diversity

MDPI

Review

An Updated Checklist of Freshwater Gastropods (Mollusca: Gastropoda) of Bosnia and Herzegovina, with Emphasis on Crenobiotic Species

Dejan Dmitrović [1,*], Ana Savić [2], Goran Šukalo [1] and Vladimir Pešić [3]

[1] Department of Biology and Department of Ecology and Environment Protection, Faculty of Natural Sciences and Mathematics, University of Banja Luka, Mladena Stojanovića 2, 78000 Banja Luka, Republic of Srpska, Bosnia and Herzegovina
[2] Department of Biology and Ecology, Faculty of Sciences and Mathematics, University of Niš, Višegradska 33, 18000 Niš, Serbia
[3] Department of Biology, Faculty of Science and Mathematics, University of Montenegro, Džordža Vašingtona bb., 81000 Podgorica, Montenegro
* Correspondence: dejan.dmitrovic@pmf.unibl.org

Abstract: An updated checklist of freshwater gastropods of Bosnia and Herzegovina, including 144 species and subspecies from 59 genera and 17 families, is presented in this paper. Hydrobiidae is the most diverse family, representing ~50% of the species richness in the country. In total, ~38% of the recorded taxa are endemic. The highest number of species was recorded from underground waters and/or springs, followed by rivers and standing waters. This inventory includes 18 crenobiotic taxa, of which 9 are endemic to Bosnia and Herzegovina. The country is divided between the Dniester–Lower Danube and Dalmatia ecoregions. The Dalmatia ecoregion has the highest overall diversity, i.e., 82 species and subspecies. Three invasive species are recorded in Bosnia and Herzegovina. Our study reveals that most species still lack conservation assessments, and only five species are nationally protected.

Keywords: freshwater gastropods; fauna; biogeography; ecology; biodiversity protection

Citation: Dmitrović, D.; Savić, A.; Šukalo, G.; Pešić, V. An Updated Checklist of Freshwater Gastropods (Mollusca: Gastropoda) of Bosnia and Herzegovina, with Emphasis on Crenobiotic Species. *Diversity* **2023**, *15*, 357. https://doi.org/10.3390/d15030357

Academic Editor: Alan Christian

Received: 26 December 2022
Revised: 19 February 2023
Accepted: 24 February 2023
Published: 1 March 2023

1. Introduction

Freshwater gastropods play important roles in ecosystem processes and in the stability of the trophic webs in freshwater ecosystems [1]. Given their high diversity and endemism in some types of freshwater ecosystems—such as springs and underground waters—and the fact that freshwater gastropods arecurrently very threatened by human-induced changes, there is a need to prioritize species for conservation aims [2]. The first step in this direction is to build comprehensive checklists at the national and regional levels in order to support decision-making and the planning of conservation efforts.

Historically, the first checklist of the gastropod fauna of Bosnia and Herzegovina was made in the second half of the 19th century by Otto von Möllendorff, as an integral part of his inaugural dissertation for acquiring a Ph.D. [3]. This was the oldest publication that was entirely devoted to the fauna of Bosnia and Herzegovina, and one part was focused on the gastropod fauna [4]. The dissertation included data on 23 species of freshwater gastropods in Bosnia and Herzegovina, including descriptions of3 species that were new to science at the time. Up to the end of the 19th century, a large number of scientists made significant contributions to the research on the diversity and distribution of freshwater snails in Bosnia and Herzegovina, including Brancsik [5–7], Servain [8], Boettger [9], and Bourguignat [10].

In the mid-20th century, Jaeckel et al. [11] provided a list of terrestrial and freshwater gastropods of the northern part of the Balkan Peninsula, providing data on the gastropod fauna inhabiting both Bosnia and Herzegovina. The analysis of these faunistic data yielded a total of 37 taxa of freshwater gastropods inhabiting the area of Bosnia and Herzegovina

until that date. By the end of the 20th century, the number of authors and publications on the freshwater gastropods of Bosnia and Herzegovina had considerably increased, including Bole [12,13], Bole and Velkovrh [14], Boeters [15], Schütt [16–22], and Radoman [23–28].

Almost three decades later, at the beginning of the 21st century, Karaman [29] gave an overview of the previous investigations of gastropod fauna in Bosnia and Herzegovina, listing 78 species and subspecies of freshwater snails. This number of taxa is the same as the number reported by Bank and Neubert [30] for Bosnia and Herzegovina in their list of the terrestrial and freshwater gastropods of Europe. However, despite the identical total numbers of taxa, the comparison of the two lists shows a faunal discrepancy, indicating the necessity of updating the checklists of freshwater gastropods of Bosnia and Herzegovina.

During the last decade, a large number of new species have been described from Bosnia and Herzegovina, mainly by Peter Glöer and Jozef Grego. Most of these new species were described from underground waters and spring habitats [31–43].

Considering all of the above, we aim to provide an updated checklist of freshwater gastropods by including novel information that has recently been accumulated on the diversity of this faunistic group in Bosnia and Herzegovina. In this paper, we also perform a critical review of their diversity, endemism, and IUCN assessments, providing a robust framework for the distribution and biogeography of freshwater gastropods inhabiting Bosnia and Herzegovina.

2. Materials and Methods

Our updated checklist of freshwater gastropods of Bosnia and Herzegovina is based on all available malacological publications, comprising both national and international publications [3,5–70]. The nomenclature and taxonomical status of gastropods are defined according to MolluscaBase [71], while ecoregional delimitation is given according to the FEOW (Freshwater Ecoregions of the World) conservation science program [72] (Figure 1).

In this study, we additionally analyzed data from 105 springs located in the northwestern part of Bosnia and Herzegovina. A list of the investigated springs and an overview of their hydromorphological characteristics are available in the works of Dmitrović et al. [51], Savić et al. [66], and Pešić et al. [73] (Figure 1). Springs are grouped as modified/natural and permanent/intermittent. Statistical analyses were performed using PRIMER 7.0 [74]. We performed PCA (principal component analysis) in order to distinguish modified springs from natural springs. This analysis was performed on centered and standardized physicochemical data (i.e., water temperature, conductivity, pH, oxygen concentration, and discharge). Physicochemical parameters were available for 86 springs. In order to determine homogeneity in the assemblages of springs (modified/natural and permanent/intermittent), and in order to determine which species are the main contributors to those assemblages, we performed SIMPER analysis. Faunistic data were available for all 105 springs. The Mann–Whitney test was used to determine the existence of statistically significant differences in the average values of physicochemical characteristics between modified and natural springs. To test uniformity of distribution of species belonging to two ecoregions, we used the chi-squared test.

The overview of IUCN Red List categories of gastropod taxa inhabiting the territory of Bosnia and Herzegovina was carried out based on the *European Red List of Non-marine Mollusks* from 2011 [75], as well as relevant works published after that date (for example, [40,66,76,77]).

