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The impact of human presence on the nest distribution of Blackbird *Turdus merula* and Song Thrush *T. philomelos*

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Abstract. In urban areas of Łódź (Central Poland), the vertical and horizontal distributions of the Blackbird *Turdus merula* and Song Thrush *Turdus philomelos* nests were investigated in relation to running lanes and paths as places of penetration of humans. A significant effect of human penetration on vertical and horizontal distribution of Blackbird nests in parks was found. The park population of Blackbirds, unlike forest-breeding ones built nests more distantly from the lanes, lower, and under the shelter of shrubs. In the Blackbird park population, 74.2% of the nests were built in shrubs. The mean nesting height was 1.18 m. Distribution of distance between the nest and lanes are negatively skewed ($\hat{\alpha}_3 = -0.57$). The reverse was true of the forest population of this species where 81.9% nests were built in trees. The mean nesting height was 1.29 m. Nests of the forest population of Blackbird were distributed randomly. Differentiation in nest sites between urban and forest populations of Blackbird is a statistically significant. Only one pair of the Song Thrush was recorded in a parks. The forest population of the Song Thrush nesting in the trees, mean nesting height was higher than those of the Blackbird. The presence of people in the forest had a significant negative effect on the horizontal distribution of Song Thrush nests. Therefore, human disturbance is considered the factor that prevents this species from colonising urban parks (contrary to the situation in West European countries).

Key words: Blackbird *Turdus merula*, Song Thrush *Turdus philomelos*, urban wildlife, human impact on wildlife, nest distribution.

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INTRODUCTION

Some data on the Blackbird *Turdus merula* and Song Thrush *Turdus philomelos* breeding in the urban areas of Poland can be found in the papers by Graczyk (1959, 1960, 1961, 1963a, 1963b) and Luniak (1970). In Western Europe studies of the Blackbird were conducted by Snow (1958a, 1958b, 1969), Ribaut (1964), Korodi (1967), Osborne & Osborne (1980), Schwabl (1983) and Schnack (1991). Data on synurbization of the Blackbird were summarized by Luniak *et al.* (1990) and Walasz (1990). The comparative studies on the ecology of these two species under forest and park conditions were carried out by Dyrz (1963, 1969). These papers show the important differences in inhabiting urban areas by those species, and differences between parks and forest populations of Blackbirds in respect to breeding ecology and behaviour. Osborne & Osborne (1980) reported that the nests of Blackbirds situated near paths or buildings were deserted more rarely than

“far” situated nests and they suggested that the presence of man affected the outcome of these nests.

The objective of this work was to study the effect of man visited lanes and paths on the vertical and horizontal distribution of Blackbird and Song Thrush nest sites.

The study compares two habitats: urban park and a neighbouring municipal forest.

STUDY AREA

The data were collected in 14 parks within the city of Łódź (Central Poland), of an total area of 120.6 ha, and in the southern part of the Łagiewnicki Forest that is most frequently visited by people. A detailed description of these parks and their vegetation has been presented by Mowszowicz (1962). The Łagiewnicki Forest is located in the northernmost outskirts of the town of an area of 1,300 ha. *Quercus robur* and *Quercus*

sessilis are dominating trees there. They form oak stands or predominate in mixed woods together with *Carpinus betulus*, *Betula verrucosa*, and *Pinus silvestris*.

The southern part of the Forest, Arturówek, is divided by a grid of eleven streets of a total length of 9.7 km, and this part of the Forest is the most frequented by people. Together with ponds, it makes an important recreation centre as which, during sunny weekends, is used by ten thousand people (Wojciechowski 1971).

METHODS

Field work was performed between April 24 and July 20, 1980. Nests were searched for in the places of previous location of breeding pairs as determined by the combined mapping method (Tomiałojć 1980). The distance between each nest and the nearest point of a lane in the park or a path in the forest was measured. In each case the species of nesting tree or shrub was determined.

