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NIGHT RAPTOR (AVES: STRIGIFORMES) DIVERSITY OF FOREST HABITATS LOCATED BETWEEN THE RIVERS PRUT AND SIRET

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Summary:

Introduction

We cannot talk about nocturnal predatory birds, incorrectly named, in a generic way, "owls", without taking into account their rich symbolism. Nocturnal predatory birds always had an important role in human culture, from its very beginning. During the various civilizations, nocturnal predatory birds represented different symbols, from wisdom to death; in other words, their symbolism was positive, but also negative.

Unfortunately, the rich symbolism associated to this group of birds brought them troubles over time. Because of the negative connotations inspired by Christianity and associated to owls, seen as diabolic birds, symbols of sins or omens of death, these creatures were persecuted and killed throughout Europe. In Romania too, because of the superstitions according to which owls might bring death, in some regions the owls are still killed while in other regions, like Bukovina, particularly due to their esoteric "links", they are protected by villagers and they are included in the category of "respected" birds, such as the swallow and the stork.

Therefore, the nocturnal predatory birds represent a group of birds whose cryptic ecologies, generated by their nocturnal habits, stirred the imagination of people from the most ancient times. Even today, they are largely unstudied, even if they are key species in the forestry ecosystems all over the world. At the same time, their effective protection is still sub-optimal. For all these reasons, nocturnal predatory birds are still a real challenge for the ornithology studies.

Chapter 1. History of the research concerning the nocturnal predatory birds in Romania

Recent data concerning the nocturnal predatory birds for the studied region are also available in the documentations of the SAP regions (Special Protection Areas). Thus, for the Bârnova forest the species *Bubo bubo* and *Strix uralensis* are mentioned and, more recently, in 2011, due to our efforts, the region Dorohoi – Şaua Bucecei was declared SAP due to the presence of the species *Strix uralensis*.

Nevertheless, in order to demonstrate the lack of studies at the national level concerning the populations of nocturnal predatory birds, we will analyze two of the species that are mentioned in the Birds Directive, namely the legal support that allows the assigning of the SAP title: the Eurasian eagle-owl (*Bubo bubo*) and the Ural owl (*Strix uralensis*), species that also live in our area of study.

Thus, in case of the *Strix uralensis* species, there is a great difference between the populations estimated for our country by different authors: if we analyze the standard forms of the Natura 2000 sites, we can see that the species is present in 21 Special Avifauna Protection Areas. The estimated number of nesting pairs from this species in the above-mentioned sites is estimated between 876 and 1085. At the same time, in the Atlas of Nesting Birds in Romania, the national population is estimated at 200-800 pairs (Munteanu *et al*., 2002), compared to the estimations of 12000-20000 nesting pairs from BirdLife International.

In case of the *Bubo bubo* species, the differences between various sources are smaller. Thus, in the 29 SPA where the presence of the species was confirmed, the values are situated between 107 and 171. The Romanian Breeding Bird Atlas estimates a population of 200-600 pairs of Eurasian eagle-owl on the territory of Romania, while BirdLife International estimates that the national population is of 750-1000 pairs.

Chapter 2. The natural environment of the area of study

Geographical position

The area of study is situated in the Eastern part of Romania, including a large part of the region of Moldavia, namely the region situated between the rivers Siret, in the Western part, and Prut, in the Eastern part. In the North, the area is limited by the frontier with Ukraine, and in the South, by the Siret river and by the Danube. The geographical coordinates corresponding to the limits of the area of study are the following: 48˚15'52,29" N and 26˚41'58,52" E in the North, 45˚23'28,62" N and

27˚59’3,41” E in the South. The Eastern limit has the following coordinates: 46˚26’12,31”N and 28˚15’38,34” E, while the Western limit has the following coordinates: 47˚58’57,59” N and 26˚1’50,54” E.

The same area includes territories belonging to the counties of Botoşani, Iaşi, Vaslui, Galaţi, as well as the Eastern parts of the counties Neamţ, Bacău and Vrancea. Thus, the total surface of the area of study is of **22460,3 km²** or **2246030 ha**.

Chapter 3. Methods resorted to. The length of the study

The nocturnal predatory birds are a group of birds difficult to study because of their ecological preferences. The main objective of our study was to identify the species and the distribution, to estimate the populations, their ecological preferences and the interactions existing between the nocturnal predatory birds that live in the forest habitats situated between the rivers Prut and Siret. Analyzing the data obtained, we can take a series of preservation measures. The collected information can be used by the forest districts and by the administrations of the wooded areas in order to elaborate improved management plans. The study herein aims at updating the information concerning the nocturnal predatory birds living in the areas Natura 2000 and AIA (Avifaunal Importance Areas); we intended to identify new important sites for the maintenance of the population of some species belonging to the *Strigiformes* order.

