MONTENEGRO
MINISTRY OF SUSTAINABLE DEVELOPMENT AND TOURISM

AGENCIJA ZA ZAŠTITU ŽIVOTNE SREDINE

AAMCONSULTING

ESTABLISHMENT OF NATURA 2000 NETWORK IN MONTENEGRO

GENERAL REPORT ON CAVE HABITAT TYPE

Author: Dr Marko G. Karaman

Contributor: Miloš Pavićević

Date: 1. December 2018.

INTRODUCTION

This report is general overview of results from the caves inventory within the project „Establishment of Natura 2000 network in Montenegro“. General goal of the project is to build foundations of the future Natura 2000 network in Montenegro. The data gathering is the core activity of this project. Even though this activity cannot deliver all data needed for establishment of this part of future Natura 2000 network, its main objective is to provide a firm base for the next activities and projects leading to completion of data sets needed for Natura 2000 site proposal. Activities covered by the project are extensive field mapping in preselected areas (so called Key Biodiversity Areas - KBAs) combined with comprehensive desktop research.

This report is an output of the caves inventory aiming to collect both speleological and biological data from the speleological objects located in KBAs and ASCIs incl. 2-3 km wide buffer zone. The inventory was focused only on the habitat type “8310 Caves not opened to the public” listed in the Annex I of the EU Habitats Directive. Only the following pre-selected areas of Montenegro were covered by this activity:

1. Key Biodiversity Areas (KBA) Prokletje and areas of special conservation importance (ASCI) Dolina Lima
2. KBA Moračke planine
3. KBA Komovi and ASCI Kanjon Male rijeke
4. KBA Hajla and ASCI Hajla
5. KBA Durmitor, ASCI Durmitor and valleys of rivers Komarnica and Pridvorica
6. KBA Maglić, ASCI Ostatak kanjona Pive and ASCI Bioc, Maglić i Volujak
7. KBA Ljubišnja and ASCI Dolina Cehotine
8. KBA Cemovsko polje – Cijevna and ASCI Cijevna Rijeka – kanjon
9. Morača Valley from approx. 8 km upstream of Podgorica to approx. Morača monastery

ESTABLISHMENT OF CRITERIA FOR CAVES ASSESSMENT

Preparation of criteria for assessing caves from the Natura 2000 value point of view was done in coordination with experts from countries that established the Natura 2000 network – Slovenia and Croatia. Participating experts were involved in the process of selecting caves as Natura 2000 habitats in their countries, Croatia and Slovenia, countries with most similar geology and biodiversity to Montenegro. Both countries are parts of the same Dinaric

karst region, one of the richest region in the world in cave dwelling animals. Montenegro, Bosnia and Hercegovina, and northern Albania are parts of the same region, also.

Participating experts were Roman Ozimec, biospeleologist, leader of biospeleological team for Natura 2000 in Croatia, and Slavko Polak, biospeleologist, museum adviser and leader of Biological sector in Notranjski muzej Postojna (Museum of karst).

According to their experience and literature data I select followed criteria which were confirmed by both experts.

CRITERIA FOR SELECTION OF CAVES THAT SHOULD BE INCLUDED IN NETWORK OF NATURA 2000 SITES

- speleological objects that are habitats for species from the Annex II list of Habitat Directive (not known in MNE till now);

- speleological objects that are type localities (locus tipicus) for newly described species;

- speleological objects that are habitats for endemic, relict and/or rare species;

- speleological objects that have large ecological diversity – number of different habitats inside of object (ponds, lakes, water flows, sand, gravel, mud, rocks etc.);

- speleological objects that have high total genetically diversity (biodiversity): total number of species, invertebrate and vertebrate. Number of troglobites, troglophiles and trogloxenes;

- speleological objects with large population of endemic, relict and/or rare species. Total number of individual specimens. Cave might be poor in total biodiversity (one or only several species) but might be habitat for one large population of important species;

- speleological objects that are not foreseen to be opened for the public.

IMPLEMENTED ACTIVITIES

Activities carried out during the implementation included the field work and desktop research. Members of biospeleological team are Dr Marko Karaman (museum advisor in Invertebrate Collection of Natural History Museum of Montenegro) and Miloš Pavićević (student of Biological faculty in Podgorica).

As a first step, published data about speleological researches and about biodiversity in the speleological objects in Montenegro were collected. These data are scarce through scientific and scientific-popular journals from all over the world. The huge work was been to collect as much as possible more data. According to results obtained from collected data, we planned field work activities.