For characterizing the effect of penetration of an area by man on spatial distribution of nests, the values of skewness measure (α_3) of distribution

$$\alpha_3 = \frac{\mu_3}{s^3}$$

$$\mu_3 = \frac{1}{N} \sum (x_i - \bar{x})^3$$

(N – number x_i – value of measurement; \bar{x} – mean; s – standard deviation) in the form of unloaded estimator $\hat{\alpha}_3$ were used.

$$\hat{\alpha}_3 = \frac{\sqrt{n(n-1)}}{n-2} \alpha_3$$

The skewness measures of distribution were compared with $\alpha_3 = 0.631$ for theoretical random distribution (Clark & Evans 1954) with Student's t -test. The hypothesis H_0 : where expected random distributions of distance between nest and nearest point of paths (in case when

habitat penetration by man is not influenced on the horizontal distribution of nests) was accepted.

The relationship between the height of nesting and the distance of nest from lanes was determined using linear regression in logarithmic transformation (Platt 1978, Sokal & Rohlf 1984). Statistical significance was examined at $P = 0.05$.

RESULTS

In the park areas studied 62 pairs of Blackbird nested, averaging 5.1 p/10 ha. The density varied considerably from park to park and ranged from 1.5 to 13.3 p/10 ha (Tab. 1). In parks, where shrub clumps are absent (19 Stycznia, Dąbrowskiego, XX-Lecia PRL), the density of breeding pairs (1.5 to 2.5 p/10ha) was considerably lower than in parks with large areas of shrubs (Staszica, Kilińskiego, Reymonta, at Lecznicza Str.), where density varied from 10.0 to 13.3 p/10 ha (Tab. 1). Only one pair of the Song Thrush was recorded in XX-Lecia PRL park.

Table 1. Number of breeding pairs of Blackbirds in parks studied

[Tabela 1. Liczba gniazdujących par kosa w parkach Łodzi.]

Parks (ha)	pairs	p/10 ha
Dąbrowskiego (6.7)	1	1.5
Hibnera (6.9)	5	7.3
Kilińskiego (3.0)	3	10.0
Kolejowy (2.3)	2	8.7
Matejki (2.5)	2	8.0
Poniatowskiego (47.7)	15	3.1
Reymonta (4.5)	6	13.3
Lecznicza Str. (1.9)	2	10.5
Sienkiewicza (3.2)	2	6.3
Staszica (4.0)	5	12.5
Źródlińska I (10.6)	10	9.4
Źródlińska II (6.7)	4	6.0
19 Stycznia (12.2)	3	2.5
XX-LeciaPRL (10.0)	2	2.0
Total (120.6)	62	5.1

Numbers of the breeding Blackbird pairs in a sample area in the Łągiewnicki Forest (150 ha) amounted to 22, attaining a density of 1.5 p/10 ha; number of nests and density of the Song Thrush in these same area amounted to 54 pairs and 3.6 p/10 ha, respectively.

In the case of Blackbird park population, 74.2% of the nests were built in shrubs (Tab. 2). In parks 8.1% of Blackbird nests were situated on artificial structures (Tab. 2). The reverse was true of the forest population of this species where 81.9% nests were built in trees. This differentiation in nest sites between urban and forest populations of Blackbird is a statistically significant (Pearson χ^2 test: $\chi^2 = 51.94$, $P < 0.001$, $n = 128$). In the forest most nests were built in young spruces *Picea abies* (38.9%) and hornbeams *Carpinus betulus* (26.4%). Only a low percentage of nests were found in oaks *Quercus sp.*, although this tree species was most numerous in the forest tract studied.

Table 2. Location of the Blackbird and Song Thrush nests

[Tabela 2. Umieszczenie gniazd kosa i śpiewaka.]