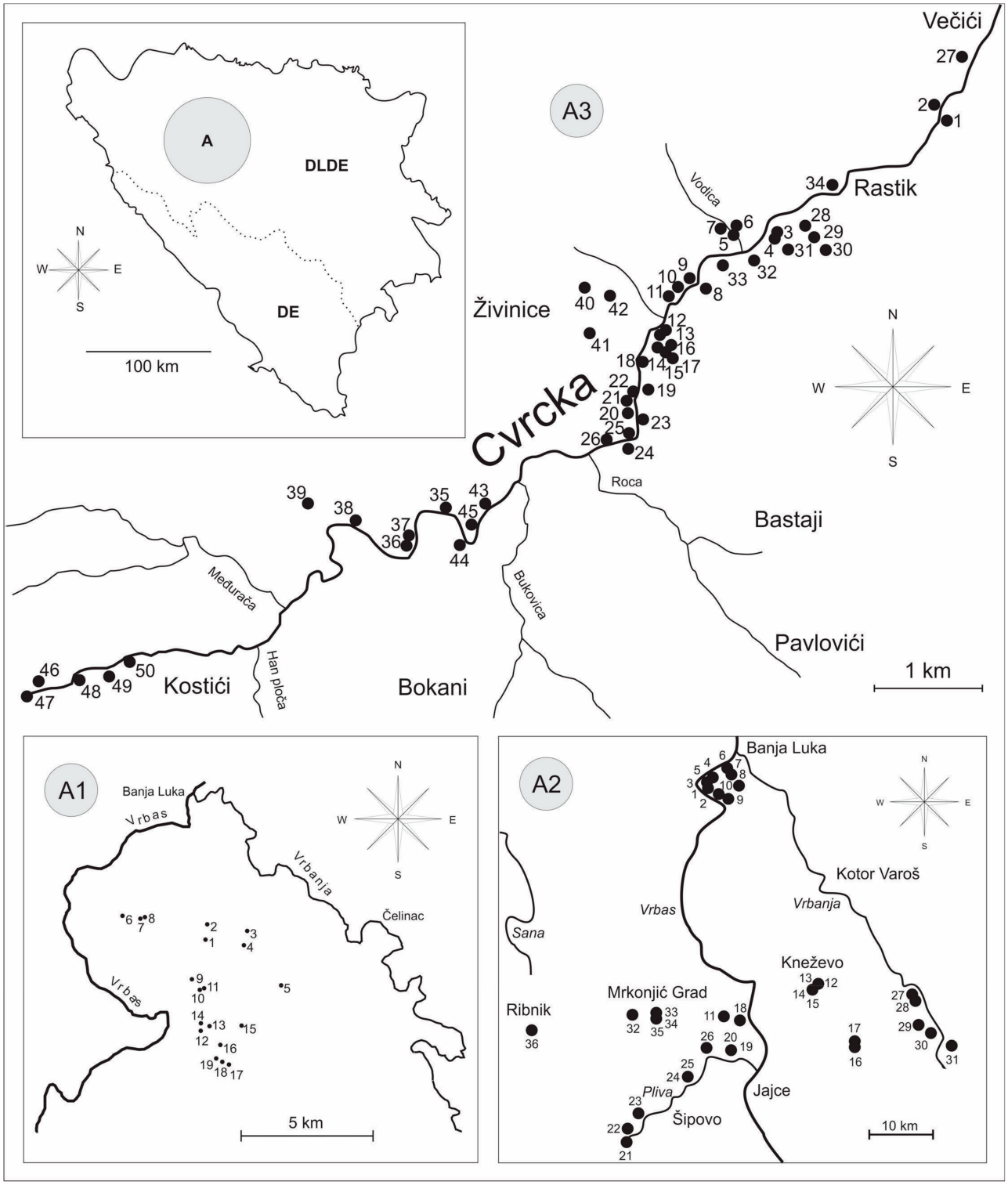

Figure 1. The freshwater ecoregional delineations of Bosnia and Herzegovina according to the FEOW [72]: the Dniester–Lower Danube ecoregion (DLDE) and the Dalmatia ecoregion (DE). Crenoecologically explored area (**A**) by: Dmitrović et al. [51] (**A1**), Savić et al. [66] (**A2**), and Pešić et al. [73] (**A3**).

3. Results and Discussion

3.1. Diversity of Freshwater Gastropods in Bosnia and Herzegovina

A total of 144 species and subspecies of freshwater gastropods belonging to 59 genera and 17 families (Table 1) are listed for Bosnia and Herzegovina. The most diverse family was Hydrobiidae, with 71 species and subspecies (i.e., 49.3% of the gastropod species richness), followed by Moitessieriidae (18 species; 12.5%) and Planorbidae (13 species; 9.0%). The lowest number of taxa (one species each) was found in the families Amphimelaniidae, Tateidae, Amnicolidae, and Acroloxidae. The most species-rich genus was *Plagigeyeria* Tomlin, 1930, with 16 species (11.1%), followed by *Belgrandiella* A. J. Wagner, 1928, with 10 species (6.9%), and *Paladilhiopsis* Pavlović, 1913, with 8 species (5.6%). All of the other genera were individually represented, with species richness of less than 5% of the total fauna.

Table 1. An updated checklist with the distribution, habitat, and conservation status data of freshwater gastropods in Bosnia and Herzegovina. All taxa whose type localities are located in Bosnia and Herzegovina are marked with an asterisk (*). Endemic species and subspecies are marked with two asterisks (**). Ecoregional classification: Dniester–Lower Danube ecoregion (I), Dalmatia ecoregion (II). Habitat classification: underground waters (A), springs (B, crenobionts = k), rivers (C), and standing waters (i.e., lakes, ponds, and/or swamps) (D). The presence of taxa are marked with +. The conservation status of taxa (CS) is given at the European level (standard IUCN abbreviations were used).

TAXA LIST	I	II	A	B	C	D	CS
Familia: Neritidae Rafinesque, 1815							
Theodoxus baeticus (Lamarck, 1822)		+		+			
Theodoxus danubialis (C. Pfeiffer, 1828)	+				+		LC
Theodoxus fluviatilis (Linnaeus, 1758)	+	+		+	+		LC
Theodoxus subterrelictus Schütt, 1963 *		+	+				EN
Familia: Viviparidae J. E. Gray, 1847							
Viviparus acerosus Bourguignat, 1862	+						LC
Viviparus contectus (Millet, 1813)	+	+			+	+	LC
Viviparus viviparus (Linnaeus, 1758)	+				+		LC
Familia: Melanopsidae H. Adams and A. Adams, 1854							
Esperiana esperi (Férussac, 1823)	+				+		LC
Microcolpia daudebartii acicularis (A. Férussac, 1823)	+				+		LC
Familia: Amphimelaniidae P. Fischer and Crosse, 1891							
Holandriana holandrii (C. Pfeiffer, 1828)	+	+			+		LC
Familia: Bithyniidae Gray, 1857							
Bithynia leachii (Sheppard, 1823)	+						LC
Bithynia mostarensis Möllendorff, 1873 *		+				+	DD
Bithynia tentaculata (Linnaeus, 1758)	+	+		+	+	+	LC
Bithynia zeta Glöer and Pešić, 2007		+		+			EN
Familia: Moitessieriidae Bourguignat, 1864							
Bosnidilhia vreloana Boeters, Glöer and Pešić, 2013 **	+		+	+			
Lanzaia bosnica Bole, 1970 **	+		+				DD
Lanzaia edlaueri Schütt, 1961 *		+	+				DD
Lanzaia vjetrenicae Kuščer, 1933 *		+	+				VU
Paladilhiopsis absoloni (A. J. Wagner, 1914) *		+	+				LC

Table 1. *Cont.*

TAXA LIST	I	II	A	B	C	D	CS
Paladilhiopsis arion Rysiewska and Osikowski, 2021 **		+	+				
Paladilhiopsis blihensis (Glöer and Grego, 2015) **	+		+				
Paladilhiopsis bosniaca (Clessin, 1910) **	+		+				DD
Paladilhiopsis brandisi (Clessin, 1911) *	+		+				DD
Paladilhiopsis maroskoi (Glöer and Grego, 2015) **	+		+				
Paladilhiopsis montenegrina Schütt, 1959 *		+	+				EN
Paladilhiopsis solida Kuščer, 1933 *		+	+				DD
Bythiospeum dervovici Glöer and Mulaomerović, 2021 **	+		+				
Bythiospeum hrustovoense Glöer and Grego, 2015 **	+		+				
Bythiospeum petroedei Glöer and Grego, 2015 **	+		+				
Bythiospeum plivense Glöer and Grego, 2015 **	+		+				
Iglica bagliviaeformis Schütt, 1970		+	+				EN
Iglica bosnica Schütt, 1975 **	+		+				DD
Familia: Tateidae Thiele, 1925							
Potamopyrgus antipodarum (J. E. Gray, 1843)	+			+			LC
Familia: Hydrobiidae W. Stimpson, 1865							
Pseudamnicola confinis (Brancsik, 1897) **	+			+		+	DD
Pseudamnicola troglobia Bole, 1961 **		+	+				LC
Pseudamnicola virescens (Küster, 1853)		+					DD
Montenegrospeum bogici (Pešić and Glöer, 2012)		+	+				
Narentiana albida Radoman, 1973		+		+[k]			NT
Narentiana vjetrenicae (Radoman, 1973) **		+		+			EN
Litthabitella chilodia (Westerlund, 1886)		+	+	+	+		LC
Bracenica plana (Bole, 1961)		+	+	+			NT
Hauffenia edlaueri (Schütt, 1961) *		+	+				DD
Hauffenia steffeki Haase, Grego, Eröss, Farkas and Fehér, 2021 **	+		+	+			NT
Belgrandiella bajraktarevici Glöer and Mulaomerović, 2021 **	+			+			
Belgrandiella bozidarcurcici Glöer and Pešić, 2014 **	+			+[k]			
Belgrandiella dabriana Radoman, 1975 **	+			+[k]			NT
Belgrandiella driniana (Radoman, 1975) *	+			+[k]			
Belgrandiella erythropoma Schütt, 1959 **	+			+[k]			
Belgrandiella fontinalis (F. J. Schmidt, 1847)	+			+[k]			LC
Belgrandiella koprivnensis Radoman, 1975 *	+			+[k]			DD
Belgrandiella kurtovici Glöer and Mulaomerović, 2021 **		+		+			
Belgrandiella substricta (Kuščer, 1932)	+						VU
Belgrandiella travnicensis (Radoman, 1975) **	+	+		+[k]			
Graziana glinensis Radoman, 1975 *	+			+[k]			LC
Graziana lacheineri (Küster, 1853)	+			+[k]			LC
Graziana vrbasensis Radoman, 1975 **	+			+[k]			DD
Sarajana apfelbecki (Brancsik, 1888) **	+	+		+[k]			DD

