Snake Conservation State in the Reserves of the Volga Basin

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Abstract. There are 23 nature reserves in the Volga basin, all of them in the Russian Federation. According to our data and open access literature sources, ten out of the eleven species of snakes that are reliably known to be found in the Volga basin, inhabit and, therefore, are protected in 22 reserves. No snakes have been recorded in the Vishersky Reserve. One species inhabits the nature reserves "Basegi" and "Tsentralno-Lesnoy", two species – in the reserves "Bolshaya Kokshaga", "Darvinsky", "Kaluzhskie zaseki", "Kologrivsky forest", "Nurgush", "Prioksko-terrasny", in the reserves "Bashkirsky", "Visimsky", "Volzhsko-Uralsky" there are 3 species each, the reserves "Zhigulevsky" and "Volga forest-steppe" – 4 species each, in the reserves "Astrakhansky" and "Bogdinsko-Baskunchaksky" – 5 species each, in the reserve "Chornye Zemli" – 7 species. Eryx jaculus was not found in the reserves of the Volga basin. Species Eryx miliaris inhabits two reserves, Natrix natrix – 20, Natrix tessellata – 2, Coronella austria – 11, Elaphe dione – 4, Elaphe sauromates – 2, Hierophis caspius – 3, Malpolon monspessulanus – 1, Vipera berus – 19, Vipera renardi – 2. The latter species is represented in both reserves (Volga forest-steppe and Astrakhansky) only by the nominate subspecies Vipera r. renardi, and in the Volga Basin, by the endemic subspecies V. r. bashkirovi, which has no conservation status in regional reserves. Three species of snakes are the least prosperous in terms conservation in the Volga basin: Eryx jaculus, Eryx miliaris, and Vipera renardi.

1. Introduction

Snakes are an important component of the ecosystems of the Volga basin, including the protected areas of the region. They play a significant role in the regulation of the number of murine rodents, reptiles, amphibians and insects, serve as food for many vertebrates, including commercial mammals. Snakes, currently reliably known to inhabit the Volga basin, are represented by 11 species belonging to four families: Boidae – Eryx jaculus (Linnaeus, 1758) and E. miliaris (Pallas, 1773); Colubridae – Natrix natrix (Linnaeus, 1758), N. tessellata (Laurenti, 1768), Coronella austria (Laurenti, 1768), Elaphe dione (Pallas, 1773), E. sauromates (Pallas, 1814) and Hierophis caspius (Gmelin, 1789); Lamprophiidae – Malpolon monspessulanus (Hermann, 1804); Viperidae – Vipera berus (Linnaeus, 1758) and V. renardi (Christoph, 1861). Many of their populations are declining and in need of protection.

The preservation of their habitat in protected areas is considered to be the most important protection measure in the countries of the former USSR. The development of nature reserve management in the Volga basin began in 1919 with the establishment of the Astrakhansky reserve. Nowadays, 23 nature reserves are located on the territory of the Volga basin [1]. The "youngest" of
them is the Kologrivsky Forest reserve, established in 2006. It should be noted that data on the ophidiofauna of the reserves in this region from the earlier reports [2-4] needs to be clarified and supplemented.

The purpose of this study is to analyze the modern representation of snakes in the reserves of the Volga basin.

2. Materials and Methods
The Volga basin is located in the Russian Federation and the Republic of Kazakhstan. All 23 nature reserves of the Volga basin are located in Russia (figure 1). There are no reserves in the regions of Kazakhstan, which geographically belong to the Volga basin.

![Figure 1](image)

**Figure 1.** Natural reserves of the Volga basin (the names of the reserves are given in table 1).

We base our research on the analysis of available data on the habitat of snakes in the reserves of the Volga basin. The source of material for the analysis was our data from 1988-2019 for five reserves, as well as published information from other researchers and data from open sources.
3. Results and Discussion

Snakes have never been found in the Vishersky Reserve. Ten out of eleven (90.9%) snake species that reliably inhabit the Volga basin are found and, therefore, protected in the remaining 22 regional nature reserves (table 1).

The ophidiofauna of the Volga basin reserves does not include *Eryx jaculus*, a species only known in the region from single records exclusively from the Republic of Kalmykia [5, 6] and included in the Red Data Book of the Russian Federation [7]. Two other species from the Red Data Book of the Russian Federation – *Eryx miliaris* and *Elaphe sauromates* – are protected in the Bogdinsko-Baskunchaksky and Chorny Zemli reserves.

