Analele Universităţii din Craiova, seria Agricultură – Montanologie – Cadastru (Annals of the University of Craiova - Agriculture, Montanology, Cadastre Series) Vol. 55/2025

SPECIES COMPOSITION OF THE AVIFAUNA IN A FOREST COMPLEX SOUTHWEST OF VARNA CITY

Ivaylo IVANOV[1]

[1]*Konstantin Preslavsky University of Shumen, 115 Universitetska str., 9700, Shumen Bulgaria*
e-mail: i.p.ivanov@shu.bg

Corresponding author: i.p.ivanov@shu.bg

Abstract

The aim of the study is to clarify the species composition of the avifauna in forest habitats located near Varna city, but outside the boundaries of settlements. These are remote territories, allowing for the exclusion of synanthropic species populations. For this purpose, three relatively large and compact forest areas situated southwest of Varna were investigated. This geographical area is poorly studied, with no previous publicly available data or publications identified. The study areas exhibit considerable similarities regarding the type of forest habitat, including the composition, age, and type of vegetation (broadleaf/coniferous, mixed).

The research employs the transect survey method within the forest territory. The chosen approach encompasses three distinct yet relatively close forest areas, which together provide a clear picture of the species composition across this region. The systematic approach allows for a comprehensive, randomized survey of the avifaunal composition across different types of forest communities. It also serves as a robust foundation for subsequent species-specific studies. The survey was conducted via transects along existing forest roads, which varied in their maintenance level and usage intensity.

This paper presents the findings on species composition, emphasizing the similarities and clarifying the differences observed across the three sub-regions. Given that, in geographical terms, there are no insurmountable barriers to species movement within the study area, it is hypothesized that the variations in the avifaunal species composition are primarily driven by differences in the floristic composition and age structure of the forest habitats.

***Key words**: avifauna, Varna, forest habitat, transect survey, species richness*

INTRODUCTION

Forest ecosystems located on the periphery of large urban agglomerations represent key buffer zones and crucial habitats for a wide range of wildlife, including birds. These territories are subjected to increasing anthropogenic pressure from expanding urbanization, yet they serve as vital refugia and corridors for species that cannot adapt to the urban environment (Marzluff, 2001; Shochat et al., 2006).

It has long been established that bird species diversity in forests is closely linked to the structural complexity and heterogeneity of the vegetation, including the age and vertical stratification of the tree stand (MacArthur & MacArthur, 1961). However, these peripheral forest massifs often remain understudied, and the lack of systematic information impedes effective forest resource management, especially in the context of habitat fragmentation (Fahrig, 2003). The factors determining the presence and diversity of birds include both the structure of the forest stand and the

intensity of human intervention (silvicultural practices, maintenance of the road network).

The present study aims to clarify the species composition of the avifauna in the forest complex located southwest of Varna city. This work focuses on three relatively large and compact forest micro-regions, remote from synanthropic populations, intending to contribute to establishing the ecological links between habitat characteristics and the composition of bird communities. By documenting the avifauna in this poorly studied area, the current research contributes to enriching the knowledge base on regional biodiversity and provides a scientific foundation for subsequent research activities.

MATERIALS AND METHODS

Study Area:

The study was conducted in a forest complex located southwest of Varna city, with the aim of being carried out outside the boundaries of settlements. The study area includes three relatively large, compact, and distinct forest regions, which are representative of the forest landscape in this part of the Black Sea coast. These territories were selected to eliminate the significant influence of synanthropic populations and to focus on the natural avifauna of the forest habitats. The dominant forest types include broadleaf, coniferous, and mixed stands with varying age and management. The research area has homogeneous topography and similar climatic conditions, but with internal differences in the species composition and age of the tree stand.

Data Collection:

Study Period and Frequency of Visits

The core period for collecting data on breeding birds at this geographical latitude (April–June) is crucial. The methodology for abundance studies requires two visits to the studied territory with a minimum interval of 15 days within one breeding season. The field work was carried out over 2 days. Field observations were conducted twice during the breeding season: the first count was performed on May 8, 2025, and the second count was performed on June 10, 2025. The interval between the two surveys is approximately 32 days, which ensures coverage of different phenophases of the species' breeding period.