Table 1. *Cont.*

TAXA LIST	I	II	A	B	C	D	CS
Plagigeyeria angyaldorkae Grego 2020 **		+	+				
Plagigeyeria erossi Grego 2020 **		+	+				
Plagigeyeria inflata (A. J. Wagner, 1928) **		+	+				
Plagigeyeria jakabi Grego, 2020 **		+	+				
Plagigeyeria konjicensis Grego, 2020 **		+	+				
Plagigeyeria lewarnei Grego, 2020 **		+	+				
Plagigeyeria listicaensis Grego, 2020 **		+	+				
Plagigeyeria ljutaensis Grego, 2020 **		+	+				
Plagigeyeria mostarensis Kuščer, 1933 *		+	+				DD
Plagigeyeria olsavskyi Grego, 2020 **		+	+				
Plagigeyeria ozimeci Grego, 2020 **		+	+				
Plagigeyeria plagiostoma (A. J. Wagner, 1914) **	+		+				DD
Plagigeyeria pseudocostellina Grego, 2020 **		+	+				
Plagigeyeria reischuetzorum Grego, 2020 **		+	+				
Plagigeyeria vriosticaensis Grego, 2020 **		+	+				
Plagigeyeria zetatridyma Schütt, 1960		+	+				
Travunijana edlaueri (Schütt, 1961) *		+	+				DD
Travunijana gloeri Grego, 2020 **		+	+				
Travunijana nitida (Schütt, 1963) *		+	+				DD
Travunijana ovalis (Kuščer, 1933) **		+	+				
Travunijana robusta (Schütt, 1959) *		+	+				DD
Travunijana tribunicae (Schütt, 1963) *		+	+				CR
Travunijana vruljakensis Grego and Glöer, 2019 **		+		+[k]			
Saxurinator brandti Schütt, 1968 *		+	+				VU
Saxurinator orthodoxus Schütt, 1960							CR
Cilgia dalmatica (Schütt, 1961) *		+	+				DD
Kerkia briani Rysiewska and Osikowski, 2020 **		+	+				
Kerkia minuta Grego and Hofman, 2022 **		+	+				
Kerkia tabanensis (Boeters, Glöer and Pešić, 2014)		+		+			
Horatia klecakiana Bourguignat, 1887		+	+				LC
Iglicopsis butoti Falniowski and Hofman, 2021 **		+	+				
Sadleriana fluminensis (Küster, 1853)	+	+		+	+	+	LC
Sadleriana sadleriana (Frauenfeld, 1863)	+			+			LC
Sadleriana schmidtii (Menke, 1849)							LC
Radomaniola bosniaca (Radoman, 1973) *	+			+[k]			DD
Radomaniola curta germari (Frauenfeld, 1863)		+		+[k]			LC
Radomaniola curta mostarensis (Radoman, 1973) *		+		+	+		LC
Radomaniola curta narentana (Radoman, 1973) **		+		+	+		LC
Radomaniola curta pivensis (Radoman, 1973) *	+			+			LC
Radomaniola nachtigallae Delicado and Hauffe, 2022 **	+			+[k]			
Anagastina hadouphylax (Schütt, 1959) *		+	+				CR

Table 1. *Cont.*

TAXA LIST	I	II	A	B	C	D	CS
Islamia bosniaca Radoman, 1973 **	+		+	+			VU
Islamia buturovici Glöer and Mulaomerović, 2021 **	+		+				
Islamia dmitroviciana Boeters, Glöer and Pešić, 2013 **	+		+	+			
Islamia steffeki Glöer and Grego, 2015 **	+		+				
Islamia valvataeformis (Möllendorff, 1873) **	+		+	+			DD
Pyrgula annulata (Linnaeus, 1758)		+			+		LC
Familia: LithoglyphidaeTryon, 1866							
Dabriana bosniaca Radoman, 1974 **	+		+				NT
Lithoglyphus fuscus (C. Pfeiffer, 1828)	+				+		LC
Lithoglyphus naticoides (C. Pfeiffer, 1828)	+				+		LC
Lithoglyphus pyramidatus Möllendorff, 1873 **	+				+		
Familia: Amnicolidae Tryon, 1863							
Marstoniopsis vrbasi Bole and Velkovrh, 1987 **	+		+				CR
Familia: Bythinellidae Locard, 1893							
Bythinella austriaca austriaca (Frauenfeld, 1857)	+			+			LC
Bythinella marici Glöer and Pešić, 2014 **	+				+		
Bythinella opaca (M. von Gallenstein, 1848)	+	+		+[k]			LC
Bythinella samecana Clessin, 1911 **	+			+[k]			DD
Familia: Emmericiidae Brusina, 1870							
Emmericia narentana Bourguignat, 1881		+		+		+	DD
Emmericia patula (Brumati, 1838)		+		+	+		LC
Emmericia ventricosa Brusina, 1870		+		+	+		VU
Familia: Valvatidae Gray, 1840							
Valvata cristata O. F. Müller, 1774	+						LC
Valvata macrostoma Mörch, 1864							LC
Valvata montenegrina Glöer and Pešić, 2008		+			+		EN
Valvata piscinalis piscinalis (O. F. Müller, 1774)	+	+		+	+	+	LC
Familia: Lymnaeidae Rafinesque, 1815							
Galba truncatula (O. F. Müller, 1774)	+	+		+	+	+	LC
Ladislavella occulta (Jackiewicz, 1959)	+						
Stagnicola palustris (O. F. Müller, 1774)		+				+	LC
Radix auricularia (Linnaeus, 1758)	+	+			+	+	LC
Ampullaceana balthica (Linnaeus, 1758)	+	+		+	+		LC
Peregriana labiata (Rossmässler, 1835)	+	+		+	+	+	LC
Lymnaea stagnalis (Linnaeus, 1758)	+	+			+	+	LC
Familia: Physidae Fitzinger, 1833							
Physa fontinalis (Linnaeus, 1758)	+	+		+	+	+	LC
Physella acuta (Draparnaud, 1805)	+	+		+		+	LC
Aplexa hypnorum (Linnaeus, 1758)	+					+	LC
Familia: Planorbidae Rafinesque, 1815							
Planorbis carinatus O. F. Müller, 1774							LC

Table 1. *Cont.*

TAXA LIST	I	II	A	B	C	D	CS
Planorbis planorbis (Linnaeus, 1758)	+	+			+		LC
Anisus spirorbis (Linnaeus, 1758)	+			+			LC
Anisus vortex (Linnaeus, 1758)							LC
Bathyomphalus contortus (Linnaeus, 1758)	+					+	LC
Gyraulus albus (O. F. Müller, 1774)	+	+		+	+	+	LC
Gyraulus parvus (Say, 1817)	+						LC
Planorbarius corneus (Linnaeus, 1758)	+				+		LC
Hippeutis complanatus (Linnaeus, 1758)		+			+		LC
Segmentina nitida (O. F. Müller, 1774)							LC
Ancylus fluviatilis O. F. Müller, 1774	+	+		+	+		LC
Ancylus recurvus E. von Martens, 1873	+	+	+	+			VU
Ferrissia californica (Rowell, 1863)		+			+		LC
Familia: Acroloxidae Thiele, 1931							
Acroloxus lacustris (Linnaeus, 1758)		+			+		LC

Taxa with doubtful records for the territory of Bosnia and Herzegovina or species with unclear status were excluded from the updated checklist due to the lack of reliable documentation of their presence in the country. For example, *Bythinella tumidula* Clessin, 1910 [49], and *Limnaea plaskiensis* Letourneux, 1878 [8], have an uncertain taxonomic status according to MolluscaBase [71], so they were excluded from the list. Six taxa listed by Karaman [29] are not included in our updated list because the ranges of these species are outside Bosnia and Herzegovina, i.e., *Belgrandiella saxatilis* (Reyniés, 1844) [56], *Saxurinator sketi* (Bole, 1960) [78], *Bythinella kapelana* Radoman, 1976, *B. magna* Radoman, 1976 [32], *Theodoxus (Theodoxus) danubialis stragulatus* (C. Pfeiffer, 1828) [54], and *Adriohydrobia gagatinella* (Küster, 1852) [28].

The territory of Bosnia and Herzegovina includes two freshwater ecoregional units: the Dalmatia and Dniester–Lower Danube ecoregions (Figure 1). Our study showed that the largest number of freshwater gastropods belonged to the Dalmatia ecoregion (82 species and subspecies), while a smaller number (76 species and subspecies) belonged to the Dniester–Lower Danube ecoregion. Using the chi-squared test, we concluded that there is no statistically significant difference ($p = 0.633$). Twenty species and subspecies inhabit both ecoregions, while the ecoregional affiliation of *Saxurinator orthodoxus* [44] and *Sadleriana schmidtii* [30] could not be determined with certainty due to the lack of more precise data. In both ecoregions, the highest number of species and subspecies belonged to the family Hydrobiidae (Figure 2).

In comparison with the fauna of other Balkan countries, Bosnia and Herzegovina has the highest diversity of freshwater gastropods. For example, the freshwater gastropods of Croatia and Montenegro are represented by 122 and 120 taxa, respectively [30,79], while the fauna of Serbia is represented by only 65 species [80].

