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Preliminary communication

FAUNISTIC FINDINGS FROM VOLUJAK MOUNTAIN: A CONTRIBUTION TO THE KNOWLEDGE OF THE FAUNA OF THE REPUBLIC OF SRPSKA (BOSNIA AND HERZEGOVINA)

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Summary

The first, after a long absence of any scientific research, faunal findings from the area of the Volujak Mountain (southeast of the Republic of Srpska, Bosnia and Herzegovina) were presented. In addition to listing the diversity of mammal fauna, data on other faunistic groups (birds, reptiles, amphibians, fish and invertebrates) were also recorded. Various methods were used to detect the presence of the fauna of the research area: established transects, trapping with livetraps, netting for catching bats, recording organisms with an ultrasonic detector, photo-traps and visual observation. For 17 days of research, in July and August 2023, a total of 53 taxa were registered. Keystone and endangered species are distinguished: greater horseshoe bat (*Rhinolophus ferrumequinum*), lesser horseshoe bat (*Rhinolophus hipposideros*), gray wolf (*Canis lupus*), brown bear (*Ursus arctos*), Balkan chamois (*Rupicapra r. balcanicus*), meadow viper (*Vipera ursinii macrops*) and the beech longhorn beetle (*Morimus funereus*). The area is very important in terms of biodiversity, and it needs to be protected.

Key words: Volujak Mountain, fauna, keystone and endangered species, biodiversity

INTRODUCTION

The massif of the Volujak Mountain (43.268308° N, 18.687167° E) is located in the southwest of the Republic of Srpska (Bosnia and Herzegovina - B&H). One part of the northwestern side of Volujak belongs to the protected area, the Sutjeska National Park (SNP), while the northeastern part belongs to the Nature Park "Piva" in Montenegro. The southwest side of the mountain is not a protected area. There is little data on faunistic research on the southwestern side of the mountain massif, and according to the available literature data, Bolkay and Ćurčić (1920) conducted the first research. On that occasion, the presence of a meadow viper (*Vipera ursinii macrops)* was recorded. Ornithological research, which also covered Volujak Mountain, was carried out at the end of the 60s of the last century (Rucner and Obratil, 1973). Research on the diversity of mammals has not been done in this area so far. Small mammals can significantly influence vegetation and soil, exert predatory pressure on insects and other mammals, and be a food source for other predators (Hull, 1987). Bats are the second largest order of mammals and have a significant ecological and economic role in the ecosystem (biological pest control, plant pollination, seed dispersal, guano use, medical use, tourism, etc. (Kasso and Balakrishnan, 2013). In some countries, they are the most meaningful contributors to mammalian biodiversity (Racey, 2011). Grey wolf, brown bear, Eurasian lynx and chamois are species that are considered keystone and influential species in the ecosystem (Miller and Corlatti, 2009; Tallian *et al*., 2017). Large carnivores have an interchangeable role in the ecosystem, from controlling the abundance of prey and mesopredators, disease, pollination, seed dispersal, enriching the soil with nutrients, reducing soil erosion to regulating the climate in the ecosystem (Estes *et al*., 2001; Palazón, 2017; Peziol *et al*., 2023). Because of their eating habits, chamois greatly affect the plant communities in their ecosystem, and they are also an important source of food for predators, such as the Eurasian lynx and the gray wolf (Palmegiani *et al*., 2013).

Because of the above, this research was primarily focused on diversity of mammals, but due to the biodiversity richness of the area, the geographical position (border area with Montenegro), the inseparable whole with the SNP, and scarce and outdated scientific data, other faunal groups were also recorded. There are many non-invasive methods for the determination of organisms, which were applied in this research, such as visual observation of individuals (Montgomery and Roloff, 2013), recognition of found footprints and tracks, marking with feces, or soil digging (Jedrezewski and Sidrovich, 2010), but some organisms must be caught or recorded with ultrasonic detectors (Kunz and Parsons, 2009) to make the determination confident. The use of camera traps is now a widespread method for solving various biological and ecological questions, especially in mammalian research (Caravaggi *et al.*, 2017; Zlatanova and Popova, 2018), such as determination of species, determination among individuals, distribution of species, abundance of individuals in the habitat, etc.

MATERIAL AND METHODS

The examined area has a surface of 37 km^2 located from the north, on the slopes of the southwestern side of Volujak Mountain, to the east to the border with Montenegro, to the south of the northern slopes of the Lebršnik Mountain and to the west to the main road Gacko-Tjentište (Figure 1). The collection of samples on the presence of fauna was carried out from 15 - 26 July and from 14 - 20 August 2023, for a total period of 17 days.

