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Colonial wintering of Long-eared owl (*Asio otus*) in Botoşani County (N-E Romania)

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Abstract. This study explores the phenological aspects and distribution of long-eared owl (*Asio otus*) colonies in Botoşani county, N-E Romania. The anthropogenic impact was also evaluated and analyzed and the microhabitat where the colonies are located. Data was collected between November 2018 and February 2019. 9 settlements in Botoşani county, including the municipality of Botoşani, were investigated. Data about temperature, the size of the colony, the tree species where the colony is located and anthropogenic impact, were collected. 9 colonies were identified with a total of 340 individuals. Two short-eared owl (*Asio flammeus*) were identified in one of the colonies. The maximum number (51) of specimens is reached in the months of January and February, and the minimum number (30) in the months of November and December. It has been observed that when the temperatures tend to fall, the size of the colonies register significant growth. The preferred species of trees are gymnosperms (69%), the owls were found on angiosperms as well (31%). The preference for the coniferous species increases along with the drop in temperatures and the increase in rainfall or snowfall, as these types of trees offer better protection against the weather conditions. We noticed that the anthropogenic factor has a significant influence on the colonies of *Asio otus*, so we wanted to grade it with the help of a scale from 1 to 7. Grade 1 was given in only one locality (Ştiubieni), grade 2 was registered in 4 points (Dorohoi, Avrămeni, Botoşani, and Roma), grade 3 is found only in Bucecea, Corlăteni registers a grade of 4, while in Dobârceni the registered value is 5, grade 6 is met only in Săveni. Grade 7 represented the stage in which there is a decrease in the population of *Asio otus*, or the death of individuals for various reasons, a situation that has not been encountered.

Keywords: phenology, tree selection, anthropogenic impact.

Introduction

As a response to diverse changes in the ecosystem, each taxonomical group adopt different strategies to keep the individuals alive and the group integrity. In this context some bird species adopt a grouped distribution with the goal of creating a unitary population, which helps them be better protected against predators, weather conditions and the finding of food, all objectives being made easier this way. A relevant example of such an advantage that grouping gives is found in some strigiform species, which, in the cold season, change their solitary and territorial behavior that express during the reproduction period, and opt to form colonies in different places (Gryz and Gryz, 2015).

Such a significant example of this behavior is found in the long-eared owl, *Asio otus* (Strigidae, Strigiformes L.) spread throughout: Europe, North-West Africa, Asia and North America (Marks *et al*., 1994; Moga *et al*., 2005). The populations from the northern parts of its range are migratory, and those from the southern and western are sedentary (Cramp and Simmons, 1985; Kucherenko and Kalinovsky, 2018).

Long-eared owl, constitutes one of the most wide-spread strigiform species in Romania in particular, and in Central Europe in general (König and Weick, 2008; Gryz and Gryz, 2015). Typical of the long-eared owl is the way they form large colonies during winters, in diverse areas, where they can find a stable source of food, protecting themselves more easily against weather conditions and potential predators (Moga *et al.,* 2005). Among their favorite places there are the urban and suburban areas, an aspect which facilitates the observation of the species (Cramp, 1985; Galli *et al.,* 2015; Lövy and Riegert, 2013).

Throughout the cold season, in the long-eared owl, colonies, there can be spotted also individuals of short-eared owl, *Asio flammeus*, which appear as visitors due to the fact that this species' presence in Romania is rare in contrast to that of the long-eared owl (Papp and Sándor 2007; Ionescu *et al*., 2017).

It is known that the climate change which affects the whole planet, and the excessive urbanization, influence the behavior and phenology of birds (Møller *et al*., 2010). The majority of studies done on long-eared owl colonies (Laiu *et al*, 2003; Nistreanu and Postolachi, 2011; Chiba *et al*., 2005) are focused on the regime and trophic preference of the owls and very few studies explore aspects related with dynamics of individuals in the colonies (Sharikov *et al*., 2014). In this context, the aims of our study are to (i) evaluate the phenological aspects of the colonial wintering, (ii) the dynamics of populations and (iii) the anthropogenic impact over colonies. Our investigation represents the first study of its type in the county of Botoşani, which besides all the phenological and populations dynamics information, brings also data about the distribution of the species in the area.

Study area

Our study was conducted in the north of the region of Moldova, more specifically in Botoşani county (47 ° 50′N 26 ° 49′E) (Fig. 1). Located on the old Platform of Moldova, Botoşani county constitutes 2.1% of the surface of Romania, being spread over 4965 km^2 (Mititelu and Chifu, 1994; Varvara and Apostol, 2008). As regards this relief, it is not extremely varied, the predominant forms being: plains, plateaus and hills. Of the total area, agricultural lands account for the most part 82%, followed by natural grasslands 14% and forested lands that account for only 11% (Mititelu and Chifu, 1994).

