

# Species Composition and Distribution of the Herpetofauna in the Urban Green Parks and Water Bodies in the Town of Haskovo (Bulgaria)

IVELIN MOLLOV<sup>1</sup>, IVONA ASENOVA<sup>2</sup>

<sup>1</sup>University of Plovdiv "Paisii Hilendarski", Faculty of Biology, Department of Ecology and Environmental Conservation, 24 Tzar Assen Str., Plovdiv, BG-4000 Bulgaria, mollov\_i@uni-plovdiv.bg

<sup>2</sup>Regional Natural History Museum – Plovdiv, 34 Hristo G. Danov Str., Plovdiv 4000, Bulgaria, ivonaa804@gmail.com

**Abstract.** The herpetofauna of the urban green areas and water bodies in Haskovo Town consists of 2 amphibian species from 2 families, representing 8.33% of the amphibian fauna of Bulgaria, and 6 species of reptiles from 4 families, which constitute 15.00% of the reptiles in Bulgaria, as well as one invasive species of aquatic turtle. Some ecological and conservational remarks about the urban herpetofauna in the town are given.

**Key words:** Amphibia, Reptilia, urban areas.

## Introduction

The amphibians and reptiles inhabit diverse habitats, from wetlands and rivers to forests and mountainous areas. Due to the increasing global population, the number and area of urbanized territories are also growing, posing a specific threat to amphibians and reptiles. For this reason, ecological studies on these two groups, collectively referred to as 'herpetofauna,' in urban environments are of great importance to ecologists.

The Republic of Bulgaria has a rich herpetofauna, comparable to that of countries like Greece, Spain, and Italy (Stojanov *et al.*, 2011). The region around Haskovo Town, located in the southern part of Bulgaria, is known for its rich biodiversity and diverse habitats, including forests, rivers, reservoirs, and agricultural lands (Beron & Popov, 2004). Despite the high biodiversity of the Haskovo region, there is a lack of contemporary studies on the species composition and distribution of amphibians and reptiles in the town itself. This lack of up-to-date data hinders the assessment of the current state of the herpetofauna and the development of effective conservation strategies. The aim of the current work is to provide new, up-to-date data on the diversity and distribution of the herpetofauna species in Haskovo Town.

## Material and Methods

The fieldwork was conducted from March to September 2023 in the urbanized limits of the town, including key urban green areas such as "Yamacha" Park, "Kenana" Park, and water bodies "Sivata Voda" Reservoir, and "Klokotnitsa" Reservoir. These areas encompass a variety of habitats suitable for amphibians and reptiles and are important for the biodiversity of the region. The primary method for determining the species composition and distribution of amphibians and reptiles in the study area was visual observation using the transect method (Sutherland, 2000). The transects were conducted along the main paths and water bodies within the study areas. Amphibians and reptiles were studied through

visual observations and manual capture using a dip net when necessary, for accurate identification and subsequent release at the same location. Additionally, some individuals were identified based on their calls, eggs or larvae, and shed skin. Identification keys by Biserkov et al. (2007) were used. Each observation was recorded with precise coordinates using a GPS device.

The distribution maps and the geographic visualization of the collected data were performed in QGIS 3.16.6-Hannover (QGIS.org, 2021). A cluster analysis was performed to compare the similarity in species composition of amphibians and reptiles between the largest Bulgarian cities (based on literature data) and the data from Haskovo (current study), using the Rho similarity index, unweighted pair-group average linkage. The analysis was conducted using the software "PAST," version 4.11 (Hammer *et al.*, 2001).

## Results and Discussion

During the surveys conducted in the study area of Haskovo, 2 species of amphibians from 2 families were identified, representing 8.33% of the amphibian fauna of Bulgaria, and 6 species of reptiles from 4 families, constituting 15.00% of the reptiles in Bulgaria (Biserkov *et al.*, 2007; Stojanov *et al.*, 2011), as well as one invasive species of aquatic turtle. The previously reported in the literature amphibian and reptile species in Haskovo include: *Salamandra salamandra*, *Triturus ivanbureschi*, *Lissotriton vulgaris*, *Bombina variegata*, *Bufo bufo*, *Bufo viridis*, *Pelophylax ridibundus*, *Hyla orientalis*, *Lacerta trilineata*, *L. viridis*, *Podarcis tauricus*, *Emys orbicularis*, *Mauremys rivulata*, *Testudo graeca*, *T. hermanni*, *Dolichophis caspius*, *Coronella austriaca*, *Elaphe sauromates*, *Natrix natrix*, *N. tessellata* and *Vipera ammodytes*. The species recorded in the current study consist of: *Bufo bufo*, *Pelophylax ridibundus*, *Lacerta viridis*, *Podarcis muralis*, *Emys orbicularis*, *Testudo graeca*, *T. hermanni*, *Dolichophis caspius* and the invasive *Trachemys scripta elegans*.