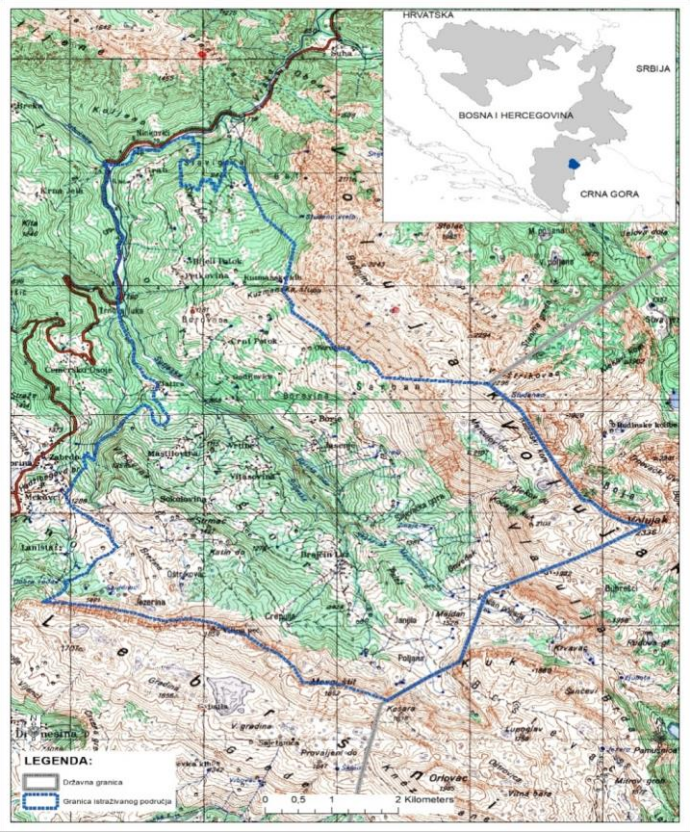

Figure 1. Researched area
(QGIS 3.32.2 "Lima"; the base is a topographic map scale 1: 50.000, sections: Gacko 1 and Gacko 3, Institute of Military Geography, 1974)

To collect evidence of the presence of small mammal fauna, Longworth and Sherman livetraps were set (Chitty and Kempson, 1949; Dizney *et al*., 2008) in forest edge areas, rocky areas and meadows. The Ultra Thin Mist Nets (Ecotone) and a stationary ultrasonic detector (AudioMoth) were used to collect evidence of bat presence (Kunz and Parsons, 2009). The mist nets were placed above mountain streams and on the edges of forests, using telescopic handles. The ultrasonic detector is placed near buildings and forest edges. Abandoned buildings were also visited where, in addition to visual observation, bat nets were placed. Species determination was done according to Dietz and Kiefer (2016). The line transect method was used to collect evidence of the presence of medium and large mammal fauna (Buckland *et al*., 2001). On seven transects, with a total length of 31 km, all signs of the presence of fauna were recorded. In addition, camera traps (Bushnell Trophy Cam HD) were set at a distance of 1 to 3 km from each other (Caravaggi *et al*., 2017). Fifteen camera traps were set, which were active for seven days. The field research lasted ten days. Identification of tracks and feces was done according to Jedrezewski and Sidrovich (2010). The presence of amphibians was searched for in the streams and the lake (Jagodino Lake). By visual observations on line transects, meadows and rocky areas, the presence of reptiles was recorded. Determination of members of the herpetofauna was done according to Speybroeck *et al*. (2021). The presence of ornithofauna, ichthyofauna and invertebrates was not studied in detail, and only sporadic observations were recorded. A camera Canon EOS 7D with a telephoto lens 100 - 400 mm (Canon) was used to register the ornitofauna, and the species were determined according to Hume *et al*. (2023). Insects were determined according to Bense (1995). The QGIS 3.32.2 Lima program was used to create the map of the research area, and the topographic map scale 1:50000 sections Gacko 1 and Gacko 3 was used as the base.