Nesting places	<i>Turdus merula</i>				<i>Turdus philomelos</i>	
	in parks		in forest		in forest	
	N	%	N	%	N	%
Trees						
<i>Betula verrucosa</i>	–	–	2	2.8	–	–
<i>Carpinus betulus</i>	1	1.6	19	26.4	21	30.4
<i>Corylus avellana</i>	–	–	4	5.6	2	2.9
<i>Picea abies</i>	–	–	28	38.9	32	46.4
<i>Picea canadensis</i>	5	8.1	–	–	–	–
<i>Picea nigra</i>	1	1.6	–	–	–	–
<i>Pinus silvestris</i>	–	–	3	4.1	2	2.9
<i>Populus nigra</i>	2	3.2	–	–	–	–
<i>Quercus sp.</i>	–	–	3	4.1	12	17.4
<i>Sorbus intermedia</i>	1	1.6	–	–	–	–
<i>Tilia cordata</i>	1	1.6	–	–	–	–
Total	11	17.7	59	81.9	69	100.0
Shrubs						
<i>Cotoneaster sp.</i>	5	8.1	–	–	–	–
<i>Crataegus oxyacantha</i>	2	3.1	–	–	–	–
<i>Evonymus europaeus</i>	–	–	2	2.8	–	–
<i>Parthenocissus sp.</i>	4	6.5	–	–	–	–
<i>Philadelphus sp.</i>	7	11.3	–	–	–	–
<i>Physocarpus sp.</i>	1	1.6	–	–	–	–
<i>Rosa sp.</i>	3	4.8	1	1.4	–	–
<i>Sambucus nigra</i>	6	9.7	8	11.1	–	–
<i>Spiraea sp.</i>	5	8.1	–	–	–	–
<i>Symphoricarpos albus</i>	4	6.5	–	–	–	–
<i>Syringa vulgaris</i>	9	14.5	–	–	–	–
<i>Viburnum opulus</i>	–	–	1	1.4	–	–
Total	46	74.2	12	16.7	–	–
Other sites	5	8.1	1	1.4	–	–

All of Song Thrush nests were placed in trees, 30.4% in hornbeams, similarly as in the case of Blackbird. A significantly superior percentage of Song Thrush nests were built in oaks as compared with the Blackbird (Pearson χ^2 test: $\chi^2 = 4.6375$, $P < 0.05$, $n = 128$).

Table 3. Statistical description of the nest distribution.

1. – distribution of distances between nests and lanes, 2. – distribution of nest placing heights, $\hat{\alpha}^3$ – unloaded estimator measures of skewness of distribution, $\hat{\beta}^2$ – unloaded estimators of flatness factor

[Tabela 3. Opisy statystyczne rozkładów odległości gniazd od alejek i rozkładów wysokości umieszczenia gniazd.]

1. – rozkład odległości gniazd od alejek, 2. – rozkład wysokości umieszczenia gniazd, $\hat{\alpha}^3$ – nieobciążony estymator miary skośności rozkładu, $\hat{\beta}^2$ – nieobciążony estymator kurtozy rozkładu.]

Distribution	N	\bar{x}	SD	SE \bar{x}	V%	$\hat{\alpha}^3$	$\hat{\beta}^2$
1 <i>T. merula</i> - park	62	6.21	2.85	0.36	45.9	-0.57	-0.93
1 - forest	72	49.35	26.09	3.07	52.9	0.16	-0.93
<i>T. philomelos</i>	69	58.17	27.72	3.34	47.7	-0.33	-1.17
2 <i>T. merula</i> - park	62	1.18	0.86	0.11	72.9	1.61	2.22
2 - forest	72	1.29	0.63	0.07	48.8	0.34	-0.80
<i>T. philomelos</i>	69	1.82	0.72	0.09	39.6	0.32	-0.91

An analysis of vertical nest distribution showed significant differences between the two Blackbird populations, and between the Blackbird and Song Thrush in the forest area (Tab. 3 and Fig. 1). The mean nest height of urban Blackbirds was 1.2 m with the distinct tendency for nesting low ($\hat{\alpha}^3 = 1.61$, $\hat{\beta}^2 = 2.22$). The forest population was found to built nests at a height of 1.3 m on the average, and the distribution of the values of the nest height resembled a normal distribution (Tab. 3). The Song Thrush nests were at a height of 0.4 to 3.5 m and the mean height of their placing was larger than in the Blackbird in the same area and amounted to 1.8 m.

The horizontal distributions of the nests are presented in a form of distributions of the values of the shortest distances between nest and lane or path (Fig. 2 and 3). The values of statistics of these distributions are given in Tab. 3. The distributions for the park Blackbird and the forest Song Thrush population are characteristic of negatively skew distributions $\hat{\alpha}^3 = -0.57$ and $\hat{\alpha}^3 = -0.33$ (Tab. 3). Thus, the probability of nesting in the proximity of lanes is lower as if it would result from the random distribution of