The study herein focused on the main 16 forestry bodies from the territory situated between the rivers Prut and Siret and, in particular, on the main 4 forestry bodies in the Iaşi county.

The main research method (Bibby *et al*., 1992) is a combination between the transect method and the fix-point method. Thus, at the beginning, we set a random route through the forest. Along this route, we fix observation stations every 1,5 km. In these stations, the sound produced by the nocturnal predatory birds will be registered for 2 minutes; then, the researcher focuses on the answers given by the wild birds. We note the place, the species and the number of registered individuals.

Chapter 4. The taxonomical analysis, the distribution and number of nocturnal predatory birds from the forest habitats situated between the rivers Prut and Siret

Until now, in the forest habitats situated in the area of study, we have identified the presence and the nesting of 6 species that belong to the *Strigiformes* order. These species are listed below:

Otus scops (Linnaeus, 1758);
Bubo bubo **(**Linnaeus, 1758);
Athene noctua (Scopoli, 1769)*;*
Strix aluco **(**Linnaeus, 1758);
Strix uralensis (Pallas, 1771);
Asio otus (Linnaeus, 1758).

The Eurasian scops owl – *Otus scops* (Linnaeus, 1758)

Distribution:

In Romania, the species is frequently met in Transylvania, in Dobrogea and in the South; it is rarely seen in Moldavia. In the area of study, we could notice the species in the following forests: Dealu Mare – Hârlău, Floreanu – Frmuşica – Ciurea, Bârnova – Repedea, Buneşti – Budei – Valea Mărului – Mălineşti, Porcarului – Răchiţelei – Coteni, Horga – Zorleni, in the meadow of the Inferior Siret river, in the forests of Gârboavele, Hanu Conachi, Medeleni, as well as in the city of Iaşi. We have to mention the fact that, even if the county of Iaşi was deeply analyzed, the species is most frequently met in the Southern part of the area of study, as it is a thermophilic species.

Habitat:

Based on the observations of the species in the county of Iaşi, we analyzed the habitat preference of the species living in this region. Thus, we managed to identify a number of 26 territories for the *Otus scops* species. The altitude of the vast majority of these territories was situated between 21 and 150 m (10 territories), and between 150 and 200 m (6 territories); in general, the altitude of these territories was of 39-501 meters.

In each territory, we mapped the habitats within a radius of 200 meters from the bird the most frequently seen; thus, we managed to identify 15 types of habitats. From these, the meadows with isolated trees and bushes were the most frequent, with a surface of 482630 m^2, representing 15,53 % from the total mapped surface. The place in this classification, representing 11,58 %, was occupied by the young forests. The smallest habitat surface used by the species was represented by compact shrubberies, occupying a surface of only 448 m^2 (0,01%).

Population:

In Romania, the total number of birds from this species is of 1800-4000 nesting birds (Munteanu *et al.*, 2004).

In the area of study, the greatest density of the noticed pairs was registered in the Meadow of the Inferior Siret river; here, in 8 observation points, we have identified 12 territories. Nevertheless, we cannot calculate a density value, as the habitat is very fragmented and varied. We discovered 52 territories in the area of study, but, as the individuals of this species prefer to nest in other habitats than the forestry ones, an aspect that does not constitute the subject of the study herein, we consider that the population is much larger.

Ecology and protection:

In Romania, as well as in the greatest part of Europe, the Eurasian scops owl is a summer guest, being present from April to September-October.

The Eurasian eagle-owl – *Bubo bubo* (Linnaeus, 1758)

Distribution:

In what concerns the nesting of the species in the county of Iaşi, there are only two mentions in the scientific literature. Thus, the species spends the nesting period in the Bârnova forest (Munteanu, 2004) and in the Pârcovaci forest (Gache, 2002). We should mention the fact that we can confirm the presence of the species since 2008 in the two above-mentioned areas, according to the ingluvies and feather samples that we found. In the Pârcovaci forest, we found ingluvies of the *Bubo bubo* species near the rocks from the Western part of the flood barrier. Recently, since 2010, through the monthly transects carried out in the 3 large forestry bodies from the county of Iaşi, we could calculate the exact presence of a territory situated in the South-western part of the Poieni village, in the Bârnova forest, near the river Pârâul Pietros. Also, in the Hârlău-Pârcovaci forest, we have identified a territory near the Reservation Humosu and another territory near the Pârcovaci flood barrier. In 2013, we have identified a territory near the Hadâmbu monastery, in the county of Iaşi, in the Floreanu – Frumuşica – Ciurea forest.