RESULTS

53 taxa were determined in the researched area (48 were determined to the species level and five to the genus level). A total of eight individuals of bats, within four genera or six species, were caught in specialized nets for catching bats. With a stationary ultrasonic detector, these species were also confirmed. Other small mammals were registered by being caught in livetraps and observed on the line transect method, where the presence of 15 individuals was recorded, of which there were eight different species. Based on the found dead individuals, footprints, feces, soil digging, photo-traps and visual observation, a total of 23 individuals of medium and large mammals were registered, and 11 species were determined. In addition to the findings of mammal fauna, 16 species of birds (15 nesting and one migratory), six species of reptiles, four species of amphibians and two species of invertebrates were established (Table 1).

Table 1. Registered fauna of the research area and the protection status of the recorded species

Local name	Scientific name	National status	IUCN
Bats			

Natererov šišmiš	*Myotis nattereri*	strictly protected +	LC
Veliki brkati večernjak	*Myotis brandtii*	unprotected	LC
Veliki potkovičar	*Rhinolophus ferrumequinum*	strictly protected +	NT[E]
Mali potkovičar	*Rhinolophus hipposideros*	strictly protected +	NT[E]
Dugodlaki šišmiš	*Hypsugo savii*	strictly protected +	LC
Sjeverni dugouhi šišmiš	*Plecotus auritus*	strictly protected +	LC
Other small mammals			
Sivi puh	*Glis glis*	protected + *	LC
Rovčica	*Crocidura leucodon*	protected +	LC
Sjeverni bjeloprsi jež	*Erinaceus roumanicus*	strictly protected + *	LC
Vjeverica	*Sciurus vulgaris*	strictly protected + *	LC
Voluharica	*Microtus* sp.	protected +	LC
Miš	*Apodemus* sp.	unprotected	LC
Krtica	*Talpa* sp.	protected +	LC
Zec	*Lepus europaeus*	protected *	LC
Medium and large mammals			
Kuna bjelica	*Martes foina*	unprotected	LC
Kuna zlatica	*Martes martes*	unprotected	LC
Mrki tvor	*Mustela putorius*	unprotected	LC
Divlja mačka	*Felis silvestris*	unprotected	LC
Jazavac	*Meles meles*	unprotected	LC
Lisica	*Vulpes vulpes*	unprotected	LC
Sivi vuk	*Canis lupus*	unprotected	LC
Mrki medvjed	*Ursus arctos*	protected + *	LC
Divlja svinja	*Sus scrofa*	unprotected	LC
Srna	*Capreolus capreolus*	protected + *	LC
Balkanska divokoza	*Rupicapra r. balcanica*	protected + *	LC
Birds			
Šumska sova	*Strix aluco*	strictly protected + *	LC
Ćuk	*Otus scops*	strictly protected + *	LC
Jastreb	*Accipiter gentilis*	unprotected	LC
Sivi soko	*Falco peregrinus*	strictly protected + *	LC
Siva vrana	*Corvus cornix*	protected +	LC
Gavran	*Corvus corax*	protected *	LC
Kreja	*Garrulus glandarius*	unprotected	LC
Zelena žuna	*Picus viridis*	strictly protected + *	LC
Velika sjenica	*Parus major*	strictly protected + *	LC
Crvendać	*Erithacus rubecula*	strictly protected + *	LC
Bjeloguza	*Oenanthe oenanthe*	strictly protected + *	LC
Rusi svračak	*Lanius collurio*	strictly protected + *	LC
Veliki sivi svračak	*Lanius excubitor*	strictly protected + *	LC
Poljska ševa	*Alauda arvensis*	strictly protected + *	LC
Golub grivnjaš	*Columba palumbus*	protected + *	LC
Divlja patka	*Anas platyrhynchos*	protected + *	LC

Reptiles			
Šargan	*Vipera ursinii macrops*	strictly protected + *	VU[G]
Šarka	*Vipera berus*	protected +	LC
Smukulja	*Coronella austriaca*	unprotected	LC
Smuk	*Zamenis longissimus*	unprotected	LC
Sljepić	*Anguis fragilis*	unprotected	LC
Livadski gušter	*Lacerta agilis*	protected +	LC
Amphibians			
Žutotrbi mukač	*Bombina variegata*	strictly protected + *	LC
Obična krastača	*Bufo bufo*	unprotected	LC
Šumska žaba	*Rana dalmatina*	unprotected	LC
Zelena žaba	*Pelophylax* sp.	unprotected	LC
Invertebrates			
Bukova strižibuba	*Morimus funereus*	protected +	VU[G]
Evropska škorpija	*Euscorpius* sp.	unprotected	/

Labels under IUCN criteria: [G] Global and [E] European list;

* Law on hunting of Republic of Srpska; + Regulation on strictly protected and protected wild species in Republic of Srpska

