

Short communication: Vocalization of the Long-eared owl *Asio otus* (Strigiformes, Strigidae) in the Middle Volga, Russia

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Abstract. Andreychiev A, Lapshin A, Kuznetsov V. 2021. Short Communication: Vocalization of the Long-eared owl *Asio otus* (Strigiformes, Strigidae) in the Middle Volga, Russia. *Biodiversitas* 22: 5325-5330. Both daily and seasonal year-round vocalizations of the Long-eared owl (*Asio otus*) (Linnaeus, 1758) were recorded in the Middle Volga River region, Russia with the use of digital dictophones. Voice recorders were installed in the daytime for up to 5 days. The maximum duration of continuous operation of voice recorders was about 140 hours. By the time the previous recording was finished, we would arrive and move the recorder to a different location. The Long-eared owl can be classified as a moderately vocalizing bird, with calls recorded during 3 spring months. Peak activity is associated with pre-incubation and incubation periods. In the spring months, calls of the Long-eared owl were recorded from 16.37 h to 03.43 h. In the spring, the Long-eared owl began to cry before sunset (from 1 hour 30 minutes to 3 hours 15 minutes) and after sunset (from 56 minutes to 3 hours 39 minutes). Vocalization started after sunset for an average of 50 minutes. Vocalization always ended before dawn (to 1 h 21 min). Statistically significant differences in the duration of vespers and morning vocalizations were obtained with the use Mann-Whitney U test ($Z = -3.08$; $p < 0.05$).

Keywords: *Asio otus*, climatic factors, Long-eared owl, Middle Volga, Russia, vocalization

INTRODUCTION

Vocalization of different species of animals carries a lot of scientific information about various features of their biology and ecology. The song of many bird species is a signal that conveys information about individual qualities that play a relevant role in advertising territory ownership and mate attraction (Martinez and Zuberogoitia 2002; Lourenço et al. 2013; Burgos and Zuberogoitia 2020). The hoots of some owl species have been shown to confirm this assertion and there is evidence that individual recognition and variation among populations exist. Females and males react in a variety of ways to the hooting of intruders. Thus, while territory defense is cooperative for some species, males and females of other species respond exclusively to intruders of their own sex (Martinez and Zuberogoitia 2002).

Because vocalizations are used to estimate owl populations, it is important to identify environmental factors affecting owl calling (Moreno-Mateos et al. 2011; Yee et al. 2016; Worthington-Hill and Conway 2017; Fröhlich and Ciach 2018; Ševčík et al. 2019; Zuberogoitia et al. 2019; Orlando et al. 2020). Some bird species may develop behavioral responses to adapt song parameters to adverse weather conditions (e.g., heavy rain, strong wind and cold temperatures; Sharikov and Shekhovtsov 2013; Zuberogoitia et al. 2019; Clément et al. 2021; Pérez-Granados et al. 2021). From alien studies, we should note the successful work of Spanish zoologists on the Eagle-owl (*Bubo bubo*). For the Southwestern part of Spain, it is

shown that the beginning and end of the sound activity of owls are timed to sunset and sunrise, respectively. The authors explain this circumstance from the position of good visual contact between individuals (Penteriani and Delgado 2019). Researchers highlight the influence of weather, climate, and trophic conditions on vocalization (Lehikoinen et al. 2011; Sharikov and Shekhovtsov 2013; Mikkola and Mikkola 2015). One of the interesting species is a bird of prey-the Long-eared owl, *Asio otus*.

The calls of the Long-eared owl and other owls are used in the classical version only for tracking when using the direction-finding method (Tome 1997; Zuberogoitia et al. 2020). In the Netherlands, the calls of Long-eared owls were recorded from January (van Manen 2000). Of undoubted interest, at what hours of the day do the owl most vocalize? As well as how vocalization changes by season and month. And also, what possible reasons can have an impact on this?

The research aims to determine the vocal activity of the Long-eared owl (daily and seasonal rhythm) and the possible influence of weather and climatic factors in the Middle Volga, Russia.