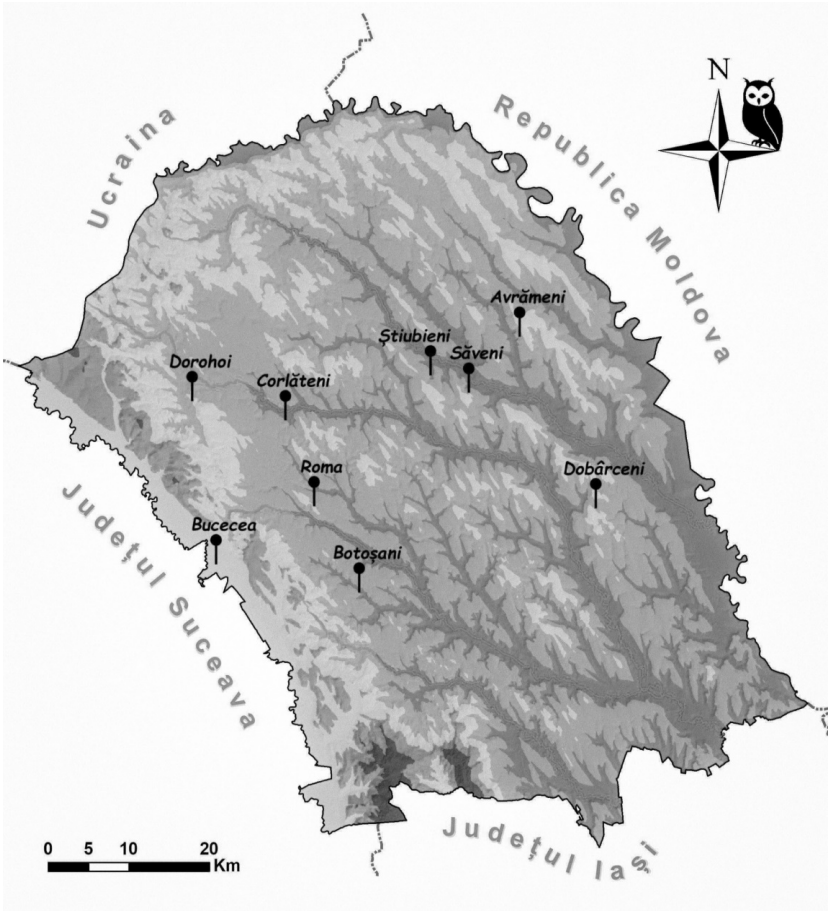

Figure 1. Study area and the points where the *Asio otus* colonies were identified

Materials and methods

Data were collected throughout the period of November – December 2018 and January – February 2019, when we conducted observation in 8 settlements from Botoşani county, as well as in the municipality of Botoşani (Fig. 1). For correctly identifying the points of interest and for an orderly gathering of data, the exploited methods were: fixed-point iteration, trail method, the counting of all individuals and taking picture to each one of them (Rang, 2002).

The identification of the colonies was accomplished by talking with locals (by showing them pictures), as well as the surveying of the areas which seemed favorable for the long-eared owl colonies (e.g.: areas with old buildings, spaces surrounded with gymnosperms). After pin pointing the colonies, we collected information about the number of individuals, the influence of the anthropic factor, tree species they occupied, as well as the number of individuals and the weather conditions. At the same time for each point of interest we registered the temperature to establish if there's a correlation between weather conditions and the type of tree chosen by the individuals. The intensity of the wind was also recorded with the help of the Beaufort scale, in which correlations were made between the visual effects produced by the wind and its type.

The antropogenic impact was evaluated on a scale from 1 to 7 as follows: Grade 1: describes the area where people are present but do not disturb the colony directly. Grade 2: here exist passing cars, but there are no street lights. Grade 3: There are people, cars and street lights at night. Grade 4: There are people who directly disturb the colony. Grade 5: The anthropic impact is big, caused by people, fireworks, noises, car lights. Grade 6: activities during the winter holidays, songs, shows. Grade 7: Death of the individuals in the colonies.

Results and discussions

Table 1. Frequency of the number of individuals, depending on the period in which the observations took place and on average temperature fluctuation

Date of observation	Settlement	Number of individuals	Temperature (^{0}C)
21.11.2018	Săveni	30	-1
21.11.2018	Avrămeni	32	-2
27.12.2018	Dobârceni	30	1
1.01.2019	Dorohoi	28	-1
1.01.2019	Săveni	51	1
12.02.2019	Dorohoi	49	-2
13.02.2019	Bucecea	30	-1
13.02.2019	Botoşani	48	0
13.02.2019	Ştiubieni	30	0
16.02.2019	Corlăteni	40	-1
16.02.2019	Roma	30	0

There were identified 9 colonies with a total of 340 specimens. The maximum number of a colony was of 51 individuals and the minimum of 28, with an approximated average of 38 specimens (Tab. 1). Concerning the dynamics, the highest number of individuals was observed in the months of January and February 2019 (Fig. 2).

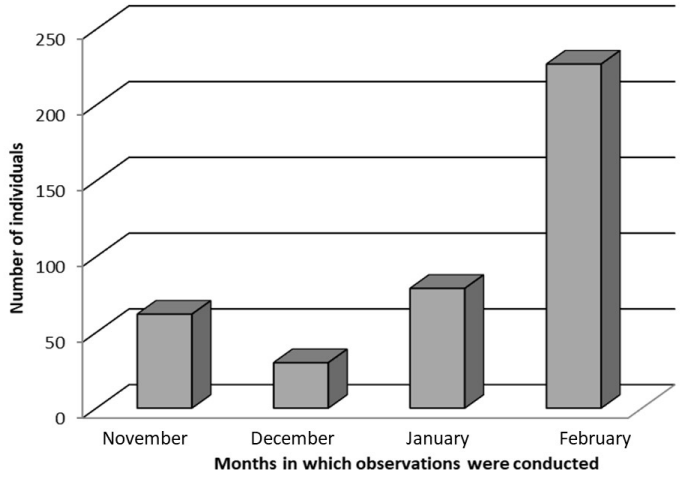

Figure 2. Frequency of the number of individuals depending on the month of the observations

It was noted that, once the average temperatures fell (from 0^0 to -2^0), the number of individuals in colonies registered an increase (from 28 to 49), fact which proves that this species' organization during the cold season is influenced by the weather conditions. According to specialty literature, in the interval of 2014-2015, the maximum number of individuals in the southern part of Romania was reached in the months of February and November (Mestecăneanu and Gava, 2015).

In other countries, the fluctuations are more different, as in Italy (Pirovano *et al*., 2000) the peak is registered in the month of December, in Russia (Sharikov *et al*., 2013) the peak is reached in the months of December and January and in Ukraine, more specifically in the Crimea (Kucherenko and Kalinovsky, 2018) the maximum number is reached in November and December. Confronting all this data, the dynamics of the populations we observed is closest to that of Russia. It is observed that, at the same time, the dynamic of long-eared owl colonies, which can differ even at the level of this country, the main reason is being represented especially by the different weather conditions.

The agricultural lands and the natural grasslands are important areas for the owl colonies, they provide a valuable food source for them. At the same time, forested areas and parks are important nesting areas for the colonies of long-eared owl. The aspects mentioned are also found in the distribution of the studied owl colonies, these being identified in the localities surrounded by meadows and agricultural lands.

The places in which the long-eared owl colonies were identified are surrounded by different old buildings, blocks, among their favorite places being: public parks (10%), block gardens (20%), private areas (20%), areas in front of public institutions buildings (30%) and areas next to the road (20%) (Fig. 3).

The species occupied by long-eared owl individuals are: *Betula pendula* (Silver birch), *Picea abies* (Norway spruce), *Fagus sylvatica* (European beech), *Thuja occidentalis* (Arborvitae), *Fraximus excelsior* (European ash), *Salix alba* (White willow) (Fig. 4), the highest preference being for the coniferous species (Pirovano *et al*., 2000) (Tab. 2, Fig. 4).

Therewith, the individuals' preference for a certain type of tree was also observed, data being collected referring to the number of specimens of long-eared owl occupying each tree species (Table 2). Most individuals were observed on the species of norway spruce, though they were present on other species too. It was observed that in the long-eared owl colonies the tree species they choose is influenced by the weather conditions as well. This fact was observed in Săveni and Dorohoi, places in which we conducted trips in different periods of time. Thus, once with the decrease in temperatures or the increase in intensity of rainfall and snowfall the long-eared owl individuals opted to group in larger numbers on species of gymnosperms, these offering a better protection against the weather. In days in which showers didn't occur, the individuals had random groupings, them being found on angiosperms as well as gymnosperms. The direction of the air currents was another parameter recorded during the study. According to Beaufort's scale, 5 types of wind were recorded, respectively: noticeable, light, weak, moderate and significant. It has been observed that the wind does not change the dynamics or degree of grouping of individuals in a colony. Moreover, in most cases, the colonies of long-eared owl were located in such a way that the buildings around them provided protection against the climatic conditions (Fig. 4) (Kucherenko and Kalinovsky, 2018).

In one of the colonies of long-eared owl, two specimens of short-eared owl (Ştiubieni) were identified, a species with few reports in the region of Moldova. At the same time, they were also observed among the colonies and

individuals of *Streptopelia decaocto* (Eurasian collared dove), *Corvus monedula* (Western jackdaw) and *Corvus frugilegus* (Rook).

Table 2. Distribution of *Asio otus* individuals depending on the tree species for each observation point

Settlement	Tree species selected and their number	Number of *Asio otus* individuals
Dorohoi	*Salix alba (2)*	18
	Fraxinus excelsior (1)	31
Săveni	*Picea abies (4)*	32
	Thuja occidentalis (3)	12
	Fagus sylvatica (1)	4
	Betula pendula (2)	3
Avrămeni	*Picea abies (3)*	32
Dobârceni	*Picea abies (4)*	30
Bucecea	*Picea abies (2)*	30
Botoşani	*Picea abies (4)*	48
Ştiubieni	*Picea abies (4)*	30
Corlăteni	*Picea abies (7)*	40
Roma	*Picea abies (6)*	30

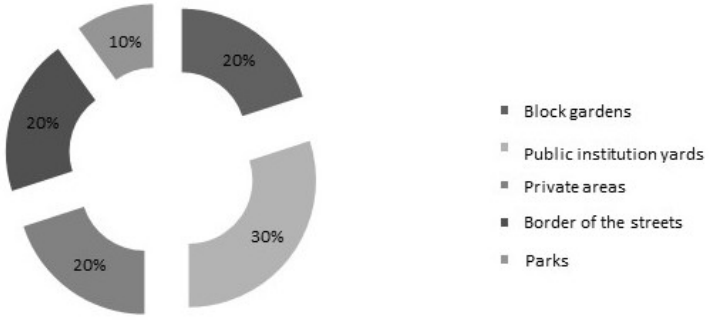

Figure 3. Areas where *Asio otus* colonies were located

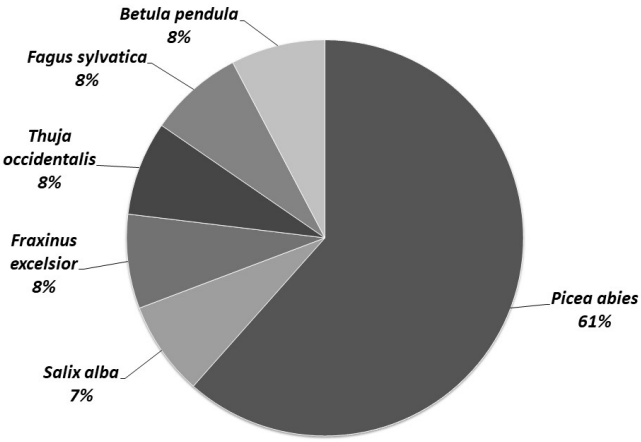

Figure 4. Distribution of *Asio otus* individuals on different tree species in the colonies.

Throughout the study, no injured or dead owls were identified, even though the anthropogenic impact exerts significant pressure on some colonies (Kucherenko and Kalinovsky, 2018). We point out that habitat destruction and disturbance of this species can have a major impact on its future. Thus, for each point we recorded the following situations: Grade 1 describes the area in which the presence of man does not influence at all the colonies of long eared owl, these being located in secluded areas (e.g: Ştiubieni). Grade 2 represents a space in which the long-eared owl individuals are phonically disturbed by the passing cars in their vicinity (e.g: Dorohoi, Avrămeni, Botoşani and Roma). Bucecea is the settlement registered with grade 3, due to the fact that the long-eared owl colony is disturbed phonically from the cars, shops and pubs nearby, as well as by the light emitted from the surrounding buildings. In the settlement of Corlăteni the colony of long eared owl was disturbed and cast off by the locals because of the owl pellets that piled up in their yards, thus grading the impact in this case with a 4. In Dobârceni, the grade given was 5, due to the fact that to the disturbance of the long-eared owls, fireworks used on hildays contributed as well. Grade 6 illustrates activities during the winter holidays, such as: placing of a stage near the colonies, installing of Christmas lights near the owls, the carols which were broadcast during the day in from of the Săveni town hall, the place around which the long-eared owls were located. The 7th grade indicates a decline in the population of owls, the death of some individuals from diverse reasons, a situation which thankfully was not registered in any of these locations.

Conclusions

In the period of November – December 2018 and January – February 2019, there were 9 long-eared owl colonies identified, with a total of 340 specimens in the county of Botoşani.

In Botoşani county the maximum number of long-eared owl individuals is reached in the months of January and February, and the minimum number is observed in the months of November and December.

The dynamic of long-eared owl colonies is influenced by the climate conditions, more precisely by temperatures and rainfall/ snowfall, these being a cause of the grouping degree of individuals.

The preferred tree species by them are represented by gymnosperms, these offering an enhanced protection against weather conditions.

The pursuance and the effectuation of the census on the species represents an important element due to the fact that the anthropic impact affects the long-eared owl colonies more and more.

Global warming is getting stronger, this being a factor which destroys habitats and limits food resources for more and more species, including the species of long-eared owl and short-eared owl.

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