Methodology and Localization

The surveys follow standard ornithological approaches, applying the transect method (route counting) along existing forest roads and clearings. A total of 3 transects were carried out—one in each of the three selected micro-regions. The total length of the routes is approximately 3 kilometers (1200 m + 900 m + 1300 m). Data was collected on standardized forms (paper). For precise positioning of the route and observations, a mobile device (smartphone/tablet) with an installed application for geographical localization and a map base (e.g., Google Earth Pro) was used. In part of the study, a handheld GPS receiver with an up-to-date map (GARMIN) was also used simultaneously. These devices serve to determine the observer's exact location, although perfectly precise positioning is not necessary for the purposes of this study.

Conducting Observations

Observations were carried out during the optimal morning period—from sunrise until approximately 11:00 AM. The second period for daytime bird activity (afternoon) was not utilized. Data collection was performed within exactly 45 minutes at each study location (transect) during each of the two visits. The researcher moved through the terrain at a relatively uniform speed. The recording radius is a maximum of 100 meters from the axis of observation (transect). All observed or heard birds were recorded.

Categorization of Species

When recording species, their degree of probability of nesting is taken into account, according to the standard scale. Species that obviously do not nest within the perimeter of the study (e.g., swifts or bee-eaters over forest territories), as well as

transient birds, are entered with the status "C" (wandering/transient).

Data Analysis:

The collected data are analyzed with the main goal of identifying the overall species composition (Species Richness) of the avifauna in the studied forest complexes. The main focus areas are:

Species Richness: Calculating the total number of recorded species in each of the three micro-regions and for the entire forest region (See Table 1 for the full list).

Composition Comparison: Comparing the species composition between the three micro-regions to identify similarities and differences. The analysis of species richness will be used to formulate the hypothesis that differences in species composition are driven by differences in the floristic composition and age of the forest stands.

RESULTS AND DISCUSSIONS

Species Composition and Community Structure

A total of 25 species of breeding/territorial birds were identified within the three forest micro-regions surveyed southwest of Varna (see Table 1 for the complete list). Species Richness across the individual transects showed minimal variation: 17 species were recorded in Transect 1 (Mixed Forest), 18 species in Transect 2 (Young Plantations/Old Oak Forest), and 17 species in Transect 3 (Broadleaf Oak Forest). This high degree of similarity in species count (17, 18, 17) suggests that the forest complex, as a whole, functions as a single ecological unit with relatively homogeneous potential for biodiversity support, despite internal differences in stand composition and age.

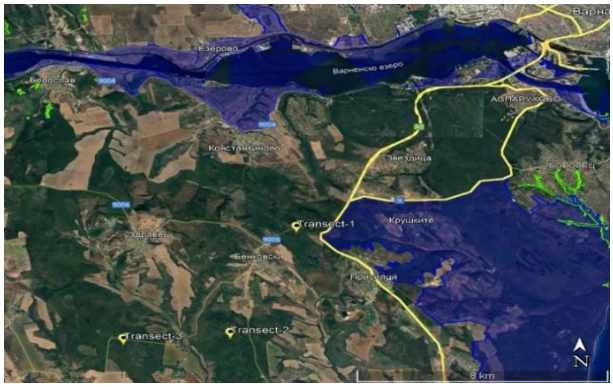

Figure 1. Map of the Study Area (T1, T2, T3)

