Long-Term Dynamics of Long-Eared Owls Asio otus at a Northern Winter Roost in European Russia

Authors: Sharikov, A.V., Makarova, T.V., and Ganova, E.V.

Source: Ardea, 101(2) : 171-176

Published By: Netherlands Ornithologists' Union

URL: https://doi.org/10.5253/078.101.0212

Long-term dynamics of Long-eared Owls *Asio otus* at a northern winter roost in European Russia

A.V. Sharikov[1,*], T.V. Makarova[1] & E.V. Ganova[1]

Sharikov A.V., Makarova T.V. & Ganova E.V. 2013. Long-term dynamics of Long-eared Owls *Asio otus* at a northern winter roost in European Russia. Ardea 101: 171–176.

We investigated the factors influencing the dynamics of Long-eared Owls *Asio otus* wintering in Moscow. The study was carried out in 2001–2011. Twelve communal roosts and 14 solitary wintering owls were found. Number of active roosts was positively correlated with the total number of wintering owls per year. The four largest roosts were active for many years, with up to 16 individuals in a single winter (9.9 ± 1.3 on average). Generalized linear models indicated that the number of wintering owls was influenced simultaneously by the abundance of Common Vole *Microtus arvalis* in the previous autumn and in spring, and the owls' breeding numbers in the study plot. The most important factor was vole abundance in early spring indirectly indicating food supply in late winter. The influence of weather was investigated on the regularly surveyed local site in Moscow. The maximum number of owls at the roosting site varied from 0 to 9 individuals (2.1 ± 0.4 on average). Among weather factors, the most important influence on the dynamics of owls was by snow cover and wind jointly, though the snow was undoubtedly of greatest significance. Air temperature and precipitation turned out to be almost of no importance for owl dynamics at the roosting site.

Key words: Long-eared Owl, *Asio otus*, winter roost, long-term dynamics, range boundary, weather conditions, food supply

[1]Research group of Avian population ecology, Zoology and Ecology Department, Moscow Pedagogical State University, Kibalchicha str. 6 – 5, 129164, Moscow, Russia;
*corresponding author (avsharikov@ya.ru)

The Long-eared Owl *Asio otus* is known to roost communally in winter (Cramp 1985). This owl species is mostly sedentary in southern parts of its distribution range and migratory or even nomadic north of 50–60°N (Cramp 1985, Priklonsky & Ivanchev 2005). Most birds from Jutland, for example, migrate in a southwestern direction to western Germany, The Netherlands, Belgium and northern France (Erritzoe & Fuller 1999). The number of owls in wintering areas may increase considerably in comparison to the breeding season (Wijnandts 1984, Sapetina 1991, Priklonsky & Ivanchev 2005, Ružić *et al.* 2009).

However, in some winters Long-eared Owls breeding in the northern part of the range stay on their breeding ground throughout the year, especially when food supply is abundant (Glutz von Blotzheim & Bauer 1980). In European Russia the northernmost wintering Long-eared Owls were recorded in the Regions of Leningrad, Tver', Moscow, Kaluga, Ryazan' and Tula (Avilova *et al.* 2001, Fetisov 2005, Ivanchev & Nazarov 2005, Margolin & Khokhlov 2005, Nikolaev & Shmitov 2005, Pchelintsev 2005, Brigadirova 2009, Sharikov & Makarova 2009). Little is known about owls wintering in the northern regions during extreme winter conditions. The aim of this study was to reveal factors that influence the dynamics of Long-eared Owls wintering in the city of Moscow, one of the northernmost places in European Russia where communal roosts of this species are known to occur. Our goal was to evaluate whether: (1) potential food supply during winter and previous autumn, and breeding number in the previous summer in city surroundings, might influence the total number of owls within the city; (2) weather might affect the number of owls during winter at least at the roost site.

METHODS

Study area

Moscow is situated in central European Russia (55°45' N, 37°37' E). By 2011, the total area of the city covered 1091 km^2. Despite a high density of buildings, the green area averages a third of the total city area (including 96 parks). Within the city area we found twelve communal winter roosts 2 to 20 km apart, and 14 solitary roosts (Figure 1). Most communal roosts were situated in large parks. Roosting trees were usually Norway Spruce *Picea abies* and occasionally Thuja *Thuja orientalis*. Solitary wintering owls were often roosting in small clusters of trees surrounded by large buildings (Sharikov 2005).