MATERIALS AND METHODS

Voice activity of the Long-eared owl was recorded year-round in three districts (Figure 1) of the Republic of Mordovia, Russia Federation (53°38'-55°11'N and 42°11'-

46°45'E). The climate of the region is moderately continental with pronounced seasons throughout the year. The average annual air temperature varies from 3.5 to 4.0°C. The average annual precipitation in the territory is 480 mm.

We recorded the vocalization of the Long-eared owl, Bolshebereznykovsky (Parakino, Shugurovo, Kosogory, Sosnovyj Gart), Chamzinsky (Kirzhemany), Dubensky (Cheberchino) districts.

We recorded the voice activity of the Long-eared owl from March to December for five years (2015-2020). We used Olympus VN-416PC, VN-406PC, VN-712PC autonomous recording units. Recording units were installed in the daytime in each sample site and automatically recorded for up to 5 days. This technique of recording vocalization was tested by Eagle-owl (rare species for the region) (Andreychev et al. 2014, 2016, 2017; Lapshin et al.

2018), Ural owl (common species for the region) (Andreychev and Lapshin 2017) and underground mammals (Andreychev 2018, 2019, 2021; Andreychev et al. 2020). Totally, we set the recording units in six sample sites (Figure 1). The maximum duration of continuous operation of voice recorders was about 140 hours. By the time the previous recording was finished, we would arrive and move the recorder to a different location.

Since no individual differences in the vocalization of the Long-eared owl were revealed, we concentrated on the total sample. Registration of the activity of the Long-eared owl is, first of all, registration of the calls of males, as females shout less often and mainly with the male. Therefore, most of the material was obtained from male vocalization since they exhibit higher vocal activity than females. This is consistent with data from other researchers (van Manen 2000; Zuberogitia et al. 2020).