Figure 2. Detailed View of Transect 1

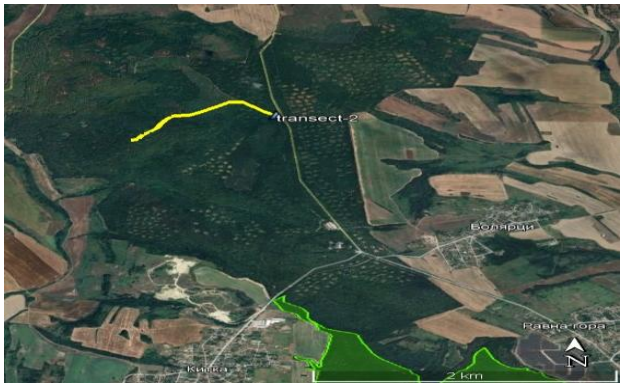

Figure 3. Detailed View of Transect 2

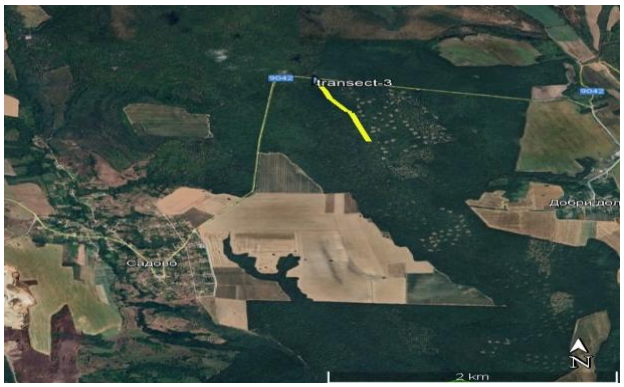

Figure 4. Detailed View of Transect 3

Table 1. Species Richness and Checklist of Avifauna

Species (Latin)	Species (English)
Fringilla coelebs	Common Chaffinch
Turdus merula	Eurasian Blackbird
Sylvia atricapilla	Blackcap
Columba palumbus	Common Wood Pigeon
Phylloscopus collybita	Common Chiffchaff
Erithacus rubecula	European Robin
Parus major	Great Tit
Turdus philomelos	Song Thrush
Dendrocopos major	Great Spotted Woodpecker
Oriolus oriolus	Eurasian Golden Oriole
Luscinia megarhynchos	Common Nightingale
Certhia brachydactyla	Short-toed Treecreeper
Coccothraustes coccothraustes	Hawfinch
Carduelis carduelis	European Goldfinch
Cuculus canorus	Common Cuckoo
Lullula arborea	Wood Lark
Aegithalos caudatus	Long-tailed Tit
Streptopelia turtur	European Turtle Dove
Dendrocoptes medius	Middle Spotted Woodpecker
Sylvia communis	Common Whitethroat
Dryobates minor	Lesser Spotted Woodpecker
Anthus trivialis	Tree Pipit
Phasianus colchicus	Common Pheasant
Chloris chloris	European Greenfinch
Cyanistes caeruleus	Eurasian Blue Tit

The communities are characterized by a prevalence of forest species typical of broadleaf and mixed woodlands. The dominant species, registered with the highest frequency across all micro-regions, are the Common Chaffinch (*Fringilla coelebs*), Blackcap (*Sylvia atricapilla*), Eurasian Blackbird (*Turdus merula*), Common Wood Pigeon (*Columba palumbus*), and the Common Chiffchaff (*Phylloscopus collybita*). The Common Chaffinch (*Fringilla coelebs*) was the most frequently recorded species, emphasizing its status as one of the most widespread and adaptable species in European forest habitats.

The registration of three woodpecker species (*Dendrocopos major*, *Dendrocoptes medius, Dryobates minor*), alongside the Short-toed Treecreeper (*Certhia brachydactyla*), indicates the presence of older and well-developed tree stands featuring sufficient deadwood and cavities crucial for these specialized species. The occurrence of the Common Nightingale (*Luscinia megarhynchos*) and the European Robin (*Erithacus rubecula*), particularly in Transect 2, suggests the presence of rich understory and scrub vegetation, which are critical for species inhabiting the lower forest strata.

Comparison of Micro-regions and Habitat Correlation

While the overall species richness (17, 18, 17) is homogeneous, a detailed qualitative comparison of species composition points to distinctions linked to habitat type:

- Transect 1 (Mixed/Old Stand): The presence of the Short-toed Treecreeper (*Certhia brachydactyla*) and the high frequency of the Great Spotted Woodpecker (*Dendrocopos major*) are associated with the older tree stand structure and the presence of coniferous species, which provide different foraging substrates compared to purely oak forests.
- Transect 2 (Young Plantations/ Coniferous Stands/ Old Oak): This micro-region showed the highest Species Richness (18 species). The registration of the Common Pheasant (*Phasianus colchicus*) and the Tree Pipit (*Anthus trivialis*) is directly correlated with the open areas and young plantations adjacent to the route, providing ground-nesting and foraging opportunities. The occurrence of the Middle-Spotted Woodpecker (*Dendrocoptes medius*) is typical for oak stands and emphasizes the importance of maintaining diverse forest structures.
- Transect 3 (Broadleaf Oak Forest): This area is typical for the predominance of thermophilic songbirds such as the European Turtle Dove (*Streptopelia turtur*) and the Eurasian Golden Oriole (*Oriolus oriolus*), which correlates well with the general characteristics of a dry oak forest.

The observed differences, though minimal, support the hypothesis that variations in avifaunal species composition are primarily driven by differences in the floristic composition and age structure of the forest habitats, rather than by geographic barriers or synanthropic pressure.

Ecological Conclusions and Management Recommendations

As the studied forest complex sustains a rich avifauna typical of the regional biodiversity, its conservation is paramount.