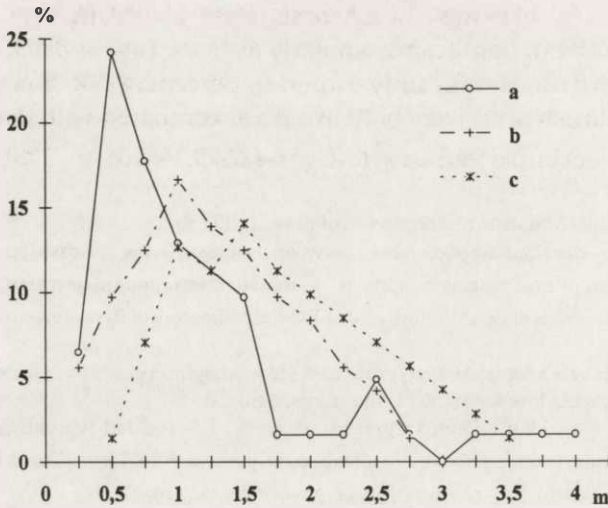


Fig. 1. Distribution of nest placing heights. a - *T. merula* - parks, b - *T. merula* - forest, c - *T. philomelos* - forest.

[Ryc. 1. Rozkłady wysokości umieszczania gniazd.]

nests $\alpha_3 = 0.631$ (Clark & Evans 1954). These distributions are significantly different from the expected distribution (Student's t-test: $t_s = 3.965$, $P < 0.001$, $n = 61$; and $t_s = 3.319$, $P < 0.002$; $n = 68$).

The horizontal distribution of blackbird nests towards paths in the forest does not differ from the expected values (Student's t-test: $t_s = 1.653$, $P > 0.05$, $n = 71$).

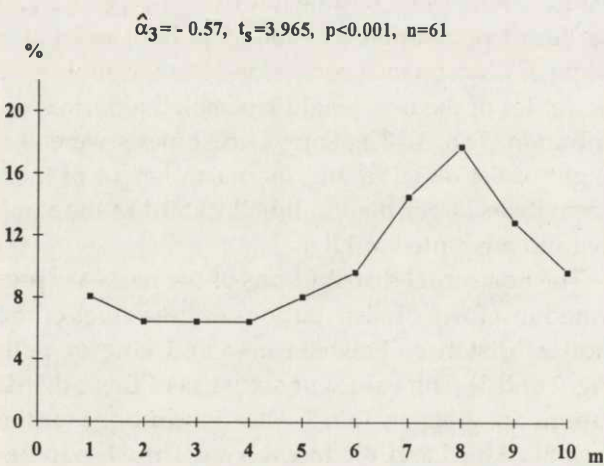


Fig. 2. Distribution of nest distances from lanes in the park population of the Blackbird.

[Ryc. 2. Rozkład odległości gniazd od alejek w populacji parkowej kosa.]

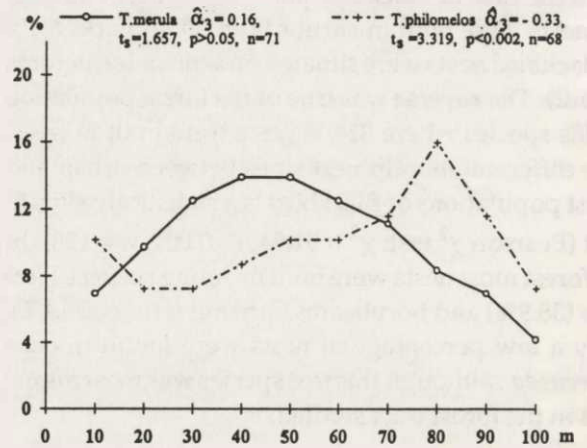


Fig. 3. Distribution of nest distances from paths in the forest population of the Blackbird and Song Thrush.

[Ryc. 3. Rozkłady odległości gniazd od ścieżek spacerowych w populacjach leśnych kosa i śpiewaka.]

There is a negative correlation between the values of the heights of nest location and the distance to the nearest lanes (Fig. 4) described by regression equation $\ln H = 3.0364 - 1.1004 \ln D$, $r = -0.83$, $P < 0.01$, $n = 59$ (where: H - height of nest location, D - distance between nest and nearest running lane). Such a correlation was not found in the forest populations of these two species.