Despite our efforts, we were unable to record some species that have been reported to occur in Haskovobased on literature data. The reasons for this may vary – habitat destruction since the time of their first registration, increasing anthropogenic pressure in the study area, as well as the relatively short period of the study.

We registered only the Marsh Frog (*P. ridibundus*) from the amphibians. It is distributed in great numbers and is abundant in all of the studied water bodies. During the study period we registered one individual of the Common Toad (*B. bufo*) in “Kenana” Park. Because of the multiple records of the first species and only one location for the second one, no distribution maps were made for these species.

We registered two species of reptiles, lacertid lizards – *L. viridis* and *P. muralis*, both in “Yamacha” Park (Fig. 1.). *P. muralis* is reported for the town of Haskovo for the first time in the current study. Two tortoise species (*T. hermanni* and *T. graeca*) were registered from “Yamacha” Park (Fig. 2) and one aquatic turtle (*E. orbicularis*) registered from “Sivata voda” Reservoir (Fig. 3). The invasive red-eared slider (*Trachemys scripta elegans*) was also recorded with one individual from this location (Fig. 3). The only snake species, that we found in the study areas was *Dolichophis caspius*, registered with two skin-sheds from “Kenana” Park (Fig. 4).

The diversity of herpetofauna in the town of Haskovo is not high. It seems the anthropogenic factor is strong in the urbanized area and only the green parks and large water bodies still presents suitable living conditions for the amphibians and reptiles. In Haskovo, 2 species of amphibians and 7 species (six native and one invasive) of reptiles were recorded. In contrast, cities like Stara Zagora (10 amphibian species and 17 reptiles), Varna (8 amphibian species and 14 reptiles), and Ruse (8 amphibian species and 13 reptiles), where proximity to the Black Sea, the Danube River, and the Sarnena Sredna Gora create favorable conditions for herpetofaunal diversity. In these regions, large water bodies, a greater variety of habitats, and specific regional climatic conditions contribute to richer species diversity (see Mollov, 2022).



**Fig. 1.** Distribution map of the Green Lizard (*L. viridis*) in "Yamacha" Park in Haskovo Town.



**Fig. 2.** Distribution map of the Herman's Tortoise (*T. hermanni*) in "Yamacha" Park in Haskovo Town. *T. graeca* was registered with only one individual from the same locality.



**Fig. 3.** Distribution map of the European Pond Turtle (*E. orbicularis*) in "Sivata Voda" Reservoir in Haskovo Town (in yellow). *T. scripta* was registered with only one individual from the same locality (in white).