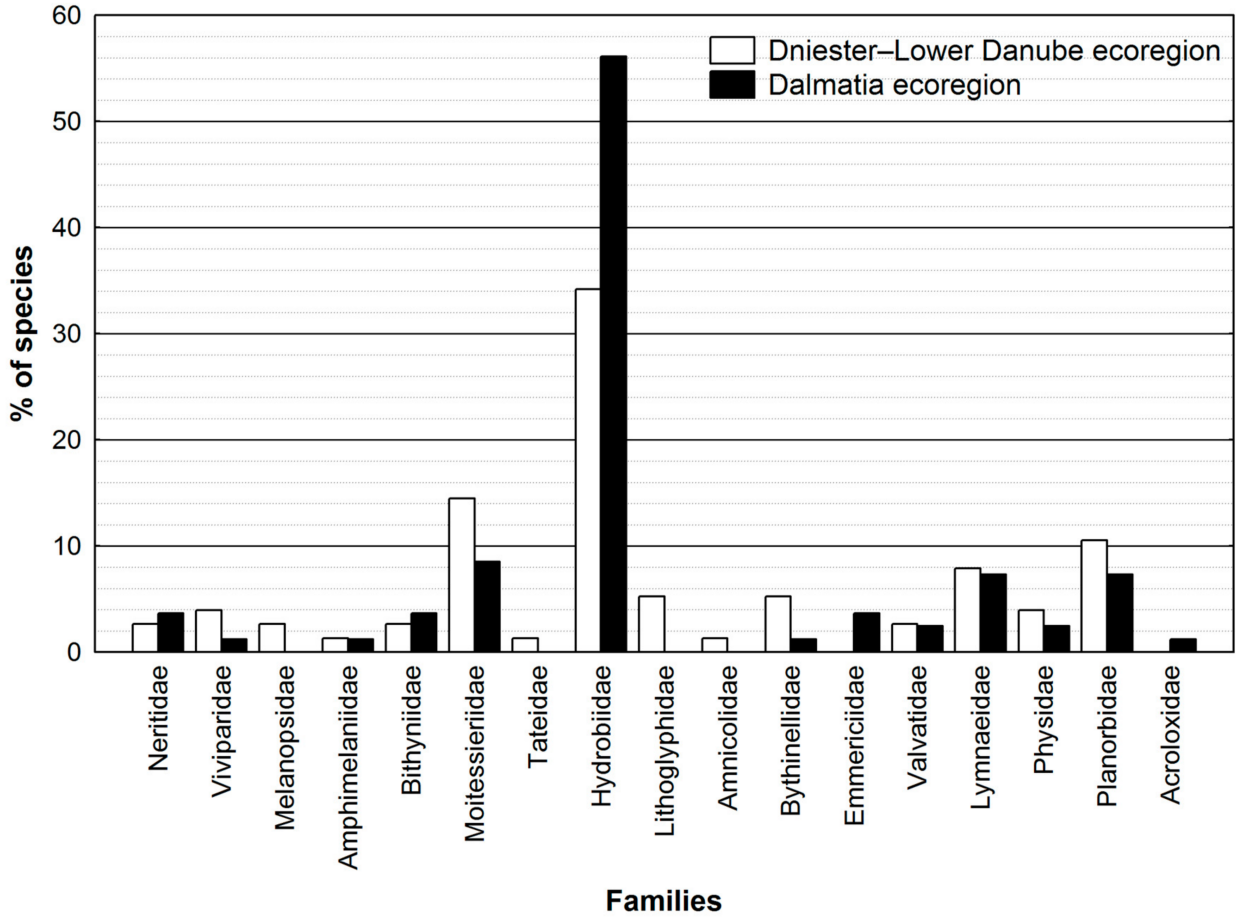

Figure 2. Percentage share of families of freshwater gastropods from two ecoregions in Bosnia and Herzegovina.

3.2. Endemism Patterns

A total of 55 species and subspecies of endemic freshwater snails occur in Bosnia and Herzegovina, of which 31 taxa occur in the Dniester–Lower Danube ecoregion, and 26 in the Dalmatia ecoregion (Table 1). Compared to the other Balkan countries—such as Serbia, where endemic species represent ca. 15% of the total fauna [80]—the endemic species of Bosnia and Herzegovina represent ~38% of the total fauna.

In terms of endemic species and subspecies, the most diverse families are Hydrobiidae (39 taxa) and Moitessieriidae (11 taxa). The genus *Plagigeyeria* is also represented by a high number of endemic taxa (14 species). All five species of the genus *Islamia* in Bosnia and Herzegovina are endemic. Moreover, the genera *Iglicopsis* and *Dabriana* are endemic to Bosnia and Herzegovina.

Most of the endemic species of Bosnia and Herzegovina are point endemics (over 90%), known only from the type locality or a small number of localities. Such are the majority of endemic species that inhabit springs or underground habitats (Table 1). In the territory of Bosnia and Herzegovina, there are type localities of 78 species and subspecies of freshwater snails (Table 1), of which 37 type localities belong to the Dniester–Lower Danube ecoregion, and the remaining 41 to the Dalmatia ecoregion. We consider species living in only one or a few localities to be faced with the danger of extinction. These localities—especially the springs (Figure 3)—are highly susceptible to various human-induced changes, including land-use changes, water extraction, and climate change.

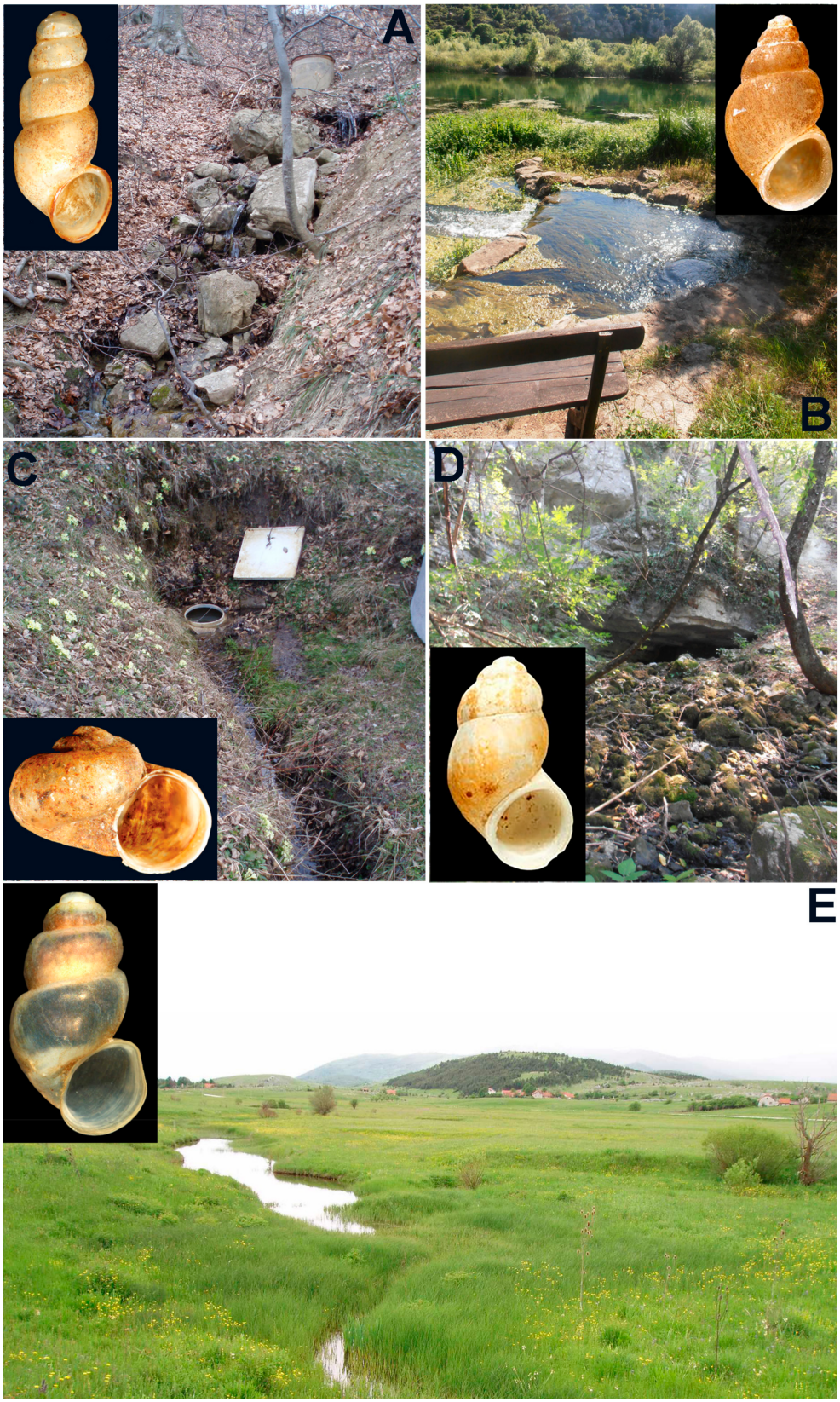

Figure 3. Type localities of selected species endemic to Bosnia and Herzegovina: *Bosnidilhia vreloana* (**A**), *Travunijana vruljakensis* (**B**), *Islamia dmitroviciana* (**C**), *Belgrandiella bozidarcurcici* (**D**), and *Bythinella marici* (**E**). Photos: Pešić V. (**B**,**D**), Marić D. (**E**), and Dmitrović D. (**A**,**C**).