DISCUSSION

Of the 53 taxa found, 34 (64%) are protected by some of the laws or/and by-laws of the Republic of Srpska like Law on hunting (Official Gazette of the Republic of Srpska, 60/09) and Regulation on strictly protected and protected wild species (Official Gazette of the Republic of Srpska, 65/20). According to the IUCN Red List, the two species found have the status of Vulnerable (meadow viper (Joger *et al*., 2009) and beech longhorn beetle (World Conservation Monitoring Centre, 1996)), and two status of Near Threatened (great horseshoe bat (Hutson *et al*., 2007a) and lesser horseshoe bat (Hutson *et al*., 2007b)).

Identified species of theriofauna (n=25) make up 27% of the total number inhabiting the territory of Bosnia and Herzegovina (after Mitchell-Jones *et al*., 1999). This diversity of mammals is almost the same as in the Sutjeska National Park - SNP (Plan upravljanja Nacionalnim parkom „Sutjeska“, 2013), which is considered one of the most important biodiversity areas in B&H and the region. Regarding the diversity of bats, these findings make up 19% of the total number inhabiting B&H (after Mitchell-Jones *et al*., 1999) and 17% of the total number of species found in the Regulation on Strictly Protected and Protected Wild Species (Official Gazette of the Republic of Srpska, 65/20). One species is unprotected, but this is probably due to the fact that the species was officially described and registered only on the territory of the Federation of Bosnia and Herzegovina (Mulaomerović, 2013). As of 2021, it is known that this species also inhabits the territory of the Republic of Srpska (Verhees *et al*., 2021). Findings of other small mammals (n=8) make up 20% of the total number of species inhabiting B&H (after Mitchell-Jones *et al*., 1999), and four species are protected by the Hunting Law (Official Gazette of the Republic of Srpska, 60/09). Medium and large mammals (n=11) make up 52% of the total number of species registered in B&H (after Mitchell-Jones *et al*., 1999), and 43% from species that are protected by the Regulation on

Strictly Protected and Protected Wild Species (Official Gazette of the Republic of Srpska, 65/20). Keystone species, such as grey wolf, brown bear and Balkan chamois were registered in the surrounding area (Trbojević, 2016; Trbojević, 2017; Sekulić *et al*., 2021), and were expected in the researched area as well. According to the IUCN Red List (Global and European Assessment), the brown bear is categorized as Least Concern (McLellan *et al*., 2017; Huber, 2018), while according to the Mediterranean List, it is categorized as Vulnerable (Boitani *et al*., 2010). The Eurasian lynx (*Lynx lynx*) was registered in the Volujak mountain area, part belonging to the SNP (Trbojević, 2020; Fležar *et al*., 2021), which is why its presence was expected in the researched area, but, the species was not registered in this research. Also, species such as Eurasian otter and least weasel have not been registered, and their presence is expected in the research area (McDonald *et al*., 2019; Loy *et al*., 2022).

The ornithofaunal findings of 15 species of nesting birds correspond to the results obtained during the inventory of the diversity of nesting birds in B&H (Kotrošan *et al*., 2018), and make up a smaller part (more than 6%) of the total diversity of nesting birds in B&H. Most of the mentioned species were also registered during the research conducted in the SNP (Sjenčić *et al*., 2017). 13 identified species are on the list of the Regulation on Strictly Protected and Protected Wild Species (Official Gazette of the Republic of Srpska, 65/20), which accounts for 3% (n=10) of strictly protected and 10% (n=3) of protected species. In the historical data from Rucner and Obratil (1973), finds of ornithofauna are mentioned that could be related to the Volujak mountain (towards the Suški stream and the part that belongs to the Sutjeska canyon). They recorded several species of nesting birds there: golden eagle (*Aquila chrysaetos*), common kestrel (*Falco tinnunculus*), rock dove (*Columba livia*), western house martin (*Delichon urbica*), Eurasian crag martin (*Ptyonoprogne rupestris*), white-winged snowfinch (*Montifringilla nivalis*) and horned lark (*Eremophila alpestris*). Although some of the listed species are expected (e.g. golden eagle and common kestrel), none of them were registered by this research.