1. Structural Diversity Preservation: The high species richness, including the presence of three woodpecker species, underlines the need to preserve older stands and deadwood. Silvicultural practices that promote diversity in tree stand age and maintain dense scrub layers are recommended for species like the Common Nightingale and the European Robin.
2. Perimeter Management: In the context of the urbanization of the Varna region, this forest complex should be treated as an ecological reservoir. All activities within the habitat and its periphery may influence the proportions of the ornithocenosis.
3. Monitoring Baseline: The current study serves as a baseline for future research. It has the potential to be upgraded and further developed to include more details and more complex (incl. statistical) analyses.

CONCLUSIONS

Based on the transect surveys conducted during the 2025 breeding season, several key findings regarding the avifauna of the forest complex southwest of Varna were established:

1. Species Richness and Homogeneity: The study identified a total of 25 species of breeding/territorial birds within the forest complex. The recorded Species Richness across the three distinct micro-regions (17, 18, and 17 species) suggests a high level of avifaunal homogeneity within the complex, indicating that the area functions as a unified ecological entity despite internal variations in habitat structure.
2. Habitat Structure as a Key Factor: The minimal variations observed in species composition are likely correlated with differences in habitat structure. The presence of specialized species, such as three different woodpecker species (*Dendrocopos major, Dendrocoptes medius, Dryobates minor*), serves as an ecological indicator confirming the importance of age diversity, structural complexity, and the availability of deadwood within the stands.
3. Role of Floristic Composition: The qualitative differences in the recorded species composition across the three micro-regions support the hypothesis that the variations are influenced by the floristic composition and age structure of the forest stands, rather than by geographic barriers. Specifically, the presence of certain thermophilic and shrub-dependent species correlates directly with specific broadleaf structures and understory development.
4. Scientific Baseline: This research establishes a crucial baseline inventory of the avifauna for this previously undocumented geographical area. The generated data contributes significantly to the regional biodiversity knowledge base, filling a notable gap in published ornithological information for the Varna periphery.
5. Future Research Potential: The methodology employed provides a robust foundation for the continued long-term monitoring of the forest complex's ecological health. The baseline data obtained has the potential to be utilized for subsequent, more detailed research, including advanced statistical analyses of population abundance and specific habitat utilization studies.

ACKNOWLEDGEMENTS

The Author wishes to express his sincere gratitude to the Department of Biology at Episkop "Konstantin Preslavsky" University, Shumen, Bulgaria, for their institutional support throughout the research process. Special thanks are extended to Prof. dr. Rositsa DAVIDOVA for her valuable guidance, comments, and encouragement, which significantly contributed to the successful completion and quality of this study. This work was partially supported by Project RD-08-

114/05.02.2025 of the Episkop "Konstantin Preslavsky" University, Shumen, Bulgaria.

REFERENCES

Beissinger, S. R., & Snyder, N. F. R. (2005). New World Parrots in Crisis: Solutions from Conservation Biology. Yale University Press.

Bibby, C. J., Burgess, N. D., & Hill, D. A. (1992). Bird Census Techniques. Academic Press.

Canterbury, G. E., Martin, T. E., Petit, D. R., Petit, L. J., & Bradford, D. F. (2000). Bird communities and habitat as ecological indicators of environmental condition in the Western Ghats, India. Conservation Biology, 14(4), 954-965.

Fahrig, L. (2003). Effects of habitat fragmentation on biodiversity. Annual review of ecology, evolution, and systematics, 34(1), 487-515.

Fuller, R. A., & Gaston, K. J. (2009). The effects of urban sprawl on bird populations. Biological Conservation, 142(9), 2324–2334.

MacArthur, R. H., & MacArthur, J. W. (1961). On bird species diversity. Ecology, 42(3), 594-598.

Marzluff, J. M. (2001). Worldwide urbanization and the conservation of bird diversity. In J. M. Marzluff, R. Bowman, & R. Donnelly (Eds.), Avian ecology and conservation in an urbanizing world (pp. 19-47). Kluwer Academic Publishers.

Wiens, J. A. (1989). The Ecology of Bird Communities, Volume 2: Reproductive Success and Predation in Different Environments. Cambridge University Press.

Shochat, E., Warren, P. S., Faeth, S. H., McIntyre, N. E., & Hope, D. (2006). From patterns to mechanisms: the effects of urbanization on biotic and abiotic processes in arid ecosystems. Frontiers in Ecology and the Environment, 4(1), 1645-1652.