3.3. Diversity of Freshwater Gastropods in Spring Habitats

An analysis of the presence of freshwater gastropods in Bosnia and Herzegovina per habitat shows that underground waters and springs (with 62 and 54 taxa, respectively) have the highest overall diversity, followed by rivers (34 taxa) and standing waters (17 taxa). It is important to mention that a large number of species collected from springs are hypogean species that come from the aquifers that feed the springs through constant washing. These include representatives of the genera *Plagigeyeria*, *Paladilhiopsis*, *Bythiospeum*, *Iglica,* and *Bosnidilhia*, which are often washed out and brought together in springs (thanatocoenosis) from geographically isolated areas [81].

Our list includes 18 crenobiotic taxa that exclusively inhabit springs (Table 1), nine of which are endemic to Bosnia and Herzegovina. Most of these species belong to the genus *Belgrandiella* (7 taxa). The genus *Belgrandiella* is distributed in the Dinaric karst and includes a large number of endemic species [33,39]. The separation of crenobiotic species (which exclusively live in springs) and crenophilous species (which prefer these habitats, but also inhabit other types of habitats, such as higher-order streams) is not always clear, due to the small number of available data on the distribution of these species and the lack of detailed ecological studies [81].

Over the last decade, we conducted a comprehensive survey on the macroinvertebrate assemblages of springs in the northwestern part of Bosnia and Herzegovina [51,60,66,73,82–87]. These studies showed that freshwater gastropods represent an important component of crenobiotic assemblages. Hydrobioid snails mostly dominated in terms of both diversity and abundance in the gastropod assemblages of the studied springs [51,66,73].

In this study, we analyzed a total of 105 springs located in the northwestern part of Bosnia and Herzegovina [51,66,73]. A total of 19 species belonging to the following families were found: Moitessieriidae (3 taxa), Tateidae (1 taxon), Hydrobiidae (8 taxa), Amnicolidae (1 taxon), Bythinellidae (1 taxon), Lymnaeidae (3 taxa), and Planorbidae (2 taxa).

The majority of the springs (100) were permanent, while 5 springs were intermittently dried. The SIMPER analysis revealed that gastropod assemblages of intermittent springs show a higher level of homogeneity (similarity = 24.25) in comparison to the communities of permanent springs (similarity = 6.44) (Table A1, Appendix A). The hydrobioid species *Bythinella opaca* proved to be the most important species for structuring the gastropod assemblages in both permanent and intermittent springs. Other species that had a large contribution were *Belgrandiella bozidarcurcici* and *Galba truncatula*. Dmitrović et al. [51], who studied snail assemblages in 19 springs in northwestern Bosnia and Herzegovina, found that spring specialists (crenobionts/crenophilous species) such as *Bythinella opaca* and *Islamia dmitroviciana* inhabit springs with intermittent dry periods.

Our study showed that most springs in our dataset from northwestern Bosnia were to some degree hydromorphologically modified. The hydromorphological changes vary from 'pipe' springs, where the water springs from an artificial pipe, to heavily 'dammed' springs that form a stone- or concrete-protected basin. As demonstrated in recent studies [66,73], hydromorphological changes in spring habitats result in changes to their ecological parameters, such as electrical conductivity and temperature. Pešić et al. [73], who studied the macroinvertebrate groups of springs in the northwestern part of Bosnia, assumed that the higher values of conductivity in modified springs are probably the result of the dominance of leaves in the substrate in the latter type of spring.

Changes in environmental parameters, in turn, affect the structure of groups of snails in modified springs [73]. As can be seen from Figure 4, the PCA of 86 springs in northwestern Bosnia did not show a clear separation of gastropod groups from modified and natural springs. There were also no statistically significant differences between modified and natural springs in terms of physicochemical characteristics (Table A2). As emphasized by Pešić et al. [73], hydromorphological changes such as spring tapping do not necessarily lead to a decrease in the diversity of spring communities, provided that the discharge and substrate composition do not change significantly. On the other hand, SIMPER analysis showed that groups of freshwater gastropods from the natural springs in our dataset show

greater homogeneity (similarity = 7.56) than communities inhabiting modified springs (similarity = 6.53) (Table A3). The hydrobioid species *Bythinella opaca* and *Belgrandiella bozidarcurcici* mainly contributed to the structuring of gastropod assemblages in both modified and natural springs. *Galba truncatula* in modified springs and *Ancylus recurvus* in natural springs can be considered to be key species for distinguishing the gastropod assemblages inhabiting these two types of springs in the investigated region of northwestern Bosnia.

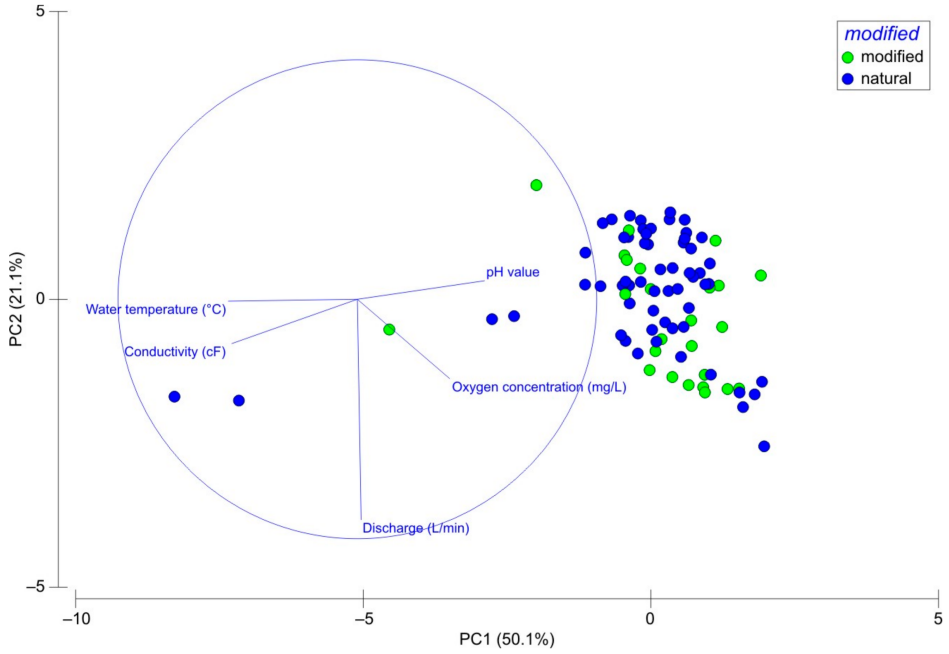

Figure 4. Results of PCA of the investigated dataset of 86 springs in the northwestern part of Bosnia and Herzegovina (see dataset in Savić et al. [66], and Pešić et al. [73]).

3.4. IUCN Red List Assessments

IUCN assessments for threatened species identify the conservation status of species, defining a Red List category by applying specific criteria that include information about population sizes, range, and descriptions of the habitat and ecology of the selected species, as well as the main threats and conservation actions needed for their successful conservation [88].

Habitat fragmentation and invasive species are recognized as the main threats to endemic freshwater gastropod species in the Dinaric region [89]. Based on the available data, three invasive species—i.e., *Potamopyrgus antipodarum*, *Physella acuta*, and *Ferrissia californica*—have been registered for Bosnia and Herzegovina (Table 1). These species have also been recorded in neighboring countries: all three species in Croatia [90], and the latter two in Serbia [80] and Montenegro [79].

Habitat conservation of endemic species warrants particular attention [91]. Our study showed that most endemic species that occur in Bosnia and Herzegovina still lack conservation assessments. For example, fewer than 10 endemic taxa have a defined IUCN status.

Most of the freshwater gastropods of Bosnia and Herzegovina (61 taxa) belong to the categories of lower risk: 5 taxa are Near Threatened (NT), and 56 taxa are of Least Concern (LC). Based on the available data, 16 taxa belong to endangered categories: 4 taxa are Critically Endangered (CR), 6 taxa are Endangered (EN), and 6 taxa are Vulnerable (VU). However, the IUCN status of many taxa of freshwater gastropods of Bosnia and Herzegovina is still unknown, and 23 taxa have a status defined as Data Deficient (DD).

Table 2 lists the crenobiotic species evaluated by authors as under threat of regional extinction in Bosnia and Herzegovina. One species was evaluated as critically endangered, six as endangered, and seven as vulnerable (Table 2).

Table 2. List of crenobiotic species evaluated as under threat of regional extinction in Bosnia and Herzegovina.