Activities were correlated with available number of field work days. We conducted surveys in the following KBAs: Prokletije and dolina Lima, Platije, Morača valley, Cijevna and Ćemovsko polje, Durmitor and Tara Canyon with Komarnica, Hajla. Reports for other KBAs (Piva, Bioč, Maglić and Volujak; Komovi and Mala rijeka Canyon; Ljubišnja and Ćehotina) were prepared according the available published data, only. Some information was collected during our previous research and from other speleologists.

RESULTS – GENERAL OVERVIEW

According to published data, we made a list (table 1) of speleological objects that are type localities for one or more species, because "locus typicus" is the most important selection criteria. Along with new described species, we noted other species collected in the same objects, if they were found.

There are no speleological objects in Montenegro that are habitats for species from the Annex list II of Habitat Directive. We expected that some of that species might be found in Montenegro: Leptodirus hochenwarti (Insecta, Coleoptera lives in Dinarides mountain range); Congeria kusceri (Mollusca, Bivalvia lives only in fresh waters inside the caves; registered in Hercegovina, near the border of Montenegro); vertebrate species Proteus anguinus, the olm (its known range is from Slovenia till the Hercegovina, near the border of Montenegro).

Many new species were registered in inventoried speleological objects for the first time in Montenegro for the first time (tab. 1). Most of these new species are endemic, too. They are endemic for Montenegro, east coast of Adriatic or they are endemic for the Balkan. Some of them inhabit one or several caves only. Their populations are very low in number and are very sensitive to any (esp. human) influence.

TABLE 1: List of speleological objects that are type localities for new described species of cave dwelling invertebrates*

Speleological object	Collected species
KBA DURMITOR AND TARA CANYON, ASCI Durmitor and valleys of rivers KOMARNICA AND PRIDVORICA	
Pećina na Splavištu, Tara Canyon (Cave at Splavište)	loc.typ.: Niphargus carcerarius Karaman, 1988 Troglophylus cavicola (Kollar, 1833) Orthoptera *Troglophilus brevicauda* Chopard, 1934 Seracamaurops (Cordiamaurops) fritschi Besuchet, 1986
Arapova Pećina cave, Grabovica, Durmitor	loc.typ.: Neobisium goldameirae Ćurčić & Dimitrijević, 2002 Troglophilus ovuliformis Karny, 1907 Orthoptera Troglophylus cavicola (Kollar, 1833)
Crna jama pit (=Jama u Podu), Poda, Mala Crna Gora, Durmitor	loc.typ.: *Anthroherpon cecai Njunjić et al. 2015;* Neobisum sp. *Leonhardella antennaria antennaria* Apfelbeck, 1907
Pećina Gornja Ališnica cave Godijelji, Durmitor;	loc.typ.: Neobisium mendelssohni Ćurčić & Ćurčić, 2002

Ledena pećina na Obloj glavi cave, Durmitor	loc.typ.: *Neotrechus hilfi grossi* Jeannel, 1928 loc.typ.: *Leonhardella antennaria antennaria* Apfelbeck, 1907 Neotrechus suturalis
Pećina u Pleću cave, Tara Canyon, Pirlitor, Durmitor	paratype: Neobisium goldameirae Ćurčić & Dimitrijević, 2002 Troglophylus cavicola (Kollar, 1833)
Jama u Vjetrenim Brdima pit, Durmitor	loc.typ.: Neobisium davidbengurioni Ćurčić & Dimitrijević, 2002 Trogulus banaticus Avram, 1971 loc.typ.: *Tartariella durmitoriensis durmitoriensis* Nonveiller & Pavićević, 1999 loc.typ.: *Adriaphaenops zupcense tartariensis* (Pavićević, 2001
Vodena pećina cave, Komarnica, Durmitor; Nade pećina cave, Vodeni Do, Komarski Gaj, Durmitor.	loc.typ.: Neobisium bozidarcurcici Dimitrijević, 2009 Trogulus banaticus Avram, 1971 Troglophylus cavicola (Kollar, 1833) loc.typ.: Anthroherpon zariquieyi Jeannel *Leonhardella antennaria brevis Jeannel*
KBA PROKLETIJE	
Duboka jama (Duboka pit)	*loc.typ. for Anthroherpon albanicum boschi;*
Gorniča jama	*loc.typ. for* Macrochaetosoma bertiscea;
Kriva jama (Špela Koruns)	*loc.typ. for Anthroherpon albanicum divergens*;
Kuna pećina (Kuna cave)	*loc.typ. for Anthroherpon albanicum muelleri*
Poda jama (Poda pit)	*loc.typ. for Anthroherpon albanicum winkleri*
ASCI DOLINA LIMA	
Bracanovića pećina	loc.typ. for: Blattochaeta remyi (Jeannel, 1931)
Župan pećina	loc.typ. for: Blattochaeta remyi (Jeannel, 1931) Neobisium remyi Beier, 1939
Đato	loc.typ. for: Rozajella deelemani Perreau & Pavićević, 2008 Porrhomma pygmaeum convexum (Westring)

