

**CONTRIBUTION TO THE KNOWLEDGE OF THE BATRACHO-
AND HERPETOFAUNA OF THE BJELOPAVLIĆI REGION
(MONTENEGRO)**

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We present the distribution of amphibians and reptiles in the Bjelopavlići region (central Montenegro) based on our field work records and of literature data. Twelve species of amphibians and 25 species of reptiles were recorded at 49 localities of which 57 % records has not been previously published. The greatest diversity of batracho- and herpetofauna was recorded at sites in the river Zeta plain. Our study provides the important information for assessments of diversity of batracho- and herpetofauna of Montenegro and their conservation.

Key words: amphibians, reptiles, Central Montenegro, Balkan Peninsula

INTRODUCTION

The Bjelopavlići region extends in the central part of Montenegro and largely corresponds to the territory of the municipality of Danilovgrad. The

region includes the river Zeta valley from Glava Zete up to Velje Brdo and hilly-mountainous areas on either side of the valley. The hilly-mountainous area on the right side of the plain is narrower than the one on the left side and it is dominated by Velji Garač and Mali Garač Mts. The highlands on the left side of the valley are dominated by Prekornica Mt. up to Nikšićka Župa and Maganik Mt.

Although the Bjelopavlići region is situated in proximity of the capital of the country and is accessible for field data collection, it has been sporadically explored herpetologically, mainly guided by the interest in researching certain groups of herptiles (such as newts and fire-bellied toads - Vukov *et al.* 2006, Ćirović *et al.* 2008). Thus, a detailed review of batracho-and herpetofauna of this region has not been presented so far.

In this paper we: (i) present new records of amphibians and reptiles in the Bjelopavlići region collected during our field research and (ii) provide an overview of literature data for this district. Apart from providing a more complete picture of diversity of batracho-and herpetofauna of Montenegro, such comprehensive distributional data can be used in the future EIA studies and action plans for protection of several areas in Danilovgrad municipality.

MATERIAL AND METHODS

The dataset of locations within the Bjelopavlići region where amphibian and reptile species were recorded consists of our unpublished records and literature data. The database included following locality information: site name, coordinates, elevation and data source type (see Supplementary information I). Literature data for the Bjelopavlići region without exact locality names and coordinates were presented in Supplementary information II. The majority of data was collected during field surveys in the period between 2009 and 2015. All species were documented through direct visual observation or road kill surveys. Specimens were identified by visual inspection of diagnostic characters according to standard herpetological literature (Arnold & Ovenden 2002). Taxonomy and current nomenclature were given according to Sillero *et al.* (2014), except for *Triturus macedonicus* (Wielstra *et al.* 2013).

RESULTS AND DISCUSSION

According to our field research and available literature, 12 species of amphibians and 25 species of reptiles were recorded in the Bjelopavlići region (Tabs 1-3). This comprises about 86 % and 68 % of amphibian and

Table 1. – Amphibian species recorded in the Bjelopavlići region. Locality numbers and names correspond to those in Supplementary information I. (+) literature data; (*) our field data; (+*) literature and our field data.