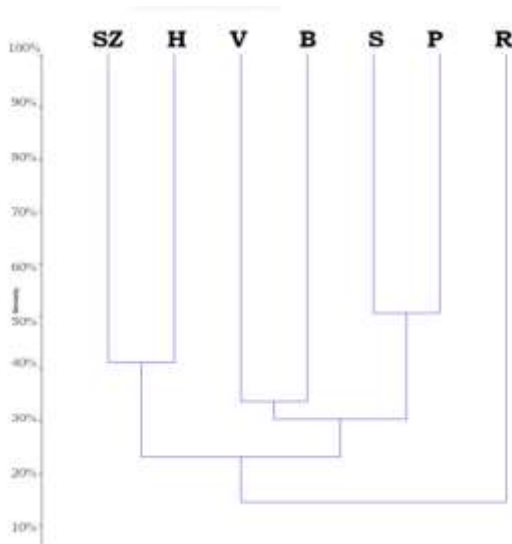


**Fig. 4.** Distribution map of the Caspian whipsnake (*Dolichophis caspius*), from "Kenana" Park in Haskovo Town.

Plovdiv City, although also highly urbanized, shows higher species diversity than Haskovo, with 6 species of amphibians and 10 species of reptiles. The proximity of Plovdiv to the Maritsa River and the presence of semi-natural areas such as the rowing canal and Adata Island provide suitable habitats for supporting various species. Sofia and Blagoevgrad also demonstrate higher levels of biodiversity. In Sofia, 9 species of amphibians and 12 species of reptiles have been recorded, while in Blagoevgrad, 7 species of amphibians and 12 species of reptiles have been documented. This further emphasizes the importance of geographic location and the availability of suitable natural conditions for species richness (see Mollov, 2022).

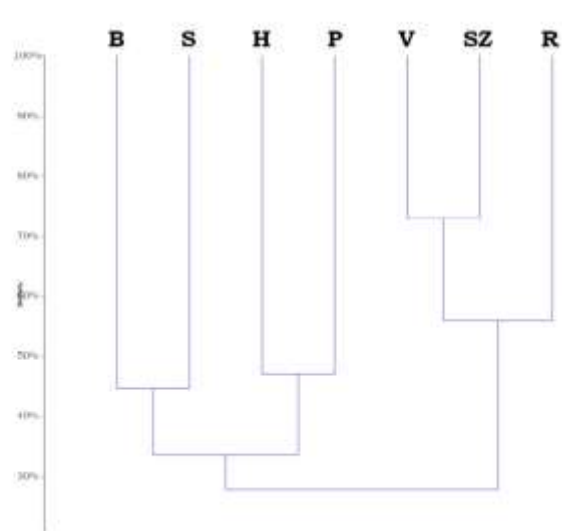
We also performed a cluster analysis (based on presence/absence data) showing the similarity in the species composition of amphibians and reptiles between the above-mentioned Bulgarian cities (based on Mollov, 2022 and we added the data from Haskovo), and the results are presented in Fig. 5 and 6. The cluster analysis, performed by us, shows similar results for both animal classes. For amphibians (Fig. 5), two major clusters with about 28% similarity are distinguished. One includes the amphibian fauna of Blagoevgrad, Sofia, Haskovo, and Plovdiv, while the other includes that of Varna, Stara Zagora, and Ruse. The amphibian fauna of the largest city, Sofia, shows the greatest similarity to that of Blagoevgrad (around 45% similarity), while the fauna of Haskovo is most similar to the amphibian fauna of Plovdiv (around 48% similarity).

For reptiles (Fig. 6), the herpetofauna of Ruse forms a separate independent cluster with about 15% similarity. The second large cluster is divided into two smaller ones, including the herpetofauna of Stara Zagora and Haskovo with about 41% similarity, and a second cluster consisting of Varna and Blagoevgrad (around 35% similarity) and Sofia and Plovdiv (around 50% similarity).



**Fig. 5.** Cluster analysis showing the similarity in the species composition of amphibians between the largest Bulgarian cities (based on literature data) and Haskovo Town (present study).

**Legend:** **B** – Blagoevgrad; **H** – Haskovo; **P** – Plovdiv; **R** – Ruse; **S** – Sofia; **SZ** – Stara Zagora; **V** – Varna.



**Fig. 6.** Cluster analysis showing the similarity in the species composition of reptiles between the largest Bulgarian cities (based on literature data) and Haskovo Town (present study).

For the amphibians, a clear geographic pattern is observed in the fauna of the studied cities, following a southwest-northeast direction, with the exception of Stara Zagora, which shows greater similarity to the amphibian fauna of Varna. In reptiles, there is no clearly defined geographic pattern for grouping the cities, but it is noteworthy that a separate cluster with a high degree of similarity is formed between Stara Zagora and Haskovo. However, it seems that not only the geographic location of the cities influences the species composition of the fauna, but also some specific urban factors.

In Haskovo, the absence of many water bodies and the limited habitat diversity negatively affect species richness. Urbanization in the region also contributes to the reduction of potential habitats, leading to lower diversity of amphibians and reptiles compared to other cities. Nevertheless, the Haskovo area remains important for some species, but with lower levels of biodiversity, highlighting the need for targeted efforts to conserve existing habitats.

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