IUCN Red List Category	Taxa
Critically Endangered (CR)	*Travunijana vruljakensis*
Endangered (EN)	*Belgrandiella dabriana*
	Belgrandiella erythropoma
	Belgrandiella travnicensis
	Graziana vrbasensis
	Sarajana apfelbecki
	Radomaniola nachtigallae
Vulnerable (VU)	*Narentiana albida*
	Belgrandiella bozidarcurcici
	Belgrandiella driniana
	Belgrandiella koprivnensis
	Graziana glinensis
	Radomaniola bosniaca
	Bithynella samecana

According to national legislation, only a few species of freshwater gastropods in Bosnia and Herzegovina have a defined conservation status. *Lithoglyphus fuscus* has the status of protected wild species, while representatives of four taxa are strictly protected wild species (*Belgrandiella bozidarcurcici*, *Graziana vrbasensis*, *Islamia dmitroviciana*, and *Bosnidilhia vreloana*) [92]. In that sense, it is necessary to invest significant science research efforts in order to form a realistic image of the threat status for each taxon of freshwater gastropod in Bosnia and Herzegovina, with the goal of implementing adequate measurements for their conservation.

Author Contributions: Conceptualization, D.D. and V.P.; methodology, D.D., A.S. and V.P.; validation, D.D., A.S., G.Š. and V.P.; formal analysis, D.D., A.S. and G.Š.; investigation, D.D. and G.Š.; resources, D.D., G.Š. and V.P.; data curation, D.D., A.S., G.Š. and V.P.; writing—original draft preparation, D.D. and V.P.; writing—review and editing, D.D., A.S., G.Š. and V.P.; visualization, D.D., A.S. and V.P.; supervision, V.P.; project administration, D.D. and V.P.; funding acquisition, D.D., A.S., G.Š. and V.P. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Table A1. Results of SIMPER analysis for gastropods assemblage in permanent/intermittent groups of springs.

Group I permanent: average similarity = 6.44 Group II intermittent: average similarity = 24.25			Group I and II: average dissimilarity = 92.65	
species	Av. Abund.	Av. Sim.	Contrib. %	Cum. %
		Group I		
Bythinella opaca	12.22	3.52	54.75	54.75
Belgrandiela bozidarcurcici	31.65	2.08	32.35	87.1
Galba truncatula	3.3	0.32	5.05	92.14
		Group II		
Bythinella opaca	31.8	24.25	100	100

Table A2. Results of Mann–Whitney test for differences in physicochemical parameters between modified and natural springs.

		N	Mean	Std. Deviation	Z	Sig.
Water temperature	modified	25	11.28	3.37	−1.850	0.064
	natural	59	12.34	4.23		
pH value	modified	25	7.92	0.22	−0.688	0.491
	natural	59	7.86	0.28		
Conductivity	modified	25	4.76	2.83	−1.135	0.256
	natural	59	4.73	3.58		
Oxygen concentration	modified	25	7.18	0.90	−1.837	0.066
	natural	59	6.91	1.12		
Discharge	modified	25	2.68	1.11	−1.806	0.071
	natural	59	2.20	1.08		

Table A3. Results of SIMPER analysis for gastropods assemblage in natural/modified groups of springs.

Group I modified: average similarity = 6.53 Group II natural: average similarity = 7.56			Group I and II: average dissimilarity = 94.23	
species	Av. Abund.	Av. Sim.	Contrib. %	Cum. %
		Group I		
Bythinella opaca	16.35	3.49	53.41	53.41
Galba truncatula	7.6	1.35	20.62	74.03
Belgrandiela bozidarcurcici	12.9	1.09	16.66	90.69
		Group II		
Bythinella opaca	11.18	4.25	56.21	56.21
Belgrandiela bozidarcurcici	40.75	2.5	33.01	89.22
Ancylus recurvus	0.89	0.63	8.3	97.53

References

1. Piechocki, A.; Wawrzyniak-Wydrowska, B. *Guide to Freshwater and Marine Mollusca of Poland*; Bogucki Wydawnictwo Naukowe: Poznan, Poland, 2016; pp. 52–62. ISBN 9788379861095.
2. Raković, M.; Tomović, J.; Popović, N.; Jovičić, K.; Stanković, J.; Slavevska Stamenković, V.; Paunović, M. Diverzitet slatkovodnih mekušaca (Gastropoda) u malim vodnim telima zapadnog Balkana—Pritisci i ugroženost. In *Zbornik Radova 51. Godišnje Konferencije o Aktuelnim Temama Korišćenja i Zaštite Voda (VODA 2022), Vrnjačka Banja, Srbija, 26–28 Oktobar 2022*; Đukić, A., Ed.; Srpsko Društvo za Zaštitu Voda: Belgrade, Serbia, 2022; pp. 43–52.
3. Von Möllendorff, O. *Beiträgezur Fauna Bosniens, Inauguraldissertation*; Hoffman & Reiber: Görlitz, Germany, 1873; pp. 30–73.
4. Berberović, L.J. Mollusca Bosne i Hercegovine. In *Problemi Inventarizacije Životinjskog Svijeta Bosne i Hercegovine–Stanje i Perspektive*; Vuković, T., Ed.; Posebna izdanja 47, Knjiga 8; Akademija Nauka i Umjetnosti Bosne i Hercegovine: Sarajevo, Bosnia and Herzegovina, 1980; pp. 57–60.
5. Brancsik, K. Nachträge zur Conchylien-Fauna Bosniens. *Nachr. Dtsch. Malakozool. Ges.* **1888**, *20*, 161–169.
6. Brancsik, C. Consignatio systematica specierum in itinere bosnensi anno 1888 per me collectarum, novaque data ad faunam molluscarum Bosniae ac Hercegovinae. *Jahresh. Nat. Ver. Trencsiner Com.* **1888–1889**, *11–12*, 68–76.
7. Brancsik, K. Einige Daten zur Conchylienfauna Bosniens, der Hercegovina u. Dalmatiens. *Jahresh. Nat. Ver. Trencsiner Com.* **1896–1897**, *19–20*, 86–90.
8. Servain, G. Excursions malacologiques en Bosnie aux environs de Sarajewo et aux sources de la Bosna. *Ann. Malacol.* **1884**, *1*, 341–380.
9. Boettger, O. Beitrag zur Kenntniss der Schneckenfauna von Central-Bosnien, sowie des südlichsten Dalmatiens und Westmontenegros. *Jahrbücher Dtsch. Malakozool. Ges.* **1885**, *12*, 53–71.
10. Bourguignat, J.R. *Étude Sur Les Noms Génériques des Petites Paludinidées à Opercule Spirescent*; Suivie de la Description du Nouveau Genre Horatia; M.V. Tremblay: Paris, France, 1887.
11. Jaeckel, S.G.; Klemm, W.; Meise, W. Die Land- und Süsswasser-Mollusken der nördlichen Balkanhalbinsel. *Abh. Ber. Staatl. Mus. Tierkd. Dresd.* **1957**, *23*, 141–205.
12. Bole, J. Nove Hidrobide (Gastropoda) iz podzemeljskih voda zahodnega Balkana. *Biološki Vestn.* **1961**, *9*, 59–69.
13. Bole, J. Prispevek k poznavanju anatomije in taksonomije podzemeljskih hidrobiid (Gastropoda, Prosobranchia). *Razprave IV Razred SAZU* **1970**, *13*, 85–111.
14. Bole, J.; Velkovrh, F. Nove vrste podzemeljskih polžev Jugoslavije. *Razprave IV Razred SAZU* **1987**, *28*, 69–83.
15. Boeters, H.D. Die Gattung *Microna* Clessin, 1890 (Prosobranchia, Hydrobiidae). *Arch. Molluskenkd.* **1970**, *100*, 113–145.
16. Schütt, H. Zur Höhlenschneckenfauna Montenegros. *Arch. Molluskenkd.* **1959**, *88*, 185–190.
17. Schütt, H. Weitere neue Süßwasser-Höhlenschnecken aus Dalmatien. *Arch. Molluskenkd.* **1961**, *90*, 139–144.
18. Schütt, H. Die *Plagigeyeria*-Arten Dalmatiens. *Arch. Molluskenkd.* **1961**, *90*, 131–137.
19. Schütt, H. Vier bemerkenswerte Höhlenschnecken. *Arch. Molluskenkd.* **1963**, *92*, 205–213.
20. Schütt, H. Verwandtschaftliche Beziehungen höhlenbewohnender Rissoaceen Dalmatiens. *Arch. Molluskenkd.* **1968**, *98*, 103–111.
21. Schütt, H. Neue Formen höhlenbewohnender Hydrobiiden des Balkan und ihre Beziehungen zu *Paladilhiopsis* Pavlović 1913. *Arch. Molluskenkd.* **1970**, *100*, 305–317.
22. Schütt, H. Die Formen der Gattung *Iglica* A.J. *Wagner. Arch. Molluskenkd.* **1975**, *106*, 1–14.
23. Radoman, P. Speciation of the genus *Emmericia* (Gastropoda) in the Adriatic area. *Basteria* **1967**, *31*, 27–43.
24. Radoman, P. New classification of fresh and brakish water Prosobranchia from the Balkans and Asia Minor. *Poseb. Izd. Prir. Muz. Beogr.* **1973**, *32*, 1–30.
25. Radoman, P. Contribution à la connaissance des Gastéropodes des eaux douces de Bosnie et d'Herzégovine. *Bull. Mus. Hist. Nat. Marseille* **1973**, *33*, 227–237.
26. Radoman, P. Ein Beitrag zur Kenntnis der Höhlenfauna Bosniens. *Arch. Molluskenkd.* **1974**, *104*, 81–84.
27. Radoman, P. Specijacija u okviru roda *Belgrandiella* i njemu srodnih rodova na Balkanskom poluostrvu. *Bull. Nat. Hist. Mus. Belgrade B* **1975**, *30*, 29–69.
28. Radoman, P. *Hydrobioidea a Superfamily of Prosobranchia (Gastropoda) I. Systematics*; Monographs 547, Department of Sciences, 57; Serbian Academy of Sciences and Arts: Belgrade, Serbia, 1983.
29. Karaman, B.J. Former Investigations of the Fauna of Snails (Mollusca, Gastropoda) in Bosnia & Herzegovina. *Nat. Montenegrina* **2006**, *5*, 55–66.
30. Bank, R.A.; Neubert, E. Checklist of the Land and Freshwater Gastropoda of Europe. MolluscaBase. 16 July 2017. Available online: https://www.molluscabase.org/aphia.php?p=sourcedetails&id=279050 (accessed on 19 December 2022).
31. Boeters, H.D.; Glöer, P.; Pešić, V. Some new freshwater gastropods from Southern Europe (Mollusca: Gastropoda: Truncatelloidea). *Folia Malacol.* **2013**, *21*, 225–235. [CrossRef]
32. Glöer, P.; Pešić, V. Two new species of the genus *Bythinella* Moquin-Tandon, 1856 (Mollusca: Gastropoda: Hydrobiidae) from the Western Balkan Peninsula. *Ecol. Montenegrina* **2014**, *1*, 249–255. [CrossRef]
33. Glöer, P.; Pešić, V. *Belgrandiella bozidarcurcici* n. sp., a new species from Bosnia and Herzegovina (Gastropoda: Hydrobiidae). *Arch. Biol. Sci.* **2014**, *66*, 461–464. [CrossRef]