No	Locality	<i>Salamandra salamandra</i>	<i>Triturus macedonicus</i>	<i>Ichthyosaura alpestris</i>	<i>Lissotriton vulgare</i>	<i>Bombina variegata</i>	<i>Bufo bufo</i>	<i>Bufo viridis</i>	<i>Hyla arborea</i>	<i>Rana dalmatina</i>	<i>Rana graeca</i>	<i>Pelophylax ridibundus</i>	<i>Pelophylax shqipericus</i>
2	Morakovo: Zabrán kralja Nikole					+							
5	Prekornica: Srednja Ponikvica			++		++		+					
6	Prekornica: Ponikvica, Ponori	*		*									
7	Prekornica: Suva Ponikvica			+									
8	Prekornica: Razmet do			+									
9	Prekornica: Četni do			+									
10	Prekornica: Vukotica						*		*	*			
12	Prekornica: Studeno						*		*				
13	Prekornica: Radovče, Katranara			+									
16	Dobro polje	*					*						*
18	Bogumilići: Ubao Kladenca				+								
19	Bogumilići: Ubao Bučevac				+								
20	Kujava						*						
23	Bralenovica						*			*			*
24	Gornji Zagarač: Erakovice		+		+	+							
25	Gornji Zagarač: Petrova voda				+								
26	Gornji Zagarač: Vodine		+		+	+							
27	Gornji Zagarač: Miogost, Blizanci		+		+	+							
28	Gornji Zagarač: Cicmanovica		+		+	+							
29	Rujjišta: Bezimena kamenica				+								
30	Rujjišta: Grlačke kamenice				+								
31	Zagarač					+					+		
32	Donji Zagarač: Pešića kamenica		+		+								
33	Donji Zagarač					+							
34	Zagreda						*		*	*			
35	Sladojevo kopito		*		*								*
36	Pitoma loza						*			*			*
37	Čurilac		*				*			*			*
38	Lazine: Jastrebo											+	
39	Lazine: Kosić, razliv Zete		+		+								
40	Kruščica						*		*	*			*
41	Sige						*			*			*
42	Kolašinovići						*	*	*	*			*
43	Glizica	*				*							
45	Gostilje						*	*	*	*			
46	Martinići						*	*	*	*			*
47	Moromiš	*	*		*	*	*	*	*	*			*
49	Bandići					*	*	*	*	*			*

Table 2. – Reptilian species (turtles/tortoises and lizards) recorded in the Bjelopavlići region. Locality numbers and names correspond to those in Supplementary information I. (+) literature data; (*) our field data; (+*) literature and our field data.

No	Locality	<i>Testudo hermanni</i>	<i>Emys orbicularis</i>	<i>Hemidactylus turcicus</i>	<i>Algyroides nigropunctatus</i>	<i>Dalmatolacerta oxycephala</i>	<i>Dinarolacerta mosorensis</i>	<i>Lacerta agilis</i>	<i>Lacerta trilineata</i>	<i>Lacerta viridis</i>	<i>Podarcis melisellensis</i>	<i>Podarcis muralis</i>	<i>Anguis fragilis</i> compl.	<i>Pseudopus apodus</i>
1	Prekornica: Đevič bor						*							
3	Prekornica: Crvena rupa						*							
4	Prekornica: Zamršten						*	*						
5	Prekornica: Srednja Ponikvica						+*	*				*		
10	Prekornica: Vukotica					*				*		*	*	
11	Prekornica: Bjelopavlička Ponikvica					+								
12	Prekornica: Studeno											*		
14	Slatina								*					*
15	Kupinovo					*								
16	Dobro polje	*	*								*	*	*	*
17	Zagorak					*								
21	Frutak	*									*			*
23	Bralenovica	*								*	*		*	*
27	Gornji Zagarač: Miogost, Blizanci	+												
34	Zagreda	*							*	*	*			
35	Sladojevo kopito		*											
36	Pitoma loza	*	*							*	*		*	
37	Čurilac	*	*	*						*	*	*	*	*
40	Kruščica	*	*								*	*	*	
41	Sige		*							*	*			
42	Kolašinovići	*			*				*	*	*		*	*
43	Glizica	*							*	*	*		*	*
44	Krvavče								*		*			*
45	Gostilje									*			*	
46	Martinići	*	*							*	*		*	*
47	Moromiš	*	*	*						*	*	*	*	*
48	Novo selo	*												
49	Bandići	*								*	*			*

Table 3. – Reptilian species (snakes) recorded in the Bjelopavlići region. Locality numbers and names correspond to those in Supplementary information I. (+) literature data; (*) our field data; (+*) literature and our field data.