One of the Moscow roosts in a public garden in the southwestern part of Moscow (55°76'N, 37°62'E) was targeted as the main study site. This roost had been used almost annually (except winter of 2004/2005), and was favourably situated to pay frequent visits. The park totaled 68 ha, mostly open areas with some trees (birches, larches, spruces and pines), of which the study site covered about 11.9 ha. The nearest roosts were at distances of 1.8 km and 2.7 km.

Data collection

Moscow city. We regularly searched for potential winter roosts within the city in 2001–2011, and checked roosts at least once between mid-December and mid-January when the number of owls normally reached its peak (AVS, unpubl. data, Smith 1981, Wijnandts 1984, Pirovano *et al.* 2000, Žañat *et al.* 2007). Mass observations of birders involved in the ongoing program “Birds of Moscow and Moscow Region” (Kalyakin & Voltzit 2006) were used as an additional source of information. When a roost was checked more than once, we used the maximum number of owls at that communal roost for the analysis.

The local site. The focal roost was monitored from November until April in 2001–2011, and was usually visited in the morning with an interval of about seven days between visits. Several times every autumn–winter season, the whole park (68 ha) was searched for other roosts.

The data on weather were provided by the Moscow meteorological station #27612 (55°45'N, 37°34'E) located 18.2 km north of the study site (http://www.ncdc.noaa.gov).

Breeding owls and prey abundance were studied at two other study areas outside the city of Moscow in 2001–2011 (Volkov *et al.* 2009, Sharikov *et al.* 2010). The number of owls breeding within the city is estimated at 30–35 pairs in years of favourable food supply (Sharikov 2005), but we fine-tuned the data on breeding number with an annual census of the local breeding population of Long-eared Owls in the northern Moscow

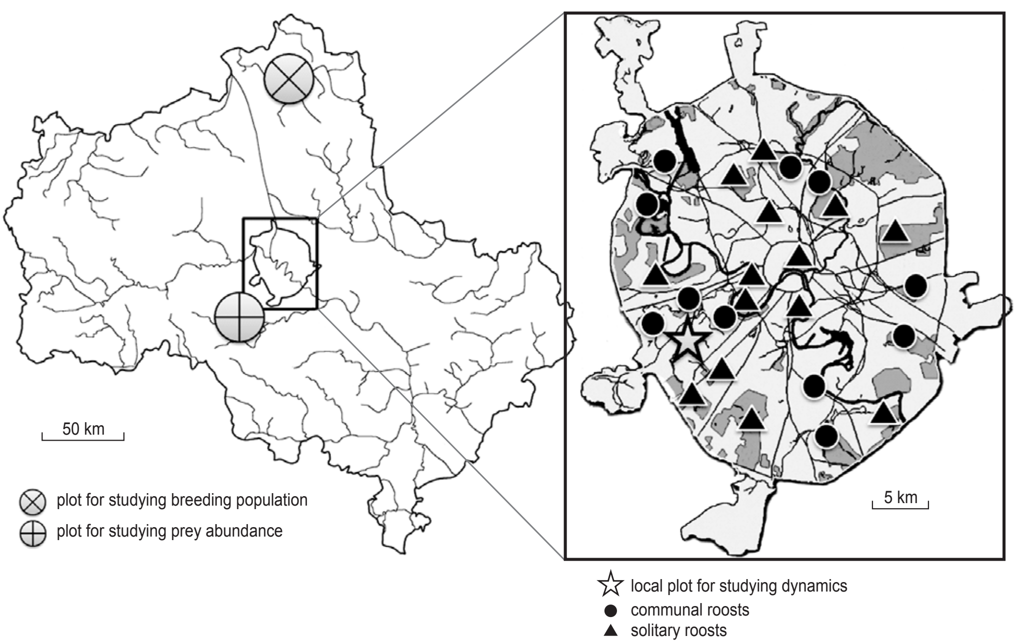

Figure 1. Map of the Moscow Region with indication of study plots outside Moscow city, and of local roosts and distribution of communal and solitary roosts of owls within city limits in 2001–2011 (large green areas in Moscow are highlighted).

Region (56°45'N, 37°50'E, area of 48 km^2) (Volkov *et al.* 2005, Volkov *et al.* 2009). Data on small mammal fluctuations were collected 20 km south of Moscow (55°46'N, 37°18'E), as an assessment of prey abundance within the city limits proved impossible. Small mammals were trapped twice a year: in March (just after snow melt) and in October or early November (snow cover about to appear) in 2001–2011. We used a standardized method of conventional trap lines, consisting of 25 snap traps with a base plate placed every 5 m (Naumov 1963). Relative prey abundance was expressed as number of individuals trapped per 100 trap nights.

Data analysis

Despite small numbers, annual changes in owl numbers at local roosts were not randomly distributed (Poisson distribution: $\chi^2 = 155.5$, df = 8, $P < 0.05$ for numbers in Moscow; $\chi^2 = 17.7$, df = 7, $P < 0.05$ for numbers at the local roost site). We used Generalized Linear/Nonlinear Models (GLZ) in Statistica 8.0 for the analysis of factors influencing the number of wintering owls (Statsoft 2007). To test the significance of a factor, models with and without the factor were compared by a chi-square test. We followed an information-theoretic approach for model selection: models were ranked using Akaike's Information Criterion (AIC, Anderson *et al.* 1998), generating a rank from the best to the least likely model.

In the analysis we used several environmental factors. (1) Breeding numbers in the previous summer at the study site north of Moscow, to identify a link between number of wintering and breeding owls. (2) Relative abundance of Common Vole *Microtus arvalis* before and just after winter and Ural Field Mouse *Apodemus uralensis* after winter at the study area south of Moscow. Autumn mouse abundance was excluded from models due to its correlation with vole abundance. Both rodents were the main prey species of Long-eared Owls in winter (Sharikov *et al.* 2009). The twin-species *Microtus arvalis* and *M. rossiaemeridionalis* were pooled. Snap-trapping conducted in autumn allowed us to estimate potential food supply at the beginning of winter and snap-trapping in early spring indicated food supply in late winter. Autumn and spring abundances of Common Vole could be analysed separately as they were not correlated (Spearman rank correlation coefficient, $P > 0.05$). Breeding number and food supply in the Moscow Region are supposed to influence the numbers of owls within city limits, and consequently were not included in models for the local roost site. (3) Weather conditions were indexed with mean daily temperature, mean snow depth, mean wind speed and mean precipitation (mm). We evaluated the influence of weather factors on owl dynamics at the local study site only, where we had an opportunity to conduct regular surveys during the entire winter. In the models, we excluded weather factors averaged for Moscow city because microclimate varied too much within city limits.

Although owls occasionally occupied roosts in late autumn and early spring, we restricted our analysis of owl dynamics to the winter months when owl numbers were most stable. During winter 2003/04 no owls roosted at the local study site. In winter 2002/03, the owls left the roost site in mid-December, hence its exclusion from the analysis. We confined our analysis of the impact of food supply and breeding density on owl dynamics in Moscow to roosts with relatively stable numbers in midwinter, based on weekly surveys and monthly summations. A comprehensive survey of solitary owls wintering in the city was impossible.

RESULTS

Twelve winter roosts of Long-eared Owls 2–20 km apart and 14 sites of wintering solitary owls were found. Few roosts were active every year. The annual number of active roosts was positively correlated with the total number of wintering owls (Spearman rank correlation coefficient: $r_s = 0.57$, $P = 0.07$). Four large roosts in public parks were active for many consecutive years. The number of Long-eared Owls roosting at these sites peaked at 16 individuals (on average 9.9 ± 1.3 per winter, CV% = 42.4, n = 10 winters) (Table 1).

Table 1. Maximum number of Long-eared Owls per winter at the largest roosts in Moscow and at the local roost site, and number of breeding owls on the study plot outside Moscow (48 km^2) in the previous summer.

Season	Moscow roosts	Local roost	Breeding pairs
2001/02	9	9	2
2002/03	4	3	1
2003/04	3	3	26
2004/05	12	0	7
2005/06	6	4	0
2006/07	16	4	5
2007/08	11	3	41
2008/09	10	3	5
2009/10	15	4	5
2010/11	10	4	7

Table 2. Ranking of models depicting the relationship between the number of wintering Long-eared Owls in Moscow and breeding numbers and prey abundance in the Moscow Region and weather at the local study site in 2001–2011. Models are ranked by Akaike's information criterion (AIC). ΔAIC is the difference in Akaike's information criterion from the top model. *P*-values for χ^2-tests are given.

Model[a]	ΔAIC	*P*
Influence of prey abundance and breeding numbers on the total number of owls		
MA (autumn) + MA (spring) + BN	0.00[b]	0.00
MA (autumn) + MA (spring) + BN + AU (spring)	0.9	0.00
MA (autumn) + MA (spring)	1.8	0.00
MA (autumn) + MA (spring) + AU (spring)	3.5	0.01
MA (spring) + AU (spring)	4.3	0.02
MA (spring)	4.5	0.01
MA (spring) + AU (spring) + BN	5.7	0.03
MA (spring) + BN	6.5	0.04
MA (autumn)	7.4	0.07
MA (autumn) + BN	8.3	0.11
MA (autumn) + AU (spring)	8.7	0.13
MA (autumn) + AU (spring) + BN	9.0	0.13
AU (spring)	9.7	0.31
BN	10.6	0.80
AU (spring) + BN	11.6	0.58
Influence of weather on number of owls at the local study site		
Snow+Wind + Snow×Wind	0.00[c]	0.01
Snow+Wind + Prec + Snow×Wind	1.2	0.01
Snow+Wind + Temp×Snow + Snow×Wind	1.3	0.01
Snow+Wind + Snow×Wind + Wind×Prec	1.4	0.01
Snow+Wind + Temp + Temp×Snow + Snow×Wind	1.6	0.01
Snow+Wind + Snow×Wind + Temp×Prec	1.7	0.02
Snow+Wind + Prec + Snow×Wind + Wind×Prec	1.8	0.01
Snow+Wind + Temp + Snow×Wind	1.9	0.02
Snow+Wind + Snow×Wind + Wind×Prec	1.98	0.02
Snow+Wind + Temp×Wind + Snow×Wind	2.0	0.02
Snow	6.8	0.31

[a] Model parameters: MA (spring), MA (autumn) = abundance of Common vole in spring and in autumn, respectively; AU (spring) = abundance of Ural Field Mouse in spring; BN = breeding numbers of Long-eared Owl in the same region in the previous summer; Snow = snow cover; Wind = wind speed; Prec = precipitation; Temp = temperature
[b] AIC of top model: 48.65.
[c] AIC of top model: 341.35.

Breeding numbers of Long-eared Owls in the Moscow Region (48 km^2) varied from 0 to 41 pairs (on average 9.9 ± 4.2 pairs) and reached its maximum in 2007. Relative abundance of voles in Moscow's suburbs averaged 1.2 ± 0.9 (CV% = 240.1) and 0.6 ± 0.3 (CV% = 144.2) individuals per 100 trap nights for Common Vole in autumn and spring respectively; and 0.3 ± 0.1 (CV% = 162.0) individuals per 100 trap nights for Ural Field Mouse in spring (Table 1).

The model in which the number of Long-eared Owls wintering in Moscow was influenced simultaneously by autumn and spring abundance of Common Vole and breeding density in the study plot was found to have the highest explanatory value (Table 2). Local breeding numbers of owls was a poor predictor of wintering numbers (Table 3). Spring abundance of Ural Field Mouse did not have an effect on the dynamics of owls at roosts in Moscow (Table 3).

The impact of weather on the dynamics of owls was investigated at the regularly surveyed study site in Moscow, where in most winters maxima varied between 3 and 5 individuals (but 9 in 2001/02 and 0 in 2004/05). The number of wintering owls at the local study site averaged 2.1 ± 0.4 (n = 8, CV% = 95.2). Mean and maximum numbers of owls at the local roost site and in Moscow overall were not correlated (Spearman rank correlation coefficient, $P > 0.05$). Numbers at the roost peaked in December (7 years) or January (2 years) (Table 1). Only snow cover and wind speed and their interaction were selected by the model as of importance to owl numbers in winter (Table 2), especially snow cover (Table 3).

Table 3. Parameter estimates from the best logistic regression models (Table 2), examining the dynamics of wintering Long-eared Owls in Moscow, 2001-2011. For abbreviations see Table 2.

Parameter	Estimate	SE	*P*
Prey abundance and breeding numbers			
Intercept	2.05	0.11	<0.005
BN	0.02	0.00	0.01
MA (spring)	0.28	0.06	<0.005
MA (autumn)	-0.19	0.07	<0.005
Weather factors			
Intercept	2.7	0.71	<0.005
Snow	-7.6	2.98	0.01
Wind	-0.7	0.29	0.02
Snow×Wind	2.4	0.68	<0.005

DISCUSSION

The few Russian studies of Long-eared Owls during the non-breeding season indicate that roosts near the northern boundary of their winter range in European Russia rarely hold 5–10 individuals per site (Shvets 1999, Fetisov 2005). Moscow seems to be one of the northernmost roosts in European Russia, and probably so across eastern Europe. This may account for the small number of wintering owls in Moscow with hardly more than twenty wintering individuals per year in recent decades, and fewer than ten per roost. In contrast, in southern European Russia winter roosts vary from several tens up to 300 Long-eared Owls (Konstantinov *et al.* 1982, Tilba & Mnatsekanov 2005, Sharikov 2006).

The between-year variation in wintering numbers depended largely on the abundance of the main prey species (Sharikov *et al.* 2009), the Common Vole. When this prey species reached a low outside Moscow city, the number of owls wintering within the city area increased, probably because a wider range of prey species was available in the city.

Fluctuations in the Long-eared Owls' breeding numbers in the Moscow region were only weakly correlated with annual changes in the number of owls wintering in Moscow. High numbers, however, is not a reliable proxy for high breeding success or high fledgling survival. Moreover, after the breeding season owls may disperse over a wider range than just the Moscow region (Cramp 1985, Sapetina 1991). Between-year fluctuations in the number of wintering owls were usually small, and hard to detect because of the overall small numbers. Incidental peak numbers at one roost, as in winter 2001/02, may have been caused by owls concentrating at local food bonanzas.

Of the weather factors taken into consideration, the depth of snow cover was an important factor influencing owl numbers on the roost, as was wind speed. Snow cover adversely affects the availability of voles, as also found by Sonerud (1986), Rubolini (2003) and Romanowski & Zmihorski (2008). However, wind speed is rarely mentioned as an influence on the owls' foraging (Shvets *et al.* 2003, Brigadirova 2009). High winds compromise the ability of owls to hear, and focus on, a squeaking or running rodent (Il'ichev 1975).

ACKNOWLEDGEMENTS

We are grateful to the reviewers for important suggestions for improvement of the manuscript. We also thank all the people who assisted us in the field work, especially Sergey V. Volkov and Lidiya D. Nikitina. We deeply appreciate Dmitry A. Shitikov for providing valuable comments and advice on the manuscript. Great encouragement and assistance at all stages of investigation was provided by the director of the Cranes Homeland Nature Reserve Olga S. Grinchenko.

REFERENCES

Anderson D.R., Burnham K.P. & White G.C. 1998. Comparison of Akaike information criterion and consistent Akaike information criterion for model selection and statistical interference from capture-recapture studies. J.Appl. Stat. 25: 263–282.

Avilova K.A., Morozova G.V. & Samoylov B.L. (eds) 2001. Birds. The Red Book of Moscow. ABF, Moscow, pp. 158–164. (In Russian)

Brigadirova O.V. 2009. Some aspects of ecology and dynamics in the number of Long-eared Owls in town parks of Tula Region. In: Volkov S.V., Sharikov A.V. & Morozov V.V. (eds) Owls of The Northern Eurasia: Ecology, spatial and habitat distribution. Moscow, pp. 46–49. (In Russian with English summary)

Cramp S. (ed.) 1985. The Birds of the Western Palearctic. Vol. 4. Oxford University Press, Oxford.

Erritzoe J. & Fuller R. 1999. Sex differences in winter distribution of Long-eared Owls (*Asio otus*) in Denmark and neighbouring countries. Vogelwarte 40: 80–87.

Fetisov S.A. 2005. Owls of Pskov Region. In: Volkov S.V., Morozov V.V. & Sharikov A.V. (eds) Owls of The Northern Eurasia. Moscow, pp. 75–101. (In Russian)

Glutz von Blotzheim U.N. & Bauer K.M. 1980. Handbuch der Vögel Mitteleuropas. Band 9. Akademische Verlagsgesellschaft, Wiesbaden.

Il'ichev V.D. 1975. Locating in birds. Nauka. Moscow. (In Russian)

Ivanchev V.P. & Nazarov I.P. 2005. Specific composition, distribution and some issue on owls' ecology in Ryazan' Region. In: Volkov S.V., Sharikov A.V. & Morozov V.V. (eds) Owls of The Northern Eurasia. Moscow, pp. 187–199. (In Russian with English summary)

Kalyakin M.V. & Voltzit O.V. 2006. Are we in Europe? Results of the first six years of the ongoing program "Birds of Moscow and Moscow Region". J. Ornithol. 147 Suppl.: 190.

Konstantinov V.M., Margolin V.A. & Babenko V.G. 1982. Features of Long-eared Owl's Ecology in anthropogenic landscapes of the center of European part of USSR. Birds' Breeding Life (Collection of scientific works). Perm', pp. 121–132. (In Russian)

Margolin V.A. & Khokhlov V.V. 2005. Retrospective characteristic of fauna and dynamics in the number of Strigiformes in Kaluga Region. In: Volkov S.V., Sharikov A.V. & Morozov V.V. (eds) Owls of The Northern Eurasia. Moscow, pp. 200–205. (In Russian)

Naumov R.L. 1963. Organization and methods for bird and detrimental rodents' counts. USSR Academy of Science. Moscow, p. 137. (In Russian)

Nikolaev V.I. & Shmitov A.U. 2005. New data on owls of Tver' Region. In: Volkov S.V., Sharikov A.V. & Morozov V.V. (eds) Owls of The Northern Eurasia. Moscow, pp. 136–139. (In Russian with English summary)

Priklonsky S.G. & Ivanchev V.P. 2005. Long-eared Owl *Asio otus* (Linnaeus, 1758). The birds of Russia and adjacent regions: Pterocletiformes, Columbiformes, Cuculiformes, Strigiformes. Nauka. Moscow, pp. 302–312. (In Russian)

Pchelintsev V.G. 2005. Present distribution and dynamics in the number of owls in Leningrad Region. In: Volkov S.V., Sharikov A.V. & Morozov V.V. (eds) Owls of The Northern Eurasia. Moscow, pp. 68–74. (In Russian with English summary)

Pirovano A., Rubolini D., Brambilla S. & Ferrari N. 2000. Winter diet of urban roosting Long-eared Owls *Asio otus* in northern Italy: the importance of the Brown Rat *Rattus norvegicus*. Bird Study 47: 242–244.

Romanowski J. & Żmihorski M. 2008. Effect of season, weather and habitat on diet variation of a feeding specialist: a case study of the long-eared owl, *Asio otus*, in Central Poland. Folia Zool. 57: 411–419.

Rubolini D., Pirovano A. & Borghi S. 2003. Influence of seasonality, temperature and rainfall on the winter diet of the long-eared owl, *Asio otus*. Folia Zool. 52: 67–76.

Ružić M., Radišić D., Tucakov M. & Šćiban M. 2009. Distribution and numbers of long-eared owl *Asio otus* communal roost in Vojvodina during the winter 2007–08. Zaštita prirode 60: 295–304. (In Serbian)

Sapetina I.M. 1991. Results of ringing of Long-eared owl (*Asio otus*) in the European part of the USSR. Results of Bird's Ringing: 1985. Nauka, Moscow, pp. 20–28. (In Russian)

Sharikov A.V. 2005. Owls of Moscow. In: Volkov S.V., Sharikov A.V. & Morozov V.V. (eds) Owls of The Northern Eurasia. Moscow, pp. 455–461. (In Russian with English summary)

Sharikov A.V. 2006. Peculiarities of winter feeding in the Long-Eared Owl (*Asio otus*) in settlements of Stavropol krai. Zoological Journal 85: 871–877. (In Russian)

Sharikov A.V. & Makarova T.V. 2009. Distribution of Long-eared Owl's winter roosts in the city of Moscow: The Past and Present. Bulletin of Moscow Society of Nature Research 114. Appendix 1, Part 2. Moscow, pp. 493–504. (In Russian)

Sharikov A.V., Kholopova N.S., Volkov S.V. & Makarova T.V. 2009. Review of the owls' diet in the Moscow City and the Moscow Region. In: Volkov S.V., Sharikov A.V. & Morozov V.V. (eds) Owls of The Northern Eurasia: Ecology, spatial and habitat distribution. Moscow, pp. 188–204. (In Russian with English summary)

Sharikov A.V., Volkov S.V., Ivanov M.N. & Basova V.B. 2010. Formation of aggregated settlements as an expression of synanthropization of the Long-Eared Owl (*Asio otus* L.). Russian J. Ecol. 41: 44–50.