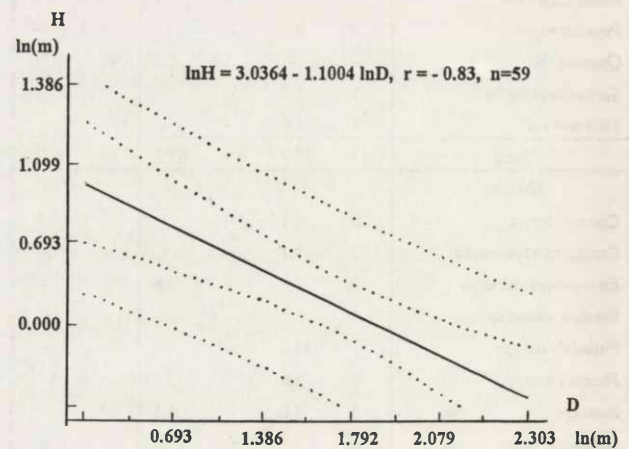


Fig. 4. Relation between the heights of nest location and the distances to the nearest lanes in the park Blackbird population.

..... - confidence intervals 0.95 and 0.99.

[Ryc. 4. Zależność pomiędzy wysokością umieszczenia gniazda a odległością gniazda od najbliższej alejki w populacji parkowej kosa. - przedziały ufności 0.95 i 0.99.]

DISCUSSION

Many bird species find favourable conditions to exist in towns and they increase in numbers, attaining frequently very high densities that have not been noted in natural habitats.

Graczyk (1962) was the first to find the Blackbird nesting in Łódź in the Poniatowski Park in 1952. In 1960 the numbers of this species in parks and gardens of centre of town amounted to 18 pairs (1.1 p/10 ha) (Graczyk 1962). In 1980 the density of breeding pairs averaged 5.1 p/10 ha, which is similar to the data obtained for other cities of Poland (Dyrz 1969, Luniak 1970).

Contrary to Blackbird, the Song Thrush has hardly colonised the Polish urban areas (Graczyk 1963a) and it does not show such spread over the urbanized areas as the West-European population (Cramp & Teagle 1951, Luniak 1990). Only during the sixties its nesting in the peripheral parks of Wrocław was observed at a density of 10.8 p/10 ha (Dyrz 1969), later it declined (Tomiałojć & Profus 1977). Also in five other cities (Berlin, Łódź, Kiev, Leningrad and Ulyanowsk) populations of Song Thrush have decreasing tendency of numbers (Luniak 1990). The density of the Song Thrush in the Łagiewnicki Forest was twice as high as the Blackbird's in the same area and it is similar to the density observed by Dyrz (1969) in analogical habitats of the Wrocław vicinities (Blackbird – 1.0 to 1.4 p/10 ha; Song Thrush – 2.2 to 2.9 p/10 ha).

Dyrz (1963) showed that the presence of shrubs is by no means the most important factor influencing the Blackbird density variability in various parks, but he admitted that it may depend on the favourable feeding conditions. However, the material collected in this study allows to conclude that the clumps of shrubs have significantly positive effects on the density of that species, especially when the human factor penetrating the biotope is taken into account. In parks, where shrub clumps are absent the density of breeding pairs is considerably lower than in parks with large areas of shrubs. This conclusion can be evidenced by the fact that the park Blackbirds contrary to the forest ones prefer nesting in shrubs (Tab. 2).

It may be noticed that in the urban Blackbird and the forest Song Thrush, the distribution of the shortest distances between nests and lanes or paths are negatively skewed, and significantly different from the theoretical distribution (Fig. 2 and 3). This indicates that

the probability of nest building is not random in character, which would be expected assuming the lack of the effect of this factor on the spatial distribution of nests. Osborne & Osborne (1980) reported that nests of Blackbirds situated near paths or buildings were deserted more rarely than "far" nests and they suggested that the presence of man affected the outcome of these nests. Possibly the "near" nests were built by a group of Blackbirds which are adapted to nesting in this habitat. Graczyk (1961, 1963b) has suggested that the urban and rural populations have diverged to the extent that the differences between them are genetic. The results of the last ethological study at this species confirms that supposition. The results of ethological experiments on the Blackbird (migratory activity, open field test, tonic immobility reaction test, handling test, predator presentation test), which were carried out by Walasz (1990) showed that the urban Blackbird had a better learning capability and an ability to adapt quicker to a new situation. In the experiments the forest Blackbirds showed a more rigid, less flexible type of reaction characterized by a lower excitability and a constant intensity of their reaction during the experiments.