**Table 1.** Ophidiofauna of nature reserves in the Volga basin

| No in figure 1 | Nature reserve                        | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | Sources of information  |
|---------------|--------------------------------------|---|---|---|---|---|---|---|---|---|----|----|------------------------|
| 1             | Darvinsky (Vologda and Yaroslavl oblasts) |   |   |   |   |   |   |   |   |   |   |   | [8]                     |
| 2             | Kologrivsky forest (Kostroma oblast)  |   |   |   |   |   |   |   |   |   |   |   | [9]                     |
| 3             | Nurgush (Kirov oblast)                |   |   |   |   |   |   |   |   |   |   |   | [10, 11]                |
| 4             | Vishersky (Perm Krai)                 |   |   |   |   |   |   |   |   |   |   |   | [10, 11]                |
| 5             | Basegi (Perm Krai)                    |   |   |   |   |   |   |   |   |   |   |   | +                       |
| 6             | Visimsky (Sverdlovsk oblast)          |   |   |   |   |   |   |   |   |   |   |   | [13]                    |
| 7             | Central Forest (Tver oblast)          |   |   |   |   |   |   |   |   |   |   |   | C                       |
| 8             | Kerzhensky (Nizhny Novgorod oblast)  |   |   |   |   |   |   |   |   |   |   |   | [14]                    |
| 9             | Big Kokshaga (Republic of Mari El)    |   |   |   |   |   |   |   |   |   |   |   | [10, 11]                |
| 10            | South Ural (Republic of Bashkortostan, Chelyabinsk oblast) |   |   |   |   |   |   |   |   |   |   |   | [16, 17]                |
| 11            | Kaluga zaseki (Kaluga oblast)         |   |   |   |   |   |   |   |   |   |   |   | R                       |
| 12            | Prioksko-Terrasny (Moscow Oblast)     |   |   |   |   |   |   |   |   |   |   |   | [19]                    |
| 13            | Oksky (Ryazan oblast)                |   |   |   |   |   |   |   |   |   |   |   | R                       |
| 14            | Mordovskiy (Republic of Mordovia)     |   |   |   |   |   |   |   |   |   |   |   | R                       |
| 15            | Prisursky (Republic of Chuvashia)     |   |   |   |   |   |   |   |   |   |   |   | Authors' data          |
| 16            | Volzhsko-Kamsky (Republic of Tatarstan) |   |   |   |   |   |   |   |   |   |   |   | [21, 22]               |
| 17            | Volga forest-steppe                  |   |   |   |   |   |   |   |   |   |   |   | Authors' data          |
| 18            | Zhigulevsky (Samara oblast)           |   |   |   |   |   |   |   |   |   |   |   | Authors' data          |
| 19            | Shulgan-Tash (Republic of Bashkortostan) |   |   |   |   |   |   |   |   |   |   |   | [23]                    |
| 20            | Bashkirsky (Republic                 |   |   |   |   |   |   |   |   |   |   |   | C                       |

*Note:* The table indicates the presence of snake species (1 = yes, 0 = no) in the respective nature reserves.
The range of the species widespread in Europe almost completely covers the Volga basin. The absence of this snake on the western macroslope of the Main Ural Ridge in two reserves (Vishersky and Basegi) can be explained by the short warm season here. In European Russia, the distribution of \( N. \) natrix is determined by a 100-day period per year with average temperatures above +10°C [28]. The species has never been found in the Central Forest Reserve, located on the western border of the Volga basin, in the center of the Russian Plain, in the southwestern part of the Valdai Upland; single finds were noted only in the protected zone of the reserve [14]. The overgrowth of meadows and former farmlands, high afforestation and the absence of lakes in the core of the Central Forest Reserve [29] are possibly the reasons for the absence of the species here.

The richest snake fauna is found in the reserves of the Lower Volga basin – Chornye Zemli Nature Reserve (7 species in the protected area "Chernozemelsky" belonging to the Volga basin), Astrakhansky Nature Reserve and Bogdinsko-Baskunchaksky Nature Reserve (5 species each).

\( H. \) caspius is found in these three reserves, located in the steppe and desert zones. This species does not inhabit other protected areas of the region. Only in two reserves of the region (Chornye Zemli and Bogdinsko-Baskunchaksky), which are located in the steppe zone, two species have been recorded – \( E. \) miliaris and \( E. \) sauromates. The only reserve where the species \( M. \) monspessulanus is found is "Chornye Zemli". We explain the absence of the species \( V. \) renardi in Chornye Zemli Nature Reserve with the high abundance of \( M. \) monspessulanus, which feeds on it [30]. The absence of \( V. \) renardi in Bogdinsko-Baskunchaksky Nature Reserve is possibly related to the high abundance of \( H. \) caspius, which also feeds on these vipers.

Two subspecies of \( V. \) renardi are widespread in the Volga basin: \( V. \) r. renardi (Christoph, 1861) and \( V. \) r. bashkirovi Garanin, Pavlov et Bakiev, 2004. The latter subspecies is found only in the Middle Volga basin and has no conservation status in the existing protected areas.

Thus, in the reserves of the Volga basin, one species of snakes of the regional ophidiofauna, \( E. \) jaculus, has no conservation status. Two species occur scarcely in protected areas: \( E. \) miliaris and \( V. \) renardi.

The species lists of snakes in some reserves will probably be expanded with a more detailed study of their ophidiofauna. Currently, we have no data about introduced snakes in the reserves of the Volga basin. Therefore, we emphasise the need for research attention to be focussed on invasive species of snakes in the reserves designed to preserve unique ecosystems and rare species [31].
4. Conclusion
We’d consider the situation to be ideal when each species of the region is represented in at least one reserve with the "common" or "numerous" status of occurrence of the species. This will allow, under unfavorable circumstances, to preserve the "regional standard" of a species [2]. This ideal in the Volga basin corresponds to the current state of protection in regional reserves of the following species of snakes: Natrix natrix, N. tessellata, Coronella austriaca, Elaphe dione, E. sauromates, Hierops caspius, Malpolon monspessulanus, Vipera berus. The species Eryx miliaris is found in two reserves ("Chornye Zemli" and "Bogdinsko-Baskunchaksky"), where this species is rare or known from single finds. Vipera renardi is also found in two reserves (Volga forest-steppe and Astrakhansky), where it is rare or known from single finds and is represented by the nominative subspecies Vipera r. renardi; another subspecies V. r. bashkirovı – endemic to the Volga basin – has no conservation status in regional reserves.

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