Of the known number of reptile species that exist in the Republic of Srpska (Šukalo, 2022), these findings make up over 21% of that diversity. The presence of meadow viper on the Volujak mountain was also recorded in research conducted more than 100 years ago (Bolkay and Ćurčić, 1920), but this is the first finding of the adder (*Vipera berus*) in this area. Determined strictly protected species cause 10% and protected species (n=2) 20% of the total number listed in the Regulation on Strictly Protected and Protected Wild Species (Official Gazette of the Republic of Srpska, 65/20). The expected species, the Mosor lizard (*Dinarolacerta mosorensis*), which according to the IUCN Red List is categorized as vulnerable - VU^{G} (Crnobrnja Isailović *et al*., 2009) and which is on the list of protected species of the Republic of Srpska (Official Gazette of the Republic of Srpska, 65/20), was not found during the research.

As for the diversity of amphibians (n=4), these findings make up over 17% of the total number of registered species in B&H (Lelo and Zimić, 2020). One species has been determined to be strictly protected, which accounts for 11% of the total number of strictly protected species listed in the Regulation on Strictly Protected and Protected Wild Species (Official Gazette of the Republic of Srpska, 65/20).

Self-initiated stocking of Jagodino Lake was carried out with rainbow trout (*Oncorhynchus mykiss*), carp (*Cyprinus carpio*) and perch (*Perca fluviatilis*) (Dalibor Šušić,

secretary of the "Volujak" Mountaineering Society, pers. com.). Originally, high-mountain lakes are without ichthyofauna, but various fish species (mainly trout) are often introduced for the purpose of commercial and tourist fishing, which can have a negative impact on the indigenous wildlife of the given lake (Ventura *et al*., 2017).

Only two species of invertebrates are shown in the results of the work, but it is clear that this faunal group is species-rich and numerous. Nevertheless, the finding of the Beech Longhorn beetle makes up 20% of the total number of protected species that are on the list of the Regulation on Strictly Protected and Protected Wild Species (Official Gazette of the Republic of Srpska, 65/20). The Rosalia longicorn (*Rosalia alpina*) is categorized as Vulnerable - VU^G according to the IUCN Red List (World Conservation Monitoring Centre, 1996b) and is on the list of strictly protected species of the Republic of Srpska (Official Gazette of the Republic of Srpska, 65/20), it was not found during the research, but it is expected in the given area. In support of the rich diversity of the area, the findings of butterflies and dragonflies from the area of Zelengora and SNP, where 35 species have each been registered (Plan gazdovanja Nacionalnim parkom Sutjeska, 2002; Kulijer and Miljević, 2017).

CONCLUSION

In general, all found species of mammals significantly expand the knowledge about the distribution and diversity of the fauna of Republika Srpska, considering that this group of organisms has never been investigated in the given area. For many species, which are not currently registered, their presence is expected, such as the Eurasian lynx, Eurasian otter, least weasel, and many species of small mammals. Given that birds, amphibians, reptiles, fish, and especially invertebrates were not the focus of the research, it is sure that their diversity in the area is also greater. Many internationally endangered and nationally strictly protected species are expected to be present in the researched area, such as the golden eagle, Rosalia longicorn and the Mosor lizard. The introduction of fish species into Lake Jagodino probably harmed this relatively small and closed ecosystem in the context of the destruction of indigenous animal and plant life. Therefore, to achieve an even better understanding of the diversity of the fauna, it is necessary to conduct a more comprehensive faunal survey and extend it to Mountain Lebršnik, which is part of this biogeographical unit. The presented results showed that the Volujak mountain area is very rich in biodiversity and deserves a particular type of protection.

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REFERENCES

Bense, U. (1995). *Longhorn Beetles: Illustrated Key to the Cerambycidae and Vesperidae of Europe*. Weikersheim: Margraf Verlag.

Boitani, L., Jdeidi, T., Masseti, M., Nader, I., de Smet, K. & Cuzin, F. (2010). *Ursus arctos* (Mediterranean assessment). The IUCN Red List of Threatened Species 2010: e.T41688A10514336. Retrieved from: https://dx.doi.org/10.2305/IUCN.UK.2017-3.RLTS.T41688A1212299

Bolkay, S. J. & Ćurčić, V. (1920). *O našim zmijama otrovnicama*. Sarajevo: Zemaljska štamparija.

Buckland, S.T., Anderson, D. R., Burnham, K. P., Laake, J. L., Borchers, D. L. & Thomas, L. (2001). *Introduction to Distance Sampling*. Oxford: Oxford University Press.