No	Locality	<i>Malopolon insignitus</i>	<i>Natrix natrix</i>	<i>Natrix tessellata</i>	<i>Dolichophis caspius</i>	<i>Elaphe quatuorlineata</i>	<i>Hierophis gemonensis</i>	<i>Platyceph najadum</i>	<i>Telescopus fallax</i>	<i>Zamenis longissimus</i>	<i>Zamenis situla</i>	<i>Vipera ammodytes</i>	<i>Vipera berus</i>
4	Prekornica: Zamršten												*
5	Prekornica: Srednja Ponikvica		*										
10	Prekornica: Vukotica					*							*
12	Prekornica: Studeno												*
16	Dobro polje	*	*	*									*
17	Zagorak			*							*		*
20	Kujava						*	*	*				
21	Frutak					*							
22	Orja Luka					*							
23	Bralenovica		*				*	*			*		*
34	Zagreda	*					*						*
35	Sladojevo kopito	*	*										*
36	Pitoma loza	*	*				*						*
37	Ćurilac	*	*		*	*	*			*			*
40	Krušćica		*	*	*		*						*
41	Sige	*	*		*		*	*					*
42	Kolašinovići	*				*	*	*			*		*
43	Glizica												*
45	Gostilje												*
46	Martinići	*	*	*	*		*	*					*
47	Moromiš	*	*	*	*	*	*	*			*		*
49	Bandići	*	*						*				*

reptile species so far known for Montenegro (Džukić 1995, Crnobrnja-Isailović & Džukić 1995, Polović & Ljubisavljević 2010, Wielstra *et al.* 2013, Sillero *et al.* 2014, Vergilov *et al.* 2016). With the exception of the Skadar Lake region (Crnobrnja-Isailović & Džukić 1995, Polović & Ljubisavljević 2010), herpetofaunal diversity of Bjelopavlići area is the largest compared to the other studied areas of Montenegro (Džukić 1991, Tomović *et al.* 2004, Polović & Čadenović 2013, Polović & Čadenović 2014a). However, it should be noted that aforementioned studies included only certain mountain regions, spatially and altitudinally more restricted in relation to the Bjelopavlići region.

Taken together, amphibians and reptiles were recorded at 49 localities in the Bjelopavlići region (Fig. 1) of which 57 % has not been previously documented in the literature. Unlike amphibians, very few records have been previously reported for reptiles (3 published localities). Amphibians were found at somewhat greater number of localities than reptiles (38 vs. 30 sites, respectively).



Fig 1. – Distribution of the records of amphibians and reptiles in the Bjelopavlići region (locality numbers explained in Tables and Supplementary information I). Solid circles - our field data; open circles - literature data; grey circle - literature and our field data.

The most frequently recorded amphibian species were *Bufo bufo* (15 out of 49 localities) and *Lissotriton vulgaris* (13), while the most common reptiles were *Vipera ammodytes* (17), *Testudo hermanni* (14), *Podarcis melisellensis* and *Lacerta viridis* (13 localities, each).

The rarest species were *Rana graeca*, *Pelophylax shqipericus*, *Algyroides nigropunctatus*, *Zamenis longissimus* and *Vipera berus* which were observed only on a single locality. However, some of these records are very important for a better understanding of the distribution pattern of herpetiles

in Montenegro. The record of *V. berus* on Prekornica Mt. presents an isolated finding site of this species in central Montenegro (see Jelić *et al.* 2013), thus providing an important contribution to the knowledge of distribution of a very rare viper in this country. Furthermore, in Montenegro, *P. shqipericus* has so far been known to occur only in the Skadar Lake area (Džukić *et al.* 2003).

The great diversity of the Bjelopavlići region is primarily caused by the influence of the Mediterranean climate, which penetrates into the mainland along the river Zeta valley, allowing the presence of some Mediterranean faunistic elements (e.g. *Hemidactylus turcicus*, *Hierophis gemonensis*, *Platyceps najadum*, *Telescopus fallax*). However, as these species were previously recorded for coastal zone of Montenegro (Crnobrnja-Isailović & Džukić 1995, Polović & Čadenović 2014b), distribution shifts caused by climatic shifts as a consequence of global warming could not be ruled out as a cause of their occurrence in Bjelopavlići area (Chamaille-James *et al.* 2006, Polović & Ljubisavljević 2010, Moreno-Rueda *et al.* 2012). Consequently, the greatest diversity of batracho- and herpetofauna was recorded at sites in the river Zeta plain (Moromiš - 27 species, Ćurilac - 18, Martinići - 18, Kolašinovići - 17, Kruščica - 14, Dobro polje - 14).