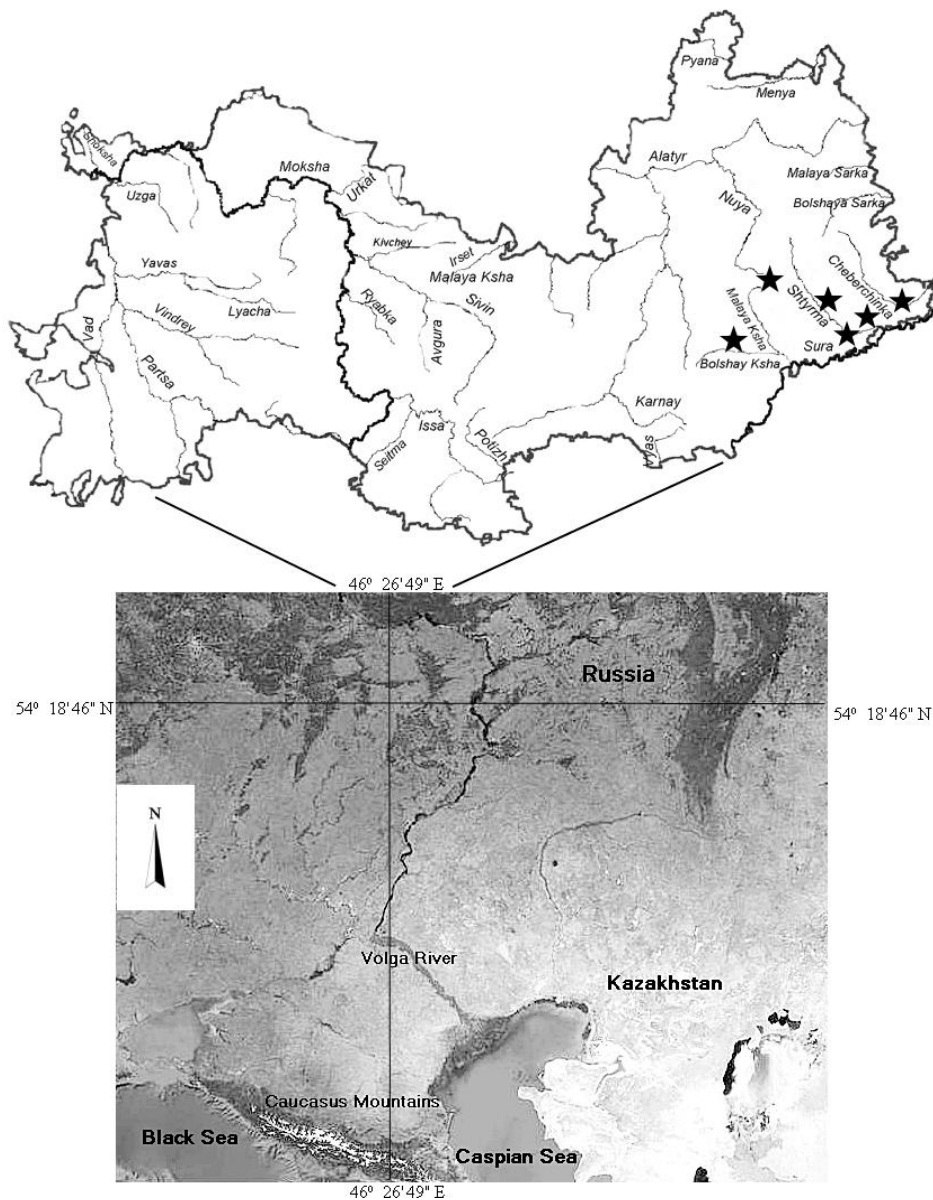


Figure 1. Research areas (black asterisks)

The resulting audio records were processed using the AIMP 1.75 (2007) and AUDACITY2.1.1 (2015) programs. We looked at the spectrograms (time on the x-axis; frequency on the y-axis; amplitude on the z-axis visualized as a color) using the software. The purpose of the spectrograms was to more effectively (faster) identify the calls and easily check when the vocalizations started and ended.

We singled out the beginning and end of vocal activity in the evening, night and morning hours when analyzing the recordings. The beginning and end of vocal activity in the evening hours were determined in the period of two hours before and after sunset. The onset of vocal activity in the morning hours was determined two hours before and after sunrise. The beginning and end of nighttime activity were recorded in the day's remaining interval between sunset and sunrise. The duration of individual periods of vocalization was determined. When identifying the confinement of the beginning and end of calls, only those days were taken into account when the Long-eared owl was shouted in the interval up to 5 hours relative to sunset and sunrise, respectively. In the presence of calls, but their absence sooner or later than this interval from sunset or sunrise, these days were not taken into account. A comparison was made for the months and seasons of the year. Similarly, a possible dependence of vocalization on the phases of the moon was revealed. The possible influence on owl activity of weather conditions (temperature (°C), force (m/s) and direction of the wind, precipitation in the form of rain or snow, cloud cover (%), pressure (mm Hg), was revealed. These variables were measured daily. To characterize the climatic conditions, we used data from a weather station Bolshie Berezniki (Phase

of the Moon 2021, rp5.ru 2021, Sun and Moon Wall Calendar 2021, Well and weather 2021).

Correlation analysis (rs-nonparametric coefficient Spearman) was used to identify the relationship between vocalization and variables. We tested the next aspects of vocalization: number of calls per day, start or end of calling time, and total length of calling time. All these variables were defined in the AUDACITY program. A comparison was made for the months and seasons of the year. Similarly, a possible dependence of vocalization on the phases of the moon was revealed. Correlation analysis (rs-nonparametric coefficient Spearman) was used to identify the relationship between vocalization and parameters. A comparison of morning and evening vocalization was made using the non-parametric Mann-Whitney U-tests. Statistical calculations were performed using the AtteStat 8 (2002), Microsoft Office Excel, Microsoft Corporation (2003), and Past (Hammer et al. 2001) computer programs.

RESULTS AND DISCUSSION

During the research period, 78 sound recordings were obtained and processed, with a total length of about 6500 hours. A common variant of the vocalization of the Long-eared owl in Mordovia is a series of calls. The frequency range of male calls was 200-300 Hz. The intervals between individual screams were 2 s. It turns out a measured «hu-hu-hu-hu-hu». The female's similar sound response was rougher, hoarser, and much rarer than the male's. The frequency range of female calls was 300-400 Hz. A single female call usually lasted 0.5-0.6s and was issued unevenly. The intervals between individual calls were from 4 seconds or more (Figure 2).