Caravaggi, A., Banks, P. B., Burton, A. C., Finlay, C. M. V., Has-well, P. M., Hayward, M. W., Rowcliffe, M. J. & Wood, M. D. (2017). A review of camera trapping for conservation behaviour research. *Remote Sensing in Ecology and Conservation*, *3*(3), 109–122. doi:/10.1002/rse2.48

Chitty, D. & Kempson, D. A. (1949). Prebaiting small mammals and a new design of live trap. *Ecology*, *30*, 536–542.

Crnobrnja Isailovic, J., Ajtic, R. & Vogrin, M. (2009). *Dinarolacerta mosorensis*. The IUCN Red List of Threatened Species 2009: e.T61526A12504486. Retrieved from: https://dx.doi.org/10.2305/IUCN.UK.2009.RLTS.T61526A12504486.en

Dietz, C. & Kiefer, A. (2016). *Bats of Britain and Europe*. New York: Bloomsbury publishing.

Dizney, L., Jones, D. P. & Ruedas, A. L. (2008). Efficacy of Three Types of Live Traps Used for Surveying Small Mammals in the Pacific Northwest. *Northwestern Naturalist*, *89*, 171-180.

Estes, J. A., Crooks, K. & Holt, R. (2001). Predators, Ecological role of. In: Levin, S. (Ed.) *Encyclopedia of Biodiversity*, Vol. 4 (pp. 857–878). San Diego: Academic Press.

Fležar, U., Pičulin, A., Bartol, M., Stergar, M., Sindičić, M., Gomerčić, T., Slijepčević, V., Trbojević, I., Trbojević, T., Jobin-Molinari, A., Molinari, P., Krofel, M. & Černe, R. (2021). Eurasian lynx in the Dinaric Mountains and the southeastern Alps, and the need for population reinforcement. *CATnews* Special Issues, *14*, 21–24.

Hjum, R., Stil, R., Svoš, E. & Harop, H. (2023). *Ptice Srbije i Evrope: vodič za raspoznavanje*. New Jersey: Princeton University Press.

Huber, D. (2018). *Ursus arctos* (Europe assessment) (errata version published in 2019). The IUCN Red List of Threatened Species 2018: e.T41688A144339998.

Hull Sieg, C. (1987). Small Mammals: Pests or Vital Components of the Ecosystem. In: Uresk, Daniel W.; Schenbeck, Greg L.; Cefkin, R., technical coordinators. Eighth Great Plains wildlife damage control workshop proceedings. Gen. Tech. Rep. RM-GTR-154. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station (pp. 88-92). Retrieved from: https://digitalcommons.unl.edu/cgi/viewcontent.cgi?referer=&httpsredir=1&article=1097&context=gpwdcwp

Hutson, T., Spitzenberger, F., Juste, J., Aulagnier, S., Fernandes, M. & Alcaldé. T. J. (2007a). *Rhinolophus ferrumequinum* (Europe assessment). The IUCN Red List of Threatened Species 2007: e.T19517A8948327. Retrieved from: www.iucnredlist.org

Hutson, T., Spitzenberger, F., Juste, J., Aulagnier, S., Fernandes, M. & Alcaldé. T. J. (2007b). *Rhinolophus hipposideros* (Europe assessment). The IUCN Red List of Threatened Species 2007: e.T19518A8950866. Retrieved from: www.iucnredlist.org

Jedrezewski, W. & Sidrovich, V. (2010). *The art of tracking animals*. Bialowieża: Mammal Research Institute, Polish Academy of Sciences.

Joger, U., Crnobrnja Isailovic, J., Vogrin, M., Corti, C., Sterijovski, B., Westerström, A., Krecsák, L., Pérez Mellado, V., Sá-Sousa, P., Cheylan, M., Pleguezuelos, M. J. & Sindaco, R. (2009). *Vipera ursinii*. The IUCN Red List of Threatened Species 2009: Retrieved from: http://dx.doi.org/10.2305/IUCN.UK.2009.RLTS.T22997A9406628.e

Kasso, M. & Balakrishnan, M. (2013). Ecological and Economic Importance of Bats (Order Chiroptera). *International Scholarly Research Notices*, *2013*, Article ID 187415, 9 stranica. Retrieved from: https://doi.org/10.1155/2013/187415

Kotrošan, D., Sjenčić, J., Kipson, M. & Sarajlić, N. (2018). Preliminarni rezultati kartiranja gnjezdarica u Bosni i Hercegovini. *Bilten Mreže posmatrača ptica u Bosni i Hercegovini*, *14*, 40–50.