Low herpetofaunal diversity that was recorded in vicinity of Zagarač is caused by a research bias, because in this area amphibian habitats were primarily surveyed (Ćirović *et al.* 2008a).

The number of detected species decreases with increasing altitude, up to the higher elevations on Prekornica Mt., with the appearance of oro-Mediterranean (*Dinarolacerta mosorensis*), Middle-European (*Ichthyosaura alpestris*, *Lacerta agilis*) and boreal (*V. berus*) faunistic elements (according to Džukić 1991).

Given that the greatest diversity of amphibians and reptiles was recorded in the river Zeta valley, which is under heavy anthropogenic pressure (agriculture, traffic, urbanization, pollution and habitat fragmentation), special attention should be paid to the future protection and preservation of their habitats. This is primarily related to the conduction and implementation of the detailed EIA studies, as well as to protection of areas planned by the Action Plan Strategy for Sustainable Development of the Municipality of Danilovgrad (Anonymous 2013).

Although expressed to a lesser extent, batracho- and herpetofaunal diversity of Prekornica Mt. is not less important, since there were recorded some rare (*V. berus*) and endemic (*D. mosorensis*) species. These species are connected to forests or forest edges that are threatened by illegal, improper and uncontrolled logging activities, and fires, whose numbers rapidly increased in the last 15 years (Anonymous 2014). Therefore,

establishing a regime of more intensive monitoring of forest exploitation and implementation of concrete measures aimed at reducing the number of fires on this mountain is highly needed.

Moreover, it should be mentioned the presence of the alpine newt (*I. alpestris*) in small aquatic habitats on Prekornica Mt. that are under significant threat from draining, introduction of predatory fishes (Denoël *et al.* 2005, Ćirović *et al.* 2008b) but also due to some urbanization plans (e.g. for Ponikvice localities) of tourism development strategy for the municipality of Danilovgrad (Dragojević *et al.* 2012).

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ПРИЛОГ ПОЗНАВАЊУ БАТРАХО- И ХЕРПЕТОФАУНЕ БЈЕЛОПАВЛИЋА (ЦРНА ГОРА)

ВУК ИКОВИЋ, ЉИЉАНА ТОМОВИЋ, КАТАРИНА
ЉУБИСАВЉЕВИЋ

РЕЗИМЕ

У раду је представљена дистрибуција водоземаца и гмизаваца у области Бјелопавлића (централни део Црне Горе) на основу података из литературе и наших теренских истраживања. На 49 локалитета забележено је 12 врста водоземаца и 25 врста гмизаваца, од чега 57 % података није претходно објављено. Највећи диверзитет батрахо- и херпетофауне забележен је на локалитетима у долини реке Зете. Информације представљене у овом раду важне су за процену диверзитета батрахо-и херпетофауне Црне Горе и њихову заштиту.

SUPPLEMENTARY INFORMATION I

Information on localities, as follows: locality number, locality name, coordinates, elevation, source (field data - f.d. or literature data).