Population:

In the area of study, the only bird group we could find is the population from the Bârnova forest, with 8-10 nesting pairs (Munteanu, 2004).

Ecology and preservation:

The Eurasian eagle-owl is a dependent species that lives in the forest habitats from the ancient forests, with old trees. Also, in order to procure food, these birds need open spaces or areas with clearings. We consider that, in order to preserve the species, we need to confer the status "Avifaunal Importance Areas" to those areas where the presence of the species is confirmed.

The little owl – *Athene noctua* (Scopoli, 1769)

Distribution:

In Romania, this bird is met all over the country, except for the high areas from the Carpathian Mountains.

In the area of study, we discovered the species in almost all the villages and towns, even in the center of the city of Iaşi. Nevertheless, we have to mention the fact that we did not meet the *Athene noctua* species within the woods; it is only met at the forest edge.

Populations:

In Romania, the total estimated number of birds from this species is of 20000-400000 nesting pairs, maybe more. It is a species that does not necessarily depend on forest habitats; therefore, an evaluation of the total number of birds would be futile, if we do not analyze the sites situated outside the forests. The species was observed at the forest edge, next to the adjacent villages and towns, the number of individuals being limited.

Ecology and preservation:

The species is sedentary. Individuals lay eggs during the months of April, May, June, and July; thus, two generations per year may be registered.

Because of the intensive agricultural activities, the number of little owls is severely reduced on the distribution area. In Romania, the species did not know the same population-based decline due to the "mosaic" approach to agriculture, implying few monocultures.

The tawny owl – *Strix aluco* (Linnaeus, 1758)

Distribution:

The species is widespread in Europe, in Great Britain and on the continent, but it is absent or rather absent on the great islands from the Atlantic Ocean or in the Mediteranean Sea. These birds extended their distribution area to the North during the years 1920-1930.

In Romania, the species is frequent and widespread, being present in all Romanian regions (Munteanu *et al*., 2004).

Population:

In Romania, we do not know a temporal evolution of the number of individuals of this species, as there is little research on this subject. The estimated number of birds would be of 3000-9000 nesting pairs (Munteanu *et al*., 2004).

In the area of study, the species was discovered in almost all the forestry bodies that we analyzed. The gross density for the Bârnova forest is of 0,42 nesting pairs / km^2; in case of the Mădârjac forest, the gross density is of 0,56 nesting pairs / km^2, wile for the Hârlău – Pârcovaci forest, the gross density is of 0,48 nesting pairs / km^2. In case of the Şaua Bucecea forest, the density is of about 0,24 nesting pairs / km^2. A density value of 0,24 nesting pairs was also calculated in case of the Tătăruşi forest. For the other forestry bodies, the number of stations was insufficient in order to offer us a realistic image; that's why we have only registered here the presence or the absence of the species.

Ecology and preservation:

The tawny owl is a sedentary and very territorial species. The individuals of this species lay eggs once a year (Cramp, 1998).

In what concerns the nesting period, we must mention the fact that we noticed in two cases the premature nesting of this species; this fact allows the birds to lay eggs twice a year.

Habitat selectivity:

The presence and the abundance of every species is limited by the resources that is has at its disposal. One of the most important resources is the habitat.

In order to quantify the selectivity of habitats, in the ecology field we use the Manley habitat selectivity index. As the *Strix aluco* species is strictly dependent on forest habitats, we only take into account these habitat types. Thus, we have identified 5 forest habitat sub-types:

- brushwood;
- young forest;
- average forest;
- old forest;
- forests with clearings.

The Manly habitat selectivity index has the biggest value, of 2,87, in case of the old forest habitat. The average forest habitat is the next on the list, with a value of 1,11.

From the above-listed data, we can conclude that the *Strix aluco* species manifests an obvious preference for the old forest habitat. This fact may be explained by the analysis of the structure corresponding to this habitat. The individuals of this species predominantly build their nests in the tree hollows (Sacci *et al*., 2004). The old forests include hollow trees that are ideal places for birds that lay their eggs. Also, these forests maintain a high biodiversity level, the food resources for the *Strix aluco* species being more abundant.

The selectivity index in case of the brushwoods and of the young forests is below 1. This fact explains the tendency of these birds to avoid this type of forests. The structure of the vegetation and the trophic resources from these regions has a major impact on the populations of wild species in general. These types of woods do not include old trees, dead wood or hollows that could be used by the tawny owls in order to build their nests (Sacci *et al*., 2004).