KBA MORAČKE PLANINE	
Pit Alexander the Great jama, Konjič brdo, Kamenik planina, Prekornica	loc.typ. for *Acheroniotes mlejneki* *Lohaj & Iakota, 2010*
Pit Lug jama, Riči vrh, Paukovići village, Koprivni do, Maganik Mn	*Neotrechus hilfi grossi* Jeannel, 1928 Neotrechus suturalis amplipennis (J. Müller) loc.typ. for *Anthroherpon latipenne punctipennis Jeannel*
Pit Meka jama (Mika jama) Četov vrh Zvornik, Žurim, 2120 m a.s.l.	loc.typ. for *Anthroherpon albanicum sydowi (Zaroquiey)* *Anthroherpon matzenaueri taliensis (taliense) (Zariquiey)*
KBA MAGLIĆ, ASCI rest of PIVA CANYON and ASCI BIOČ, MAGLIĆ I VOLUJAK	
Gjorjo pećina cave, (Jama u Smrekovcu), west slopes of Bioč, 1900 m a.s.l.	loc.typ. for *Leonhardella (L.) montenegrina Jeannel*
Hadža pećina cave, locality Ljut, under the Kula Šejtan, Ledenice Mn, 1480m a.s.l.	loc.typ. for Anillocharis tenuilimbatus Jeannel *Anthroherpon matzenaueri matzenaueri* *(Apfelbeck, 1907)* *Leonardella (Victorella) roseni (G. Muller)*
Heta jama pit, Ledenice, Bijeli Dol, Ledenice	loc.typ. for Blattochaeta hawelkai Knirsch (1929)
Kostina pećina cave, Bajovo polje	loc.typ. for Neobisium pluzinensis Ćurčić, Rađa, Dimitrijević, Ćurčić, Ćurčić &Ilić, 2013
Lea pit and Leo cave, Manita Gora, above the katun Ravno, 1650 m a.s.l. (W of Piva monastery)	loc.typ. for *Leonardella (Victorella) roseni (G. Muller)* *Anthroherpon matzenaueri matzenaueri* *(Apfelbeck, 1907)* Anillocharis tenuilimbatus Jeannel
Rožaje - HAJLA	
Bezimena jama Šoljani village, 11.4 km from Rožaje to Peć	loc.typ. for Fageiella ansiger Deeleman-Reinhold, 1976 *Nonveilleriella ognjenovici (Coleoptera)*

Pećina u Dubokom Potoku, Bijela crkva village, Rožaje	loc.typ. for Serboduvalius gejzadunayi (Lohaj, Čeplik & Iakota, 2013) loc.typ. for Rozajella jovanvladimiri Ćurčić, Brajković, Ćurčić and Waitzbauer Arrhošalites principalis Stach, 1945; Megalothorax sp.; Heteromurus (Verhoeffiella) nitidus (Templeton, 1835); Heteromurus (Verhoeffiella) media (Loksa et Blagojević, 1967); Tomocerus sp. (Collembola) Neobisium umbratile Beier, 1938 Pseudoscorpiones Melogona broelemenni (Verhoeff) Diplopoda Brachydesmus sp.

*No one speleological object inside the KBA Ljubišnja and Ćehotina is mentioned as type locality in published papers. Separate report of KBA Ljubišnja and Ćehotina valley contents data about its biodiversity. There are no published data about biodiversity in speleological objects inside the KBA Platije; Komovi and Mala Rijeka. List of speleological objects that are inside the KBA Platije is given in the separate Report.

Having in mind main goals of the project, we evaluated speleological and biospeleological characteristics of each KBA and ASCