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Winter Roost Tree Selection and Phenology of the Long-Eared Owl (*Asio otus*) in Crimea

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Abstract: The winter roost of the long-eared owl *Asio otus* in Crimea (South of Ukraine), located in Simferopol, is described. In 2015–2017, the number of long-eared owls varied on a convex curve, with the maximum reached at the end of November and in December. The birds exhibited a strong preference for roosting in conifers, where we recorded 89% of the owls. There was an inverse relationship between the mean of the maximum daily temperature (°C) and the number of owls in both seasons. The owls were not sensitive to abrupt but short-term temperature changes, but the temperature decrease curve caused practically synchronous changes in the dynamics of bird numbers. It was found that the number of owls significantly differed based on weather conditions in 16 trees. The proportion of owls sitting on coniferous trees increased with unfavourable weather, and the converse pattern was observed for deciduous trees.

Keywords: Long-eared Owl; *Asio otus*; communal roost; phenology

1. Introduction

The long-eared owl (*Asio otus*) is widespread species, migratory in the northern part of its range, and sedentary in the south and west. In winter, it forms communal roosts [1].

Most studies of the long-eared owl relate to its feeding ecology and diet selection in different parts of its range [1–3]. Little information is available on the description and analysis of its numbers and diurnal roost sites [4–7]. The literature on roosting sites and attendant behaviour is limited, and few of the existing observations have been systematic [5,8]. Furthermore, relatively little work has been carried out on other aspects of the biology of this species, such as the phenology of winter roost occupancy and behaviour at the roost [9]. This ecology aspect has not been studied in Ukraine. A greater knowledge of the ecological correlates of communal roosting could help unravel issue about migration; the estimation of the population differences in behaviour of the long-eared owl in winter, and also to establish the anthropogenetic factors that threaten them in this period.

2. Materials and Methods

Our research was conducted in the Agrarne, in the northern part of Simferopol, in the Crimea Republic (Ukraine) (45°00′60″ N, 34°03′17″ E). The roost was localized in the university yard of Academy Bioresourses and Environmental Management. It is almost completely surrounded by five-story buildings. The size of the yard is 49 × 78 m. It contains 34 trees: 10 London planes (*Platanus* sp.)—LP1–10, nine Austrian pine (*Pinus nigra*)—AP1–9, two maples (*Acer* sp.)—M1–2, two Platycladus (*Platycladus orientalis*)—T1–2, two junipers (*Juniperus* sp.)—J1–2, two oaks (*Quercus* sp.)—O1–2, one Turkish pine (*Pinus brutia*)—TP, one European yew (*Taxus baccata*)—Y, one honey locust (*Gleditsia* sp.)—G, one birch (*Betula* sp.)—B, one elm (*Ulmus* sp.)—E, one pear (*Pyrus* sp.)—P, and one spruce (*Picea* sp.)—S (Figure 1). At the roost, the trees are low, about 5–7 m. This allowed us to consider all the owls on the trees.

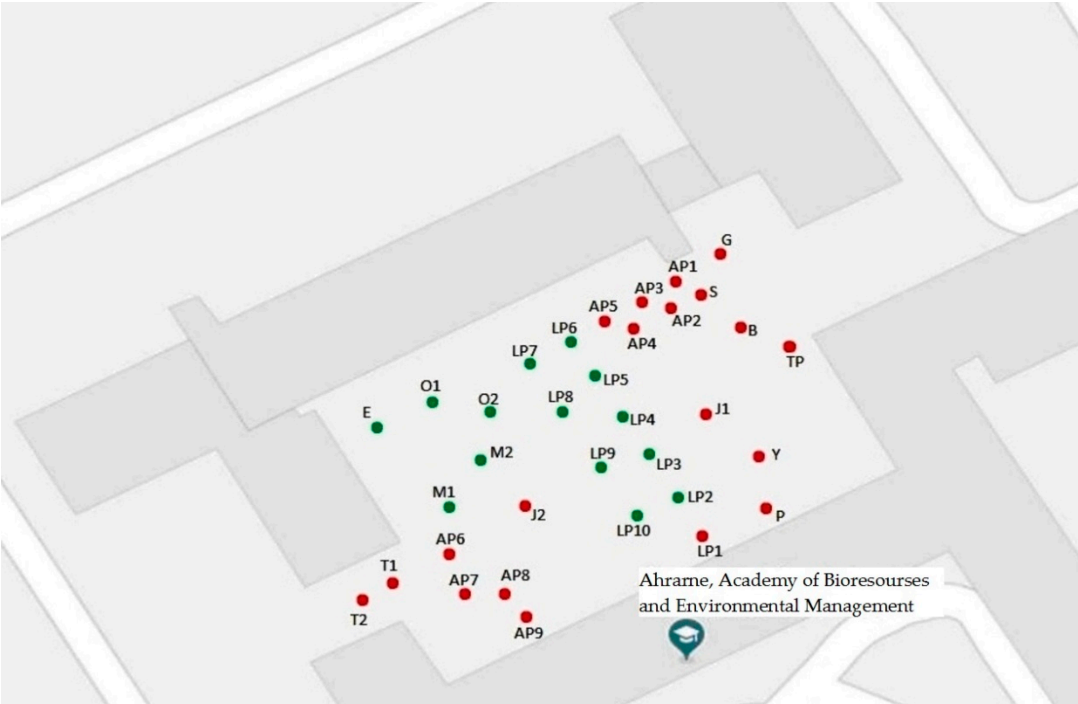

Figure 1. Map of the long-eared owls roost. Red dots: trees that were used by the owls, green dots: trees, where owls were absent, TP—Turkish Pine, AP—Austrian Pine, LP—London Plane, T—Platycladus, J—juniper, Y—European yew, G—honey locust, B—birch, P—pear, S—spruce, M—maples, O—oak, E—elm. Numerals near the dots indicate the serial number of the tree.

The owls were counted weekly from October to April 2015–2016 and 2016–2017 (n = 50 counting sessions), except for in the first ten days of January in each year. Each time, we recorded a quantity of birds on every tree and registered the mean of the maximum daily temperature, the weather, and the direction of the wind. The weather was categorized as sunny, cloudy, overcast, rain/fog and snow.

To determine the seasonal dynamics of bird numbers, we divided all months into three 10-day periods and calculated the mean value of the number of owls for two years in this period. A one-way analysis of variance (ANOVA) was used to test whether there was a significant difference between the number of birds sitting on the trees of different species and the weather conditions. The Pearson correlation coefficient was measured to determine whether there was a relationship between the value of the daily temperature and the number of owls on the roost.

3. Results and Discussion

During the study period, the number of long-eared owls changed on a convex curve, with the maximum occurring from the end of November to the middle of December (Figure 2). According to the literature, the maximum number of long-eared owls was in December in Milan, in Southern Europe [9], or with the peak in December or January in Moscow, in the north of the winter range [10]. In Romania, the number of owls was the highest in February and in November [11]. Comparing our results with those of other sites from Europe, it can be seen that the observed roost phenology is the most similar to that of North Italy.

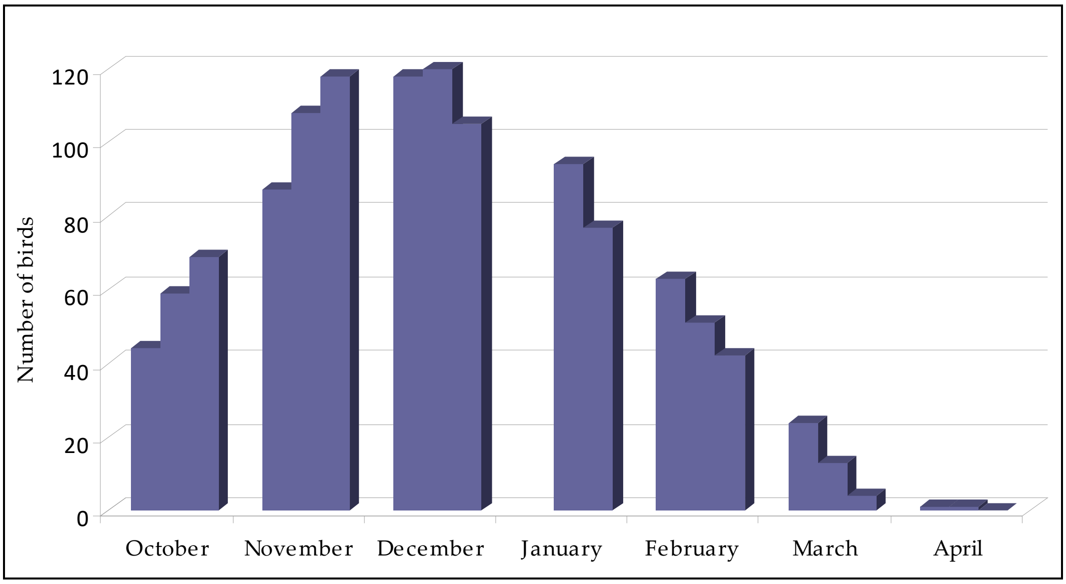

Figure 2. The mean value of the number of long-eared owls at the roost site per 10-day period from 2015–2017.

The owls arrive for wintering to the south of Ukraine from Finland, the northern regions of the Russian Federation, and the northern regions of Ukraine [12]. When we started the count in the middle of October, in both seasons the owls had already begun roosting. A possible explanation for this fact may be the arrival of birds in Crimea (south of Ukraine) in September. As noted earlier by Yu. Kostin [13] and N. Tovpinets and I. Evstaf'ev [7], the wintering owls fly into Crimea in October or in the middle of November. However, A. Poluda's [12] study of the migration of long-eared owls in the south of Ukraine has demonstrated that it takes place from the end of September in Kherson Oblast (just north of Crimea). The results presented in our work correspond more closely with the data, collected by A. Poluda. It can be seen from the data in Figure 2 that the number of birds changes smoothly, and there is no sharp increase due to migratory birds. Most likely, birds migrating through the Crimean peninsula do not use this roost region.

From the data in Figure 1, it can be seen that only 20 trees of a total of 34 were occupied by owls, and 14 trees that were mostly deciduous were not used by them at all. Errors in the counting of the number of the owls were minimized because of low trees height in the study site. The birds exhibited a strong preference for roosting in conifers. A total of 89% of the records were taken in these trees, and about 31% of the owls were observed on the Austrian pine (AP1). Only three deciduous trees were used by the owls: London plane, honey locust, and birch. The preference of long-eared owls to select roost trees from among clumps of conifers was also noted [5,7].

There was an inverse relationship between the mean of the maximum daily temperature (°C) and the numbers of owls in both seasons (Figure 3a–d). In 2015–2016, the inverse correlation was $r = -0.57$, $p < 0.05$. In the next season in 2016–2017, the inverse correlation was $r = -0.58$, $p < 0.05$.

If we divide the wintering into stages of increases and decreases of the owl numbers, the inverse correlation will raise. For example, in autumn 2015, the negative relationship was $r = -0.88$. In autumn 2016, there was a temperature anomaly (9 November 2016, $t = 23$ °C). This is the outlier is an observation point that is distant from other observations, the removal of which means that the correlation increases from $r = -0.62$ to $r = -0.93$. In spring 2017, it was -0.85. In both seasons, the curve of the numbers of owls was similar, but in 2016, the increase in the number of roosting owls was 16 days earlier than in 2015. The numbers of owls were increased correspond to a reduced temperature. That is, owls are not sensitive to abrupt but short-term temperature changes. However, the temperature decrease curve causes a practically synchronous change in the dynamics of the birds.

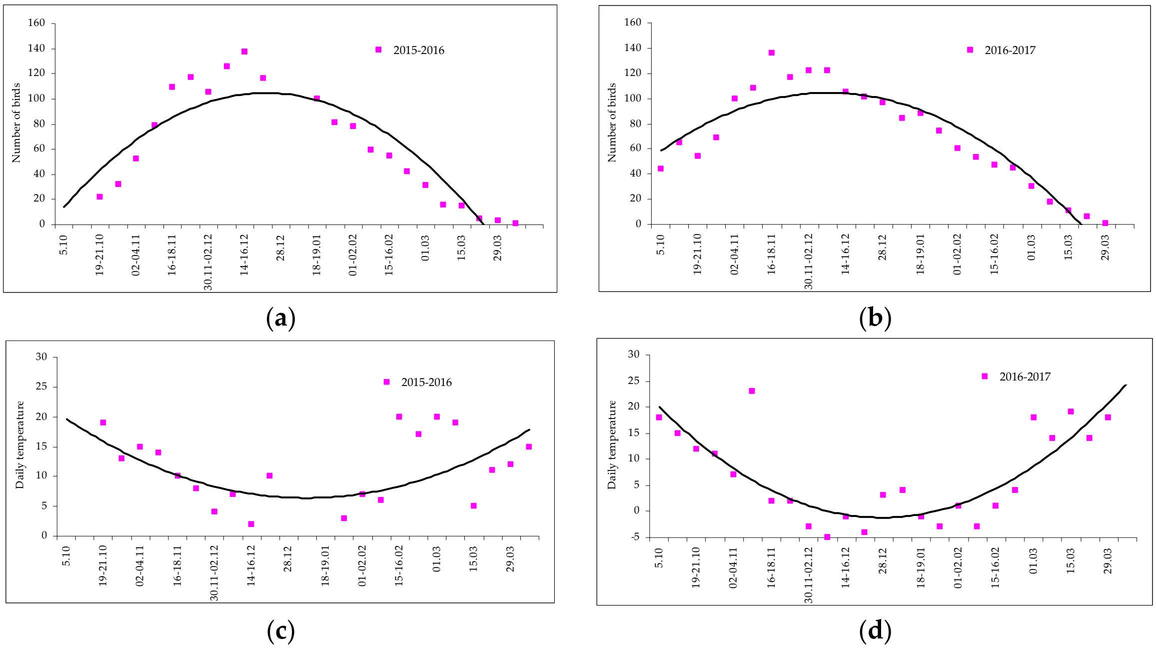

Figure 3. (**a**,**b**) The number of birds counted weekly from October to April in 2015–2016 and 2016–2017; (**c**,**d**) Temperature, °C, on days of observations.

We divided the weather conditions that accompanied the count sessions into five classes: sunny, cloudy, overcast, rain/fog and snow. A one-way ANOVA found that the number of owls significantly differs depending on weather conditions for 14 trees (Table 1).

Table 1. The list of trees for which a significant difference was found in the number of long-eared owls in different weather conditions.