The Ural owl – *Strix uralensis* (Pallas, 1771)

Distribution:

In Romania, the species follow the Carpathian Mountains, building nests in the mountain woods, in the Eastern Carpathians in particular (Munteanu *et al.*, 2004).

In what concerns the area of study, the species is mentioned in the scientific literature in the avifauna ROSPA0092, namely in the Bârnova forest (Flocea, 2004). We have identified this species through the visual observation, but also through the listening method, during its breeding period, in the following forests: Bârnova, Mădârjac, Hârlău – Pârcovaci, Humosu, Homiţa, Vorona, Dobrina – Huşi.

Population:

In Romania, the population of *Strix uralensis* is estimated to 200-800 nesting pairs (Munteanu, 2002).

In the area of study, we could identify through our monthly transects 10 nesting pairs in the Bârnova forest, 8 nesting pairs in the Mădârjac forest, 2 nesting pairs in the Hârlău forest, 3 nesting pairs in the Tătăruşi forest. We have also identified 2 nesting pairs in the Vorona forest (which is included in the Dealu Mare – Hârlău forest) and one nesting pair in the Dobrina – Huşi forest, in the yearly monitored stations. The calculated density is of 0,35 nesting pairs / km^2 for the Bârnova forest,

0,2 nesting pairs / km^2 for the Mădârjac forest and 0,16 nesting pairs / km^2 for the Hârlău – Pârcovaci forest. In the Tătăruşi forest, the density is of 0,18 nesting pairs / km^2.

Ecology and preservation:

In order to determine the affinity of the species for the sub-types of forest habitats that can be identified on the area of study, we have calculated the Manley habitat selectivity index.

The highest value of the habitat selectivity index was obtained for the habitat represented by the forest with clearings (2,12), followed by the old forests and by the average forest. The value corresponding to the habitats represented by brushwood and by young forests is below 1. We suppose that the great affinity for the forests with clearings manifested by the *Strix uralensis* species (wi = 2,12) could explain the fact that a species presenting similar ecological features, but whose individuals are smaller – *Strix aluco* – avoids this habitat (wi = 0,69).

The long-eared owl – *Asio otus* (Linnaeus, 1758)

Distribution:

In Romania, the species is spread all over the country (Munteanu *et al.*, 2004), in particular in the wooded regions. In the region of Oltenia and in the Romanian Plain, the density values are low (Munteanu *et al.*, 2004). In the area of study, the species is present, mostly, in the forest edge, the number of individuals being limited.

Population:

In Romania, the total number of birds from this species is estimated between 3000 and 8000 nesting pairs (Munteanu *et al.*, 2004). In our case, in the analyzed forestry bodies, we discovered the presence of 10 nesting pairs, all located in the forest edge. We consider that the population is much more numerous, as the pairs were observed in particular in the bands of trees, in parks or in gardens, or even in the bands of trees from open areas that are not subject of our study (personal observations).

Chapter 5. Comparative analyses

In the area of study, we have identified 6 species of nocturnal predatory birds that belong to the *Strigiformes* order, from the total number of 11 species registered in the avifauna of Romania (10 constant species and an accidental species – *Surnia ulula*). From these, 7 species prefer the forest habitats. Thus, almost 54% from the nocturnal predatory birds in Romania, or 86% from those who prefer the forest habitats, registered in Romania, are met in the studied forest habitats.

Chapter 6. The preservation of the species of nocturnal predatory birds from the forest habitats situated between the rivers Prut and Siret

The main instrument of the European Union concerning the preservation of the environment is represented by the demarcation of the Natura 2000 sites. This process is based on two directives: the Birds Directive and the Habitats Directive. Through the Birds Directive, the Special Avifauna Protection Areas are established, while the Habitats Directive sets the Sites of Community Importance (SCI).

The main bird species for which the Special Avifauna Protection Areas are set are mentioned in the Appendix I of the Birds Directive. In this appendix there are mentioned 2 species from the *Strigiformes* order that are met in the area of study: the Ural owl (*Strix uralensis*) and the Eurasian eagle-owl (*Bubo bubo*).

In the area situated between the rivers Prut and Siret there are 15 Special Avifauna Protection

Areas.

From these, only 6 areas match the studied forestry bodies. Thus, about 22 % from the forestry bodies are included in the Special Avifauna Protection Areas.

A forestry body that we consider important due to the fact that we have identified the presence of both priority species that confer to an area the status of Special Avifauna Protection Area (*Strix uralensis* and *Bubo bubo*) is the Floreanu – Frumuşica – Ciurea (Mădârjac) forest. This forestry body is not included in any Special Avifauna Protection Area. The study herein may contribute to set a new area that also includes the respective forestry body.

