in Wrocław and other larger cities in Poland.

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