Shvets O.V. 1999. Ecology of Long-eared owl wintering in urban landscape (on the example of Tula city). Proc. Third Conference on Raptors of Eastern Europe and Northern Asia, 15–18 Sept. 1998 Stavropol, Russia. Stavropol, pp. 166–169. (In Russian)

Shvets O.V., Brigadirova O.V. & Skleymina O.V. 2003. Dynamics in the number of non-breeding groups of Long-eared Owl in urban conditions. Animals in the city: Proc. Second scientific and practical Conference. Inst. of Ecol. & Evol. Problems, Russian Academy of Science, Moscow, p. 176. (In Russian)

Smith G. 1981. Winter roost site fidelity by Long-eared Owl in central Pennsylvania. Behavior 5: 339.

Sonerud G.A. 1986. Effect of snow cover on seasonal changes in diet, habitat, and regional distribution of raptors that prey on small mammals in boreal zones of Fennoscandia. Ecography 9: 33–47.

StatSoft Inc. 2007. STATISTICA, version 8.0. www.statsoft.com.

Tilba P.A. & Mnatsekanov R.A. 2005. Owls of Krasnodar Region and the Republic Adygeya. In: Volkov S.V., Sharikov A.V. & Morozov V.V. (eds) Owls of The Northern Eurasia. Moscow, pp. 269–276. (In Russian with English summary)

Volkov S.V., Sharikov A.V., Ivanov M.N., Sviridova T.V. & Grinchenko O.S. 2005. Distribution and number of Strigiformes in Moscow Region. In: Volkov S.V., Sharikov A.V. & Morozov V.V. (eds) Owls of The Northern Eurasia. Moscow, pp. 163–186. (In Russian with English summary)

Volkov S.V., Sharikov A.V., Basova V.B. & Grinchenko O.S. 2009. Influence of small mammals' abundance on the number and selection of habitats by Long-eared (*Asio otus*) and Short-eared (*Asio flammeus*) Owls. Zoological Journal 88: 1248–1257. (In Russian with English summary)

Wijnandts H. 1984. Ecological energetics of the Long-eared Owl (*Asio otus*). Ardea 72: 1–92.

Žaňat J., Škorpíková V. & Berka P. 2007. The Long-eared Owl (*Asio otus*) and its winter roosting places in South Moravia II. Crex 27: 8–34. (In Czech)

SAMENVATTING

Overwinterde Ransuilen *Asio otus* brengen de dag meestal op gezamenlijke roestplaatsen door, waar de aantallen van enkele tot honderden uilen kunnen variëren. In het onderhavige onderzoek zijn tussen 2001 en 2011 Ransuilen op roestplaatsen in Moskou gevolgd, vermoedelijk een van de noordelijkste overwinteringsplekken in Eurazië. In deze stad (ruim 1.000 km^2, waarvan ongeveer een derde uit 'groen' bestaat) werden 12 gezamenlijke roestplaatsen en 14 solitair roestende uilen vastgesteld. De meeste daarvan zaten in parken, maar niet alle roestplaatsen waren jaarlijks bezet. De vier grootste roestplaatsen (met maximaal 16 exemplaren) waren vele jaren in gebruik. Het aantal overwinterende Ransuilen was positief gecorreleerd met de talrijkheid van de Veldmuis *Microtus arvalis* (het stapelvoedsel van de uilen) in de herfst en het voorjaar voorafgaande aan de betreffende winter. Ook het aantal broedparen ter plekke in de voorafgaande zomer speelde een rol. Het maximum aantal Ransuilen op een van de belangrijkste roestplaatsen in Moskou werd beïnvloed door een combinatie van sneeuwdekdikte en wind, factoren die in sterke mate de vangst van muizen beïnvloeden. Temperatuur en neerslag hadden geen of nauwelijks invloed op de aantallen. (RGB)

Corresponding editor: Rob G. Bijlsma
Received: 14 June 2012; accepted: 3 November 2013