Tree Species	Label on the Figure 1	% Owls Sitting on a Tree under Different Weather Conditions from the Total Number of Owls in This Weather					A One-Way ANOVA	*p*-Value
		Sunny	Cloudy	Overcast	Rain, Fog	Snow		
Platanus sp.	LP1	7.4	8.1	3.7	4.5	0.1	F = 4.69	$p < 0.001$
Taxus baccata	Y	1.2	2.5	3.2	2.3	2.7	F = 10.69	$p < 0.001$
Juniperus sp.	J1	5.6	5.1	8.4	6.3	6.5	F = 13.57	$p < 0.001$
Juniperus sp.	J2	0.6	2.8	0.4	2.0	2.2	F = 3,04	$p < 0.05$
Pinus brutia	TP	20.3	23.1	13.4	13.1	11.4	F = 11.48	$p < 0.001$
Pinus nigra	AP1	29.7	24.8	37.0	32.2	35.0	F = 39.69	$p < 0.001$
Pinus nigra	AP3	7.5	5.6	10.1	11.4	12.9	F = 23.03	$p < 0.001$
Pinus nigra	AP4	5.5	7.6	7.3	9.6	10.2	F = 30.18	$p < 0.001$
Pinus nigra	AP5	1.1	1.4	2.2	1.7	3.3	F = 11.52	$p < 0.001$
Pinus nigra	AP6	0.1	0.1	0	0.3	0.5	F = 4.87	$p < 0.001$
Pinus nigra	AP7	5.0	3.6	7.3	7.9	6.4	F = 15.48	$p < 0.001$
Pinus nigra	AP8	2.7	1.6	2.9	4.4	3.9	F = 16.57	$p < 0.001$
Pinus nigra	AP9	0.4	0.4	0	0.2	2.7	F = 4.00	$p < 0.001$
Picea sp.	S	0.1	1.1	0.4	0.3	0	F = 3.12	$p < 0.05$

The trees are grouped into two classes, depending on their use by owls under different weather conditions. The first class is all coniferous trees (Y, J1, J2, AP1, AP3-9, S). The number of owls sitting on these trees during precipitation (rain or snow) increased, but in sunny and slightly cloudy, weather it decreased. The reverse trend was observed in the second group of trees: *Platanus* sp. (LP1) and *Pinus brutia* (TP). The number of owls on these was higher in good weather than in bad weather. This can be explained by the peculiarity of the structure of the tree crown. Conifers have a crown with a sharp peak, broadening in a cascade towards the underside. Obviously, this protects the owls that are sitting inside against the rain. *Platanus* sp. is a deciduous tree that sheds foliage in the winter, thus protection from precipitation on this tree is minimal. *Pinus brutia* differs from other pines due to a spreading crown, which also offers less protection from rain, snow, and fog.

Additionally, we investigated the influence of the wind direction on the distribution of owls. However, no significant difference was found in the number of birds on trees under different wind direction conditions. The buildings surrounding the university yard sheltered the owls from the wind. This is confirmed by the fact that another park is localized outside the buildings. However, the owls were not registered in all period of the study there.

Fallen owls were not found during the study period. Nevertheless, the protective properties of residential buildings also contain potentially dangerous factors for owls. During one of the counting sessions, we registered that scared owls tried to fly into buildings and beat against the windows. We observed four attacks, with the result of one being that the owl fell and was disoriented completely for some time.

Small passerine birds, as well as crows, were indifferent to owls in roosting places. At the same, time in another park of Simferopol, we observed the aggressive attack of small passerines and hooded crows (*Corvus cornix*) on a long-eared owl. Possibly, the specific feeding behaviour of birds is important. We regularly investigated the pellets (more than 100 samples) at the roosting place in Agrarne, and they contained only parts of rodents. The pellets of owls collected from under the trees from another park included the bones of birds (goldfinch, *Carduelus carduelus*). Perhaps, the individual feeding preferences of owls are associated with external signs for other birds. On the other hand, roosting behaviour of many owls may be a strategy to limit mobbing [14]. However, more research on this question needs to be undertaken before this relationship can be more clearly understood.

4. Conclusions

1. In Crimea, the maximum number of roosting long-eared owls was recorded from the end of November to the middle of December, and the minimum in October and April. The number of owls is changed smoothly in the winter roost, and there was no sharp increase due to migratory birds.
2. The birds exhibited a strong preference for roosting in conifers. The distribution of owls on some trees differed significantly under different weather conditions.
3. The temperature decrease curve caused a practically synchronous change in the dynamics of the increase of the number of birds, but abrupt short-term anomalies did not have an effect.

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