34. Glöer, P.; Grego, J. New subterranean freshwater molluscs from Bosnia & Hercegovina (Mollusca: Hydrobiidae). *Ecol. Montenegrina* **2015**, *2*, 307–314. [CrossRef]
35. Grego, J.; Glöer, P. A new Hydrobiid (Mollusca, Gastropoda, Hydrobiidae) genus of Bosnia and Hercegovina. *Ecol. Montenegrina* **2019**, *21*, 86–89. [CrossRef]
36. Grego, J. Revision of the stygobiont gastropod genera *Plagigeyeria* Tomlin, 1930 and *Travunijana* Grego & Glöer, 2019 (Mollusca; Gastropoda; Moitessieriidae and Hydrobiidae) in Hercegovina and adjacent regions. *Eur. J. Taxon.* **2020**, *691*, 1–56. [CrossRef]
37. Hofman, S.; Rysiewska, A.; Osikowski, A.; Falniowski, A. A New Species of *Kerkia* Radoman, 1978 (Caenogastropoda, Hydrobiidae) from Bosnia and Herzegovina. *ZooKeys* **2020**, *973*, 17–33. [CrossRef]
38. Falniowski, A.; Lewarne, B.; Rysiewska, A.; Osikowski, A.; Hofman, S. Crenobiont, stygophile and stygobiont molluscs in the hydrographic area of the Trebišnjica River Basin. *ZooKeys* **2021**, *1047*, 61–89. [CrossRef] [PubMed]
39. Glöer, P.; Mulaomerović, J. Four new hydrobiid species from Bosnia-Herzegovina (Mollusca: Gastropoda: Hydrobiidae). *Nachr. Ersten Vorarlb. Malakol. Ges.* **2021**, *28*, 63–66.
40. Haase, M.; Grego, J.; Erőss, Z.P.; Farkas, R.; Fehér, Z. On the origin and diversification of the stygobiotic freshwater snail genus *Hauffenia* (Caenogastropoda: Hydrobiidae) with special focus on the northern species and the description of two new species. *Eur. J. Taxon.* **2021**, *775*, 143–184. [CrossRef]
41. Hofman, S.; Grego, J.; Rysiewska, A.; Osikowski, A.; Falniowski, A. Two new species of the Balkan genus *Paladilhiopsis* Pavlović, 1913 (Caenogastropoda, Moitessieriidae). *ZooKeys* **2021**, *1046*, 157–176. [CrossRef] [PubMed]
42. Delicado, D.; Hauffe, T. Shell features and anatomy of the springsnail genus *Radomaniola* (Caenogastropoda: Hydrobiidae) show a different pace and mode of evolution over five million years. *Zool. J. Linn. Soc.* **2022**, *196*, 393–441. [CrossRef]
43. Hofman, S.; Grego, J.; Beran, L.; Jaszczyńska, A.; Osikowski, A.; Falniowski, A. *Kerkia* Radoman, 1978 (Caenogastropoda: Hydrobiidae): Endemism, apparentlymorphostatic evolution and cryptic speciation. *Molluscan Res.* **2022**, *42*, 295–319. [CrossRef]
44. Aescht, E.; Bisenberger, A. The mollusc collection at the Upper Austrian Museum in Linz (Austria): History of curatorial and educational activities concerning molluscs, checklists and profiles of main contributers. *Denisia* **2019**, *42*, 595–686.
45. Beran, L. Aquatic molluscan fauna (Mollusca) of the Korana River (Croatia). *Nat. Croat.* **2013**, *22*, 223–234.
46. Boettger, O. Eine neue Form der Paludinidengattung *Emmericia* im Mainzer Becken. *Nachr. Dtsch. Malakozool. Ges.* **1904**, *36*, 112–116.
47. Brancsik, K. Sechs Wochen durch Dalmatien, Hercegovina und Bosnien. *Jahresh. Nat. Ver. Trencsiner Com.* **1904–1905**, *27–28*, 136–193.
48. Čičić-Močić, A.; Škrijelj, R.; Đug, S. Gastropods in the Basin of the River Fojnička. *Ribarstvo* **2008**, *66*, 119–129.
49. Clessin, S. Neue Süsswasserschnecken. *Nachr. Dtsch. Malakozool. Ges.* **1910**, *42*, 71–73.
50. Clessin, S. Neue Arten. *Nachr. Dtsch. Malakozool. Ges.* **1911**, *43*, 74–77.
51. Dmitrović, D.; Savić, A.; Pešić, V. Discharge, substrate type and temperature as factors affecting gastropod assemblages in springs in Northwestern Bosnia and Herzegovina. *Arch. Biol. Sci.* **2016**, *68*, 613–621. [CrossRef]
52. Glöer, P.; Mulaomerović, J. Prvi nalaz *Ancylus recurvus* Martens, 1873 i novipodaci o vrsti *Islamia valvataeformis* (Möllendorff, 1873) u Bosni i Hercegovini. *Naš Krš* **2017**, *50*, 69–74.
53. Glöer, P.; Pešić, V. The morphological plasticity of *Theodoxus fluviatilis* (Linnaeus, 1758) (Mollusca: Gastropoda: Neritidae). *Ecol. Montenegrina* **2015**, *2*, 88–92. [CrossRef]
54. Glöer, P. *The Freshwater Gastropods of the West-Palaearctis, Volume 1: Fresh- and Brackish Waters Except Spring and Subterranean Snails. Identification Key, Anatomy, Ecology, Distribution*; Glöer, P.: Hetlingen, Germany, 2019.
55. Glöer, P. *The Freshwater Gastropods of the West-Palaearctis, Volume 2: Moitessieriidae, Bythinellidae, Stenothyridae. Identification Key, Anatomy, Ecology, Distribution*; Glöer, P.: Hetlingen, Germany, 2022.
56. Glöer, P. *The Freshwater Gastropods of the West-Palaearctis, Volume 3: Hydrobiidae. Identification Key, Anatomy, Ecology, Distribution*; Glöer, P.: Hetlingen, Germany, 2022.
57. Glöer, P.; Mulaomerović, J.; Mitrović, B. Some taxonomic notes on *Horatia* spp. of the Balkans with the designation of the neotype of *Horatia knorri* Schütt, 1961 (Gastropoda: Hydrobiidae). *Folia Malacol.* **2022**, *30*, 109–116. [CrossRef]
58. Hofman, S.; Osikowski, A.; Rysiewska, A.; Grego, J.; Gloeer, P.; Dmitrović, D.; Falniowski, A. *Sarajana* Radoman, 1975 (Caenogastropoda: Truncatelloidea): Premature invalidation of a genus. *J. Conchol.* **2019**, *43*, 407–418.
59. Jackiewicz, M. New European locality of *Lymnaea (Stagnicola) occulta* (Jackiewicz, 1959) (Gastropoda: Basommatophora: Lymnaeidae). *Malakol. Abh.* **1997**, *18*, 255–259.
60. Kukavica, B.; Davidović-Plavšić, B.; Dmitrović, D.; Šukalo, G.; Savić, A.; Pešić, V. Seasonal Dynamics of Oxidative and Antioxidative Parameters in *Sadleriana fluminensis* (Gastropoda: Hydrobiidae). *Malacologia* **2021**, *64*, 57–67. [CrossRef]
61. Kuščer, L. Prispevek k poznavnju podzemskih gastropodov Dalmacije in Hercegovine. Zagreb. *Prirodosl. Istraživanja Kralj. Jugosl.* **1933**, *18*, 59–67.
62. Von Möllendorff, O. Excursionsberichte aus Bosnien. *Nachr. Dtsch. Malakozool. Ges.* **1871**, *3*, 65–70.
63. Mulaomerović, J. *Physa fontinalis* (Linnaeus, 1758)–nova vrsta slatkovodnog puža u Bosni i Hercegovini (?). *Naš Krš* **2016**, *49*, 71–73.