1. Prekornica Mt.: Đević bor, 42.7195 N, 19.2492 E, 1653 m, f.d.; 2. Morakovo: Zabran kralja Nikole, 42.7048 N, 19.2202 E, 1159 m, Džukić *et al.* (2015); 3. Prekornica Mt.: Crvena rupa, 42.6898 N, 19.2725 E, 1643 m, f.d.; 4. Prekornica Mt.: Zamršten, 42.6846 N, 19.2694 E, 1620 m, f.d.; 5. Prekornica Mt.: Srednja Ponikvica, 42.6739 N, 19.2671 E, 1400 m, Radojičić *et al.* (2002); Vukov *et al.* (2006); Ljubisavljević *et al.* (2007a, b), Polović (2011), f.d.; 6. Prekornica Mt.: Ponikvica: Ponori, 42.6687 N, 19.2764 E, 1440 m, f.d.; 7. Prekornica Mt.: Suva Ponikvica, 42.6709 N, 19.2544 E, 1371 m, Džukić *et al.*, 2015; 8. Prekornica: Razmet do, 42.6722 N, 19.2279 E, 1425 m, Ćirović *et al.* (2008a); 9. Prekornica Mt.: Četni do, 42.6515 N, 19.2132 E, 1343 m, Džukić *et al.* (2015); 10. Prekornica Mt.: Vukotica, 42.6373 N, 19.2440 E, 920 m, f.d.; 11. Prekornica Mt.: Bjelopavlička Ponikvica, 42.6894 N, 19.0928 E, 1158 m, Polović (2011); 12. Prekornica Mt.: Studeno, 42.6132 N, 19.1805 E, 1100 m, f.d.; 13. Prekornica Mt.: Radovče: Katranara, 42.5856 N, 19.2581 E, 874 m, Džukić *et al.* (2015); 14. Slatina, 42.5864 N, 19.1641 E, 600 m, f.d.; 15. Kupinovo, 42.6436 N, 19.0473 E, 550 m, f.d.; 16. Dobro polje, 42.6306 N, 19.0315 E, 44 m, f.d.; 17. Zagorak, 42.6195 N, 19.0199 E, 211 m, f.d.; 18. Bogumilići: Ubao Kladenca, 42.6122 N, 19.0151 E, 484 m, Ćirović *et al.* (2008a); 19. Bogumilići: Ubao Bučevac, 42.6085 N, 19.0204 E, 481 m, Ćirović *et al.* (2008a); 20. Kujava, 42.6015 N, 19.0358 E, 163 m, f.d.; 21. Frutak, 42.5803 N, 19.0535 E, 138 m, f.d.; 22. Orja Luka, 42.5639 N, 19.0833 E, 45 m, f.d.; 23. Bralenovica, 42.5584 N, 19.0861 E, 55 m, f.d.; 24. Gornji Zagarač: Erakovice, 42.5371 N, 19.0354 E, 1082 m, Ćirović *et al.* (2008a), Džukić *et al.* (2015); 25. Gornji Zagarač: Petrova voda, 42.5342 N, 19.0428 E, 1070 m, Ćirović *et al.* (2008a); 26. Gornji Zagarač: Vodine, 42.5288 N, 19.0331 E, 686 m, Ćirović *et al.* (2008a), Džukić *et al.* (2015); 27. Gornji Zagarač: Miogost: Blizanci, 42.5197 N, 19.0297 E, 595 m, Ćirović *et al.* (2008a), Džukić *et al.* (2015); 28. Gornji Zagarač: Cicmanovica, 42.5146 N, 19.0366 E, 629 m, Ćirović *et al.* (2008a), Džukić *et al.* (2015); 29. Rujišta: Bezimena kamenica, 42.5152 N, 19.0295 E, 617 m, Ćirović *et al.* (2008a), Džukić *et al.* (2015); 30. Rujišta: Grlačke kamenice, 42.5047 N, 19.0349 E, 653 m, Ćirović *et al.* (2008a); 31. Zagarač, 42.5086 N, 19.0802 E, 196 m, Džukić *et al.* (2015); 32. Donji Zagarač: Pešića kamenica, 42.5044 N, 19.0933 E, 118 m, Ćirović *et al.* (2008a); 33. Donji Zagarač, 42.5003 N, 19.0994 E, 99 m, Džukić *et al.* (2015); 34. Zagreda, 42.5287 N, 19.0837 E, 300 m, f.d.; 35. Sladojevo kopito, 42.5233 N, 19.1050 E, 50 m, f.d.; 36. Pitoma loza, 42.5071 N, 19.1202 E, 48 m, f.d.; 37. Ćurilac, 42.5364 N, 19.1142 E, 45 m, f.d.; 38. Lazine: Jastreb, 42.5382 N, 19.1361 E, 47 m, Džukić *et al.* (2015); 39. Lazine: Kosić: Razliv Zete, 42.5392 N, 19.1428 E, 50 m, Ćirović *et al.* (2008a), Džukić *et al.* (2015); 40. Kruščica, 42.5490 N, 19.1471 E, 55 m, f.d.; 41. Sige, 42.5571 N, 19.1440 E, 55 m,