We have also identified the *Strix uralensis* species in the Dobrina – Huşi forest, an area that meets all conditions in order to be designated Special Avifauna Protection Area.

Conclusion:

1. Our study is the first study exclusively dedicated to the nocturnal predatory birds from the territory situated between the rivers Prut and Siret. The area is barely studied from the avifaunal point of view; thus, the information collected in the research herein fills a gap in the scientific literature.
2. We have identified a number of 6 species that belong to the *Strigiformes* order and that are met and nest in the forest habitats had in view. These species are listed below:

Otus scops;
Bubo bubo;
Athene noctua;
Strix aluco;
Strix uralensis;
Asio otus.

The identified species represent 54 % from the species of the *Strigiformes* order that are included in the avifauna of Romania and 86 % from the species that are met in the forest habitats in Romania.

3. In what concerns the collected data, we have filled in and updated the information concerning the situation of the nocturnal predatory birds in the studied forests. Our study brings new information concerning the nocturnal predatory birds from the studied area that may be included in the Natura 2000 regions. We also confirmed the presence of the species *Bubo bubo* and *Strix uralensis* in ROSPA0092, represented by the Bârnova forest. We have identified as well the presence of the *Bubo bubo* species in the forests Floreanu – Frumuşica – Ciurea and Dealu Mare – Hârlău, as well as the presence of the *Strix uralensis* species in the forests Floreanu – Frumuşica – Ciurea, Dealu Mare – Hârlău, Tătăruşi and Dobrina - Huşi. At the same time, we have managed to map the territories occupied by the above-mentioned species.
4. We have updated the information concerning the nesting period of the *Otus scops* species in the county of Iaşi. According to the collected data, the species was not mentioned in the scientific literature since the '60s. At the same time, it is the first observation of this species within and around the city of Iaşi from the '60s until now. During the 3 years of study, we have identified a number of 52 territories of this species. The scientific literature does not offer data concerning the species on the studied territory. According to the observations of this species in the county of Iaşi, we have analyzed the habitat preference of the Eurasian scops owl using the mapping of the territories.
5. We have identified 4 territories of *Bubo bubo*, a species that has known a severe decrease during the last century. Thus, we have confirmed the presence of the species in the region Natura 2000 ROSPA0092, represented by the Bârnova forest, and we have identified the species in another 2 areas that are not mentioned in the scientific literature.
6. The *Strix aluco* species is best represented in the studied forest habitats. We have identified the presence of this species in 19 forestry bodies, as well as in the parks from the cities Iaşi and Paşcani. We have calculated as well the gross density of the nesting pairs in case of 4 large forestry bodies located in the county of Iaşi.

7 In case of the *Strix aluco* species, we mention for the first time in our country the development of two generations per year. In the international scientific literature, there is a single mention of this phenomenon.

8. An important study carried out by us is the identification of the periods of maximum territorial activity in case of the *Strix aluco* species in the area of study. This research helped us to continue the analysis of the species living in these forestry bodies at a moment when the chance to detect the pairs was the highest.

9. We have concluded that the species from the *Strix* genre (*Strix aluco* and *Strix uralensis*) prefer the forest habitat types.

10. In the area of study, we could identify the presence of the *Strix uralensis* species, a species that may confer the status of Natura 2000 to this area, in 5 analyzed forestry bodies; in case of 3 of these bodies, the species is mentioned for the first time in the scientific literature: Tătăruși – Homița – Codrii Paşcanilor, Floreanu – Frumuşica – Ciurea and Dobrina – Huşi. In case of 4 of the 5 forestry bodies where we have identified the species, we have also calculated for the first time the gross density value of the nesting pairs in the area of study.

11. After the data analysis, we concluded that a part of the forests from the studied area is well represented from the point of view of the number of nocturnal predatory birds. Also, through the analysis of the nesting period in case of some species – *Bubo bubo* or *Strix uralensis* that are indicators in this respect – we have concluded that a part of the forest habitats is still well-preserved.

12. In what concerns the Special Avifauna Protection Areas, we have noticed that the vast majority of the territories specific to the *Strix uralensis* species identified by us are not included in these areas. The situation is similar in the case of the *Bubo bubo* species, where only the territory identified in the Bârnova forest is included in the site.

13. As the species of nocturnal predatory birds are umbrella species, we consider that measures should be taken for their preservation.

Nevertheless, we consider that, in order to have a clear image concerning the situation of the nocturnal predatory birds living in the area, the research should be continued.

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