64. Mulaomerović, J.; Giöer, P. First record of the species *Bithynia zeta* Glöer & Pešić, 2007 (Gastropoda: Hydrobiidae) in Bosnia and Herzegovina. *Nat. Slo.* **2021**, *23*, 35–36.
65. Mulaomerović, J.; Glöer, P.; Husanović, M. Prilog rasprostranjenosti izvorskih i vodenih puževa na kraškim poljima. *Voda i Mi* **2021**, *105*, 43–46.
66. Savić, A.; Dmitrović, D.; Glöer, P.; Pešić, V. Assessing environmental response of gastropod species in karst springs: What species response curves say us about niche characteristic and extinction risk? *Biodivers. Conserv.* **2020**, *29*, 695–708. [CrossRef]
67. Trožić-Borovac, S.; Šanjta, A.; Krlić-Avdibegović, S. Diverzitet gastropoda u izvorima na području spomenika prirode Vrela Bosne. *Voda i Mi* **2013**, *81*, 23–30.
68. Wagner, A. Beschreibungen neuer Land- und Süßwasserschnecken aus Südösterreich, Kroatien und Bosnien. *Verh. Kais. Königlichen Zool. Bot. Ges. Wien* **1912**, *62*, 246–260.
69. Wagner, A. Höhlenschnecken aus Süddalmatien und der Hercegovina. *Sitz. Kais. Akad. Wiss. Wien Math. Nat. Kl. I. Abt.* **1914**, *123*, 33–48.
70. Wagner, A. Studien zur Molluskenfauna der Balkanhalbinsel mit besonderer Berücksichtigung Bulgariens und Thraziens, nebst monographischer Bearbeitung einzelner Gruppen. *Ann. Zool. Musei Pol. Hist. Nat.* **1927**, *6*, 263–399.
71. MolluscaBase. Available online: https://www.molluscabase.org (accessed on 10 February 2023).
72. Freshwater Ecoregions of the World (FEOW). Available online: https://www.feow.org (accessed on 22 December 2022).
73. Pešić, V.; Dmitrović, D.; Savić, A.; Milošević, Đ.; Zawal, A.; Vukašinović-Pešić, V.; Von Fumetti, S. Application of macroinvertebrate multimetrics as a measure of the impact of anthropogenic modification of spring habitats. *Aquat. Conserv. Mar. Freshw. Ecosyst.* **2019**, *29*, 341–352. [CrossRef]
74. Clarke, K.R.; Gorley, R.N. *PRIMER v7: User Manual/Tutorial*; PRIMER-e: Auckland, New Zealand, 2015; Available online: http://updates.primer-e.com/primer7/manuals/Getting_started_with_PRIMER_7.pdf (accessed on 22 December 2022).
75. Cuttelod, A.; Seddon, M.; Neubert, E. *European Red List of Non-Marine Molluscs*; European Commission: Luxembourg, 2011; pp. 48–64. ISBN 978-92-79-20198-1.
76. Cordeiro, J.; Perez, K.; The IUCN Red List of Threatened Species. *Ferrissia californica*. Available online: https://www.iucnredlist.org/species/189119/8686887 (accessed on 22 December 2022).
77. Van Damme, D.; The IUCN Red List of Threatened Species. *Potamopyrgus antipodarum*. Available online: https://www.iucnredlist.org/species/155980/738398 (accessed on 22 December 2022).
78. Slapnik, R.; Jalzic, B.; The IUCN Red List of Threatened Species. *Saxurinator sketi*. Available online: https://www.iucnredlist.org/species/156082/4888492 (accessed on 22 December 2022).
79. Raković, M.; Paunović, M.; Tomović, J.; Popović, N.; Csányi, B.; Jovanović, M.; Glöer, P.; Pešić, V. Do Molluscs Assemblages reflect River Typology: A Case Study of Montenegro. In *The Rivers of Montenegro*; Pešić, V., Paunović, M., Kostianoy, A.G., Eds.; Springer International Publishing: Cham, Switzerland, 2020; pp. 265–285. ISBN 978-3-030-55712-6.
80. Marković, V.; Gojšina, V.; Novaković, B.; Božanić, M.; Stojanović, K.; Karan-Žnidaršič, T.; Živić, I. The freshwater molluscs of Serbia: Annotated checklist with remarks on distribution and protection status. *Zootaxa* **2021**, *5003*, 1–64. [CrossRef] [PubMed]
81. Pešić, V.; Gadawski, P.; Gligorović, B.; Glöer, P.; Grabowski, M.; Kovács, T.; Murány, D.; Płóciennik, M.; Šundić, D. The Diversity of the zoobenthos communities of the Lake Skadar/Shkodra Basin. In *The Skadar/Shkodra Lake Environment*; Pešić, V., Karaman, G., Kostianoy, A., Eds.; Springer International Publishing: Cham, Switzerland, 2018; pp. 255–294. ISBN 978-3-319-99249-5.
82. Pešić, V.; Dmitrović, D.; Savić, A.; von Fumetti, S. Studies on eucrenal-hypocrenal zonation of springs along the river mainstream: A case study of a karst canyon in Bosnia and Herzegovina. *Biologia* **2016**, *71*, 809–817. [CrossRef]
83. Płóciennik, M.; Dmitrović, D.; Pešić, V.; Gadawski, P. Ecological patterns of Chironomidae assemblages in Dynaric karst springs. *Knowl. Manag. Aquat. Ecosyst.* **2016**, *417*, 11:1–11:19. [CrossRef]
84. Von Fumetti, S.; Dmitrović, D.; Pešić, V. The influence of flooding and river connectivity on macroinvertebrate assemblages in rheocrene springs along a third-order river. *Fundam. Appl. Limnol.* **2017**, *190*, 251–263. [CrossRef]
85. Savić, A.; Dmitrović, D.; Pešić, V. Ephemeroptera, Plecoptera, and Trichoptera assemblages of karst springs in relationto some environmental factors: A case study in central Bosnia and Herzegovina. *Turk. J. Zool.* **2017**, *41*, 119–129. [CrossRef]
86. Pešić, V.; Dmitrović, D.; Savić, A. Riparian Springs-Challenges from a Neglected Habitat. In *Small Water Bodies of the Western Balkans*; Pešić, V., Milošević, D., Miliša, M., Eds.; Springer International Publishing: Cham, Switzerland, 2022; pp. 109–127. ISBN 978-3-030-86477-4.
87. Stanić-Koštroman, S.; Kamberović, J.; Dmitrović, D.; Dedić, A.; Škobić, D.; Lasić, A.; Gligora Udovič, M.; Herceg, N. Ecological Characteristics and Specifics of Spring Habitats in Bosnia and Herzegovina. In *Small Water Bodies of the Western Balkans*; Pešić, V., Milošević, D., Miliša, M., Eds.; Springer International Publishing: Cham, Switzerland, 2022; pp. 129–145. ISBN 978-3-030-86477-4.
88. The IUCN Red List of Threatened Species. Available online: https://www.iucnredlist.org (accessed on 24 December 2022).
89. Pešić, V.; Glöer, P. A new freshwater snail genus (Hydrobiidae, Gastropoda) from Montenegro, with a discussion on gastropod diversity and endemism in Skadar Lake. *ZooKeys* **2013**, *281*, 69–90. [CrossRef]
90. Žganec, K.; Lajtner, J.; Ćuk, R.; Crnčan, P.; Pušić, I.; Atanacković, A.; Kralj, T.; Valić, D.; Jelić, M.; Maguire, I. Alien macroinvertebrates in Croatian freshwaters. *Aquat. Invasions* **2020**, *15*, 593–615. [CrossRef]

91. Raković, M.; Tomović, J.; Popović, N.; Pešić, V.; Dmitrović, D.; Slavevska Stamenković, V.; Hinić, J.; Stefanovska, N.; Lajtner, J.; Paunović, M. Gastropods in Small Water Bodies of the Western Balkans—Endangerments and Threats. In *Small Water Bodies of the Western Balkans*; Pešić, V., Milošević, D., Miliša, M., Eds.; Springer International Publishing: Cham, Switzerland, 2022; pp. 227–249. ISBN 978-3-030-86477-4.
92. Uredba o strogo zaštićenim i zaštićenim divljim vrstama. *Službeni Glas. Repub. Srp.* **2020**, *65*, 2–33.