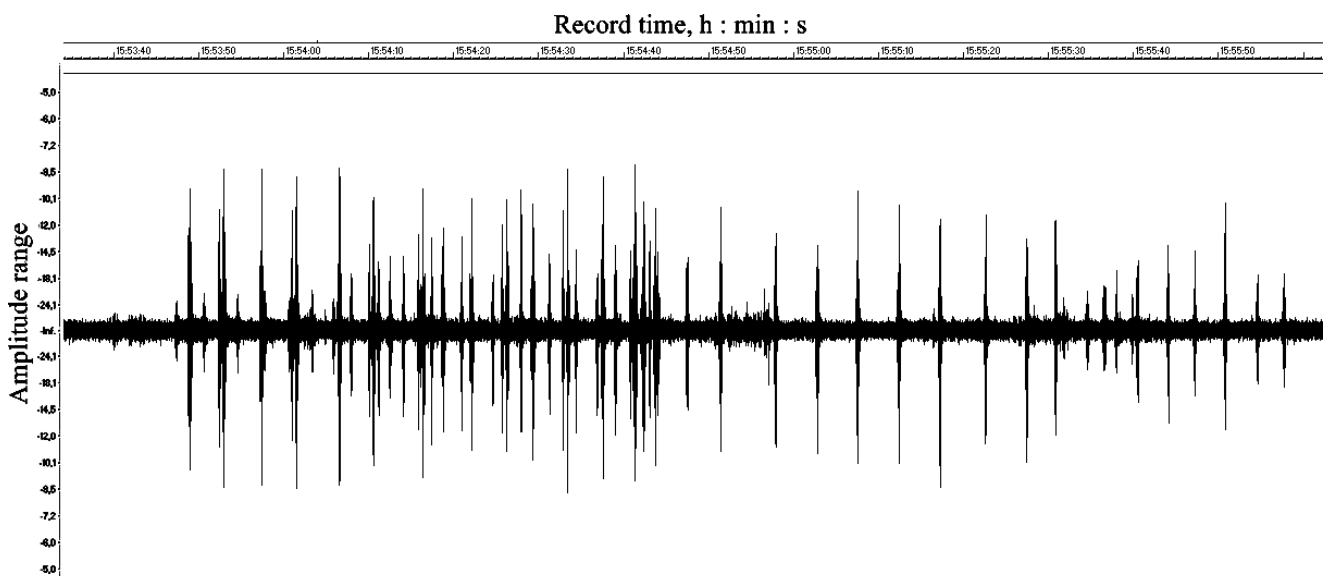


Figure 2. Oscillograms obtained by voice recorders vocalizations of Long-eared owl

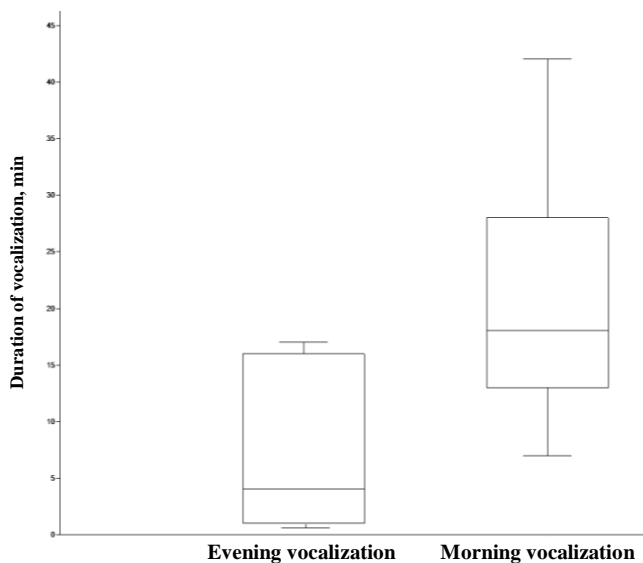


Figure 3. Ranges of the duration of evening and morning vocalization of the Long-eared owl based on materials for the spring period. Note: "striped box" is the median, the boundaries of the box are 25-75% quantiles, whiskers-minimum and maximum values

The vocal activity was recorded from March to May. The peak of vocal activity was recorded in April. In the spring months, calls of the Long-eared owl were recorded from 16.37 h to 03.43 h. During this period, the Long-eared owl showed vocal activity during several hours from 1 to 6 h 42 min (village Kosogory-13.04.17) per night. The vocal activity showed a bimodal peak, one in the evening hours (before 00.00 h) and the second before sunrise. Calls after 00.00 h were recorded less frequently, mainly in April.

A comparison of the entire evening and morning vocalization duration for the entire year using the Mann-

Whitney test revealed statistically significant differences between the first sample and the second ($Z: -3.08$; $p < 0.05$) (Figure 3). The duration of the evening vocalization of the Long-eared owl is significantly inferior to the morning vocalization.

As it was found out as a result of research, the vocalization of the Long-eared owl practically does not depend on the meteorological conditions of the environment. There is a statistically significant relationship between a binary variable of vocalization (yes-the owl calls are present or no-the owl calls are absent) and precipitation in the form of rain and snow ($rs: -0.34$, $p: 0.01$). This is indirectly evidenced by the cessation of vocalization of the Long-eared owl with the beginning of rain. No statistically significant relationships were found with temperature ($rs: -0.18$, $p: 0.78$), pressure ($rs: 0.11$, $p: 0.66$) and wind force ($rs: -0.85$, $p: 0.81$). Vocalization was observed in the temperature range from -8 to $+19^{\circ}\text{C}$ ($+3 \pm 6.5^{\circ}\text{C}$; CV: 26%). Calls of the Long-eared owl in the region were recorded at wind strength from 1 to 6 m/s (3 ± 1.11 m/s; CV: 233%), at cloud cover from 10 to 100% ($76 \pm 0.89\%$; CV: 29%), at pressure from 738 to 763 mm Hg (750 ± 2.02 mm Hg; CV: 0.7%). Calls were recorded equally in both the rising and waning phases of the moon. No calls were recorded during the full moon.

Comparison of the timing of the beginning of vocalization in the evening with sunset and its completion in the morning with sunrise did not reveal a statistically significant relationship. But, nevertheless, we consider it appropriate to give a general trend. In the spring, the Long-eared owl began to cry before sunset (from 1 hour 30 minutes to 3 hours 15 minutes) and after sunset (from 56 minutes to 3 hours 39 minutes) (Figure 4). Vocalization started after sunset for an average 50 minutes. Vocalization always ended before dawn (to 1 h 21 min) (Figure 5).

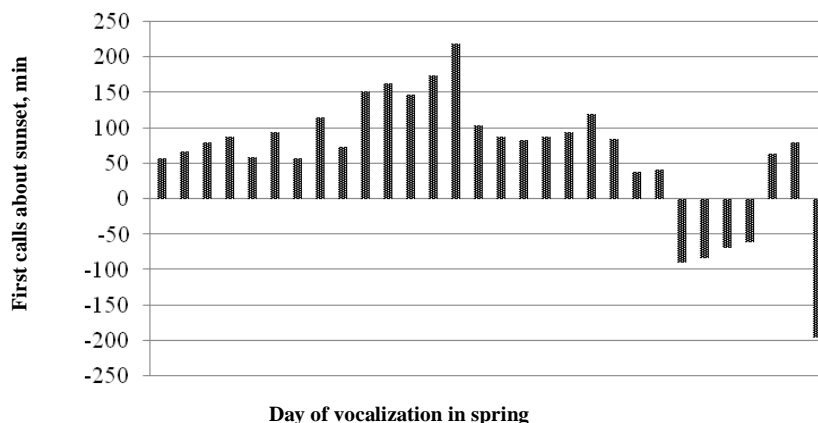


Figure 4. The timing of vocal activity of the Long-eared owl to sunset. Note: the number of columns corresponds to the number of days when the Long-eared owl began vocalization in the interval after 5 hours relative to sunset