A distinctly smaller refuge distance in the urban Blackbirds allows it to exist in under conditions of an intensive human penetration, as observed in town parks (Aniola 1957, Graczyk 1961). However, the effect of this factor on horizontal and vertical nest distribution is very marked (Fig. 2 and 4) and there is a significant compensation between the horizontal and vertical distribution.

Strawiński (1963) concluded that the composition of bird communities in parks may be determined by the frequency of human visits. Based on the occurrence of these two species in urban areas, and the distribution of nest distances from the lanes in forest populations (Tab. 3 and Fig. 3), it may be concluded that the presence of the public – among others – may influence the inhabiting of parks by Song Thrush. The absence of this species in parks may, among others, be associated with its higher shyness and inability to adapt to nesting in habitats with the mass presence of the public.

Conclusions

1. The densities of the Blackbird and Song Thrush in the parks of Łódź and in the municipal Łagiewnicki

Forest show a pattern similar to that in analogical habitats of other Polish towns.

2. Differences in the Blackbird densities in various parks are due to the presence of shrubs and the penetration of humans.

3. Penetration of habitats by humans is a significant factor that determines the horizontal and vertical distribution of nests in the park Blackbird population.

4. The presence of the people in a forest affects negatively the horizontal distribution of Song Thrush nests. Thus, the intensive human penetration may be one of the causes which prevent colonization of parks by this species.

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STRESZCZENIE

[Wpływ obecności ludzi na przestrzenne rozmieszczenie gniazd kosa *Turdus merula* i drozda śpiewaka *T. philomelos*]

Badania przeprowadzono w 14 parkach Łodzi oraz w przylegającej do miasta części Lasu Łągiwnickiego.

Analizą objęto miejsca założenia gniazd, wysokości ich umieszczenia oraz odległości gniazd do najbliższych alejek i ścieżek spacerowych, które potraktowane zostały jako miejsca penetracji biotopu przez człowieka.

Do oceny wpływu penetracji środowiska na poziomą strukturę przestrzenną gniazd wykorzystano różnicę między wartością estymatora nieobciążonego miary skośności (α_3), rozkładu odległości gniazd do najbliższych punktów alejek a wartością teoretyczną tej miary dla rozkładu losowego, podaną przez Clarka i Evansa (1954). Przyjęta została hipoteza zerowa, iż w przypadku braku wpływu penetracji biotopu na poziome rozmieszczenie przestrzenne gniazd, należałoby oczekiwać rozkładu losowego.

W przypadku populacji parkowej kosa stwierdzony został istotny wpływ penetracji biotopu przez człowieka na poziome rozmieszczenie gniazd. Rozkład odległości umieszczenia gniazd od alejek był ujemnie skośny ($\hat{\alpha}_3 = -0.57$) i istotnie statystycznie różny od rozkładu teoretycznego (ryc. 2, tab. 3). Populacja parkowa kosa umieszczała gniazda nisko ($\hat{\alpha}_3 = 1.61$) (ryc. 1), w większości przypadków wśród krzewów

(tab. 2). Wpływ penetracji na rozkład pionowy gniazd zauważono wykazując istotną statystycznie zależność o charakterze kompensacyjnym między rozkładem pionowym i poziomym ($\ln H = 3.0364 - 1.1004 \ln D$, $r = -0.83$, $P < 0.01$, $n = 59$), co wskazuje na próbę zachowania pewnego dystansu ucieczki przez ptaki względem ludzi, przez co gniazda umieszczane blisko alejek, znajdowały się jednocześnie przeciętnie wyżej (ryc. 4). W badanych parkach stwierdzono gnieźdzenie się tylko jednej pary śpiewaka.

W przypadku populacji leśnej kosa, poziome rozmieszczenie gniazd nie różniło się od rozkładu losowego. Natomiast u występującego na tym samym obszarze śpiewaka, stwierdzono negatywny wpływ obecności ludzi na rozkład poziomy gniazd ($\hat{\alpha}_3 = -0.33$), która to zależność ujawniła się w skali 10-krotnie silniejszej niż w przypadku populacji parkowej kosa. Wobec czego płochliwość i większy dystans ucieczki u śpiewaka wydaje się być jedną z przyczyn utrudniających zasiedlanie parków miejskich przez ten gatunek.

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