f.d.; 42. Kolašinići, 42.5657 N, 19.1679 E, 177 m, f.d.; 43. Glizica, 42.5634 N, 19.1757 E, 194 m, f.d.; 44. Krvavče, 42.5693 N, 19.1823 E, 450 m, f.d.; 45. Gostilje, 42.5791 N, 19.1981 E, 900 m, f.d.; 46. Martinići, 42.5342 N, 19.1845 E, 61 m, f.d.; 47. Moromiš, 42.5308 N, 19.2020 E, 66 m, f.d.; 48. Novo selo, 42.4998 N, 19.1638 E, 48 m, f.d.; 49. Bandići, 42.4840 N, 19.1656 E, 35 m, f.d.

SUPPLEMENTARY INFORMATION II

Literature data for the Bjelopavlići region without exact locality names and coordinates.

Lissotriton vulgaris: Garač, Džukić *et al.* (2015); *Bombina variegata*: Garač, Džukić *et al.* (2015); *Bufo bufo*: Prekornica, CN53, Čadenović (2007), Čadenović (2012), Čadenović *et al.* (2013); *B. bufo*: Bjelopavlići, CN41, Čadenović (2007), Čadenović (2012), Čadenović *et al.* (2013); *Rana dalmatina*: Bjelopavlička ravnica, Čadenović (2014); *Pelophylax ridibundus*: Bjelopavlička ravnica, Čadenović (2014); *P. ridibundus*: Prekornica, Čadenović (2014).

SUPPLEMENTARY INFORMATION III

Literature cited for the locality data in Supplementary Information I and II (not previously listed under "Literature" section)

- Čadenović, N. (2007): A contribution to the knowledge of distribution of species *Bufo bufo* in Montenegro. – **Natura Montenegrina** 6: 111-114.
- Čadenović, N. (2012): Species *Bufo bufo* (Linnaeus, 1758) in the collection of the Natural History Museum of Montenegro. – **Natura Montenegrina** 11(3): 473-483.
- Čadenović, N., Vukov, T., Popović, E., Ljubisavljević, K. (2013): Morphological differentiation of the Common toad *Bufo bufo* (Linnaeus, 1758) in the Central part of the Balkan Peninsula. – **Archives of Biological Sciences** 65(2): 685-695.
- Čadenović, N. (2014): Katalog faune Amphibia Crne Gore 10(9). – Odjeljenje prirodnih nauka, Crnogorska akademija nauka i umjetnosti, Podgorica. [In Montenegrin with English summary]
- Džukić, G., Cvijanović, M., Urošević, A., Vukov, D. T., Tomašević Kolarov, N., Slijepčević, M., Ivanović, A., Kalezić, M.L. (2015): The batrachological collections of the Institute for biological research "Siniša Stanković", University of Belgrade. – **Bulletin of the Natural History Museum in Belgrade** 8: 118-167.
- Ljubisavljević, K., Arribas, O., Džukić, F., Carranza, S. (2007a): Genetic and morphological differentiation of Mosor rock lizards, *Dinarolacerta mosorensis* (Kolombatović, 1886), with the description of a new species from the Prokletije Mountain Massif (Montenegro) (Squamata: Lacertidae). – **Zootaxa** 1613: 1-22.
- Ljubisavljević, K., Polović, L., Tomašević Kolarov, N., Džukić, G., Kalezić, M.L. (2007b): Female life-history characteristics of the Mosor rock lizard, *Dinarolacerta mosorensis* (Kolombatović, 1886) from Montenegro (Squamata: Lacertidae). – **Journal of Natural History** 41(45-48): 2979-2993.

- Polović, L. (2011): Species of the genera: *Algyroides*, *Dalmatolacerta* and *Dinarolacerta* (Lacertidae) in the Collection of the Natural History Museum of Montenegro. – **Natura Montenegrina** 10(4): 474-458.
- Radojičić, J. M., Cvetković, D. D., Tomović, Lj. M., Džukić, G. V., Kalezić, M. L. (2002): Sexual dimorphism in fire-bellied toads *Bombina spp.* from the central Balkans. – **Folia Zoologica** 51(2): 129-140.