Kulijer, D. & Miljević, I. (2017). Fauna vilinih konjica (Odonata) planine Zelengora i Nacionalnog parka Sutjeska. *Glasnik Šumarskog fakulteta Univerziteta u Banjoj Luci*, *26*, 23–39. doi:10.7251/GSF1726023K

Kunz, T. H. & Parsons, S. (2009). *Ecological and Behavioral Methods for the Study of Bats*. 2nd Edition. Baltimore: Johns Hopkins University Press.

Lelo, S. & Zimić, A. (2020). *Biosistematika vertebrata: biodiverzitet vodozemaca i gmizavaca sa posebnim osvrtom na faunu Bosne i Hercegovine.* Sarajevo: Udruženje za inventarizaciju i zaštitu životinja.

Loy, A., Kranz, A., Oleynikov, A., Roos, A., Savage, M. & Duplaix, N. (2022). *Lutra lutra* (amended version of 2021 assessment). The IUCN Red List of Threatened Species 2022: e.T12419A218069689. Retrieved from: https://dx.doi.org/10.2305/IUCN.UK.2022-2.RLTS.T12419A218069689.en

McDonald, R. A., Abramov, A. V., Stubbe, M., Herrero, J., Maran, T., Tikhonov, A., Cavallini, P., Kranz, A., Giannatos, G., Kryštufek, B. & Reid, F. (2019). *Mustela nivalis* (amended version of 2016 assessment). The IUCN Red List of Threatened Species 2019: e.T70207409A147993366. Retrieved from: https://dx.doi.org/10.2305/IUCN.UK.2016-1.RLTS.T70207409A147993366.en

McLellan, B. N., Proctor, M. F., Huber, D. & Michel, S. (2017). *Ursus arctos* (amended version of 2017 assessment). The IUCN Red List of Threatened Species 2017: e.T41688A121229971. Retrieved from: https://dx.doi.org/10.2305/IUCN.UK.2017-3.RLTS.T41688A1212299

Miller, C. & Corlatti, L. (2009). Das Gamsbuch. Germany: Neumann-Neudamm Melsungen.

Mitchell-Jones, A. J., Amori, G., Bogdanowicz, W., Krystufek, B., Reijnders, P. J. H., Spitzenberger, E., Stubbe, M., Thissen, J. B. M., Vohralik, V. i Zima, J. (1999). *The Atlas of European Mammals*. London: T & AD POYSER NATURAL HISTORY.

Mulaomerović, J. (2013). Prvi nalaz Brandtovog šišmiša *Myotis brandti* u Bosni i Hercegovini. *Naš krš, 46*(1), 14-22.

Montgomery, R.A. & G.J. Roloff (2017). Habitat Selection, In Reference Module in Life Sciences, Elsevier, ISBN: 978-0-12-809633-8. Retrieved from: http://dx.doi.org/10.1016/B978-0-12-809633-8.02383-9

Official Gazette of the Republic of Srpska, 65 (2020). Regulation on strictly protected and protected wild species.

Official Gazette of the Republic of Srpska, 60 (2009). Law on hunting.

Palazón, S. (2017). The Importance of Reintroducing Large Carnivores: The Brown Bear in the Pyrenees. In: Catalan, J. *et al*. (Eds.), *High Mountain Conservation in a Changing World*, (pp. 231-249). Advances in Global Change Research. doi:10.1007/978-3-319-55982-7_10

Palmegiani, I., Gazzola, A. & Apollonio, M. (2013). Wolf diet and its impact on the ungulates community in a new recolonized area of Western Alps: Gran Paradiso National Park. *Folia Zoologica*, *62*(1), 59-66. doi:10.25225/fozo.v62.i1.a9.2013. 10.25225/fozo.v62.i1.a9.2013

Peziol, M., Elbroch, L. M., Shipley, A. L., Evans, R. D. & Thornton, H. D. (2023). Large carnivore foraging contributes to heterogeneity in nutrient cycling. *Landscape Ecology*, *38*, 1497–1509. doi:10.1007/s10980-023-01630-0

Plan gazdovanja Nacionalnim parkom Sutjeska (2002). Nacionalni park Sutjeska, Plan gazdovanja 2003 - 2012. godina.

Plan upravljanja Nacionalnim parkom „Sutjeska“ (2013). Nacionalni park Sutjeska, Plan upravljanja 2014 - 2029. godina.