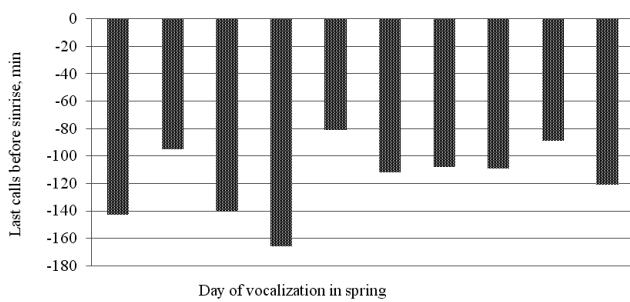


Figure 5. The timing of vocal activity of the Long-eared owl to sunrise. Note: the number of columns corresponds to the number of days when the Long-eared owl finished vocalization in the interval after 5 hours relative from sunrise

Comparing the results obtained by us with a few data on the vocal activity of the Long-eared owl in other regions, we should single out the general trend in the current timing. In Netherlands, where the calls of Long-eared owl were recorded from January to April (van Manen 2000). In Mordovia, the vocalization of the Long-eared owl was recorded from March to May. We assume that the geographic latitude of the area inhabited by the Long-eared owl may be decisive in this difference. Climatic conditions exert indisputable influence. Our research covers the northern sections (approx. 54°N), in Netherlands, these are the southern sections (approx. 52°N), therefore vocalization of the Long-eared owl in Mordovia takes place somewhat later. The spring vocalization of the Long-eared owl is confirmed by data for Germany and Spain (Block 2009; Zuberogoitia et al. 2020).

In terms of vocal characteristics, the recorded calls of the Long-eared owl are similar to those recorded for other regions (Martínez et al. 2002; van Manen 2000; Block 2009; Pukinsky and Pukinskaya 2011). There are slight differences between Mordovia and Spain in daily activity with the general tendency of birds to start vocalizing after sunset. So vocalization in Mordovia began after sunset for an average 50 minutes. And in Spain, vocalization activity was often recorded during sunset (Martínez et al. 2002). A similar discrepancy in the vocalization of owls was noted earlier on the example of the Eagle Owl in Mordovia (Lapshin et al. 2018) and Spain (Penteriani and Delgado 2019).

Our results do not show statistically significant relationships between vocalization and many meteorological factors other than precipitation. However, their influence has a place to be on other features of the biology of the species. For example, for the city of Moscow, among weather factors, the most important influence on the dynamics of Long-eared owl was by snow cover and wind jointly, though the snow was undoubted of greatest significance. Air temperature and precipitation turned out to be almost of no importance for owl dynamics at the roosting site (Sharikov et al. 2014).

Of interest is the similarity of the Long-eared owl concerning the timing of vocalization to sunset and sunrise compared to other species of owls. For Eagle Owl in

Mordovia, evening calls were recorded, as a rule, 1 hour before sunset. The completion of the morning vocalization of the owl usually occurred 1.5 hours before sunrise (Lapshin et al. 2018). For the Tawny owl (*Strix aluco*) in the Moscow region, voice responses were recorded mainly after sunset, and for the Pygmy owl (*Glaucidium passerinum*) 1.5 hours before and after sunset (Sharikov and Shekhovtsov 2013). For the Blakiston's fish owl (*Ketupa blakistoni*) in Primorye, voice responses were recorded 20-40 minutes after sunset (Pukinsky and Pukinskaya 2011). Thus, we can say that the timing of vocalization to sunrise and sunset in different types of owls has a specific character. Spring and autumn distributions of calls of different species of owls by the time of day differ slightly.

Some differences in the number of calls of the Long-eared owl per day in different regions can be explained by the results obtained by researchers in Spain on the example of the Eagle-owl. There is a lower intensity of vocalization of single males by season than males in pairs (Martínez and Zuberogoitia 2002). In areas with a high population density, calls are heard much more often in order to mark their sites from possible intruders.

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