Racey, A. P. (2011). Book Review of Ecological and Behavioral Methods for the Study of Bats by T.H. Kunz & S. Parsons. *Zoological Journal of the Linnean Society, 162*(1), 243. Retrieved from: https://doi.org/10.1111/j.1096-3642.2011.00696.x

Rucner, D. & Obratil, S. (1973). Prilog poznavanju avifaune planinskog područja Maglića, Volujka i Zelengore. *LARUS*, *25*, 61–93.

Sekulić, Ž., Kunovac, S. & Paprica, B. (2021). Staništa i sezonske migracije divokoze (*Rupicapra rupicapra balcanica*, Bolkay 1925) u posebnom lovištu „Zelengora“ i Nacionalnom parku „Sutjeska“. *Radovi Šumarskog Fakulteta Univerziteta U Sarajevu*, *51*(1), 3–11. doi:10.54652/rsf.2021.v51.i1.349

Sjenčić, J., Šćiban, M. & Crnković, N. (2017). Prilog poznavanju faune ptica Nacionalnog parka Sutjeska. *Glasnik šumarskog fakulteta Univerziteta u Banjoj Luci*, 226, 41–50. doi:10.7251/GSF1726041S

Speybroeck, J., Beukema, W., Bobby Bok, B., Van Der Voort, J. & Velikov, I. (2021). *Field Guide to the Amphibians and Reptiles of Britain and Europe*. New York: Bloomsbury Publishing.

Šukalo, G. (2022). *Gmizavci Republike Srpske*. Banja Luka: Prirodno-matematički fakultet, Univerzitet u Banjoj Luci.

Tallian, A., Ordiz, A., Metz, C. M., Milleret, C., Wikenros, C., Smith, W. D., Stahler, R. D., Kindberg, J., MacNulty, R. D., Wabakken, P., Swenson E. J. & Sand, H. (2017). Competition between apex predators? Brown bears decrease wolf kill rate on two continents. *The Royal Society B, 284*, 20162368. doi:10.1098/rspb.2016.2368

Trbojević, I. (2016). Distribucija vuka (*Canis lupus* L., 1758) u Bosni i Hercegovini. *Glasnik Šumarskog fakulteta Univerziteta u Banjoj Luci*, *25*, 41-49.doi:10.7251/GSF1625041T.

Trbojević, I. (2017). Status of brown bear in Bosnia and Herzegovina. In: International workshop on brown bears management across the Alps, the Dinaric Mountains and beyond (21 p.). Venice: LIFE DINALP BEAR. doi:10.13140/RG.2.2.18272.48644

Trbojević, T., Trbojević, I., Sekulić, Ž., Napotnik, I., Stevanović, O., Dekić, R. & Perović, A. (2020). Lynx in the Dinaric Mountains of Bosnia and Herzegovina and western Montenegro. In: Ćurić, A. (Ed.), *Rufford Balkan and East Conference 2020*. Abstract Book. International Rufford Small Grants Conference. Sarajevo: Herpetological Association in Bosnia and Herzegovina "ATRA".

Ventura, M., Tiberti, R., Buchaca, T., Buñay, D., Sabás, I. & Miró, A. (2017). Why Should We Preserve Fishless High Mountain Lakes? In: Catalan, J., Ninot, J., Aniz, M. (Eds.) *High Mountain Conservation in a Changing World*. Advances in Global Change Research, 62. Springer, Cham. doi:10.1007/978-3-319-55982-7_8

Verhees, J. F. J., Buys, C.J., Twisk, T. P., Šestović, B., Kocks, M. & Lemmers, P. (2021). New bat records in south-eastern Bosnia and Herzegovina with additional confirmation of *Myotis alcathoe* and *Myotis brandtii*. *Journal of Bat Research & Conservation*, *14*(1), 171-179. doi:10.14709/BarbJ.14.1.2021.16

Zlatanova, P. D. & Popova, D. E. (2018). Biodiversity estimates from different camera trap surveys: A case study from Osogovo MT., Bulgaria. *Nature Conservation Research. 3*(2), 13-25. doi:10.24189/ncr.2018.026.

World Conservation Monitoring Centre. (1996a). *Morimus funereus*. The IUCN Red List of Threatened Species 1996: e.T13875A4359886. Retrieved from: https://dx.doi.org/10.2305/IUCN.UK.1996.RLTS.T13875A4359886.en

World Conservation Monitoring Centre. (1996b). *Rosalia alpina*. The IUCN Red List of Threatened Species 1996: e.T19743A9009447. Retrieved from: https://dx.doi.org/10.2305/IUCN.UK.1996.RLTS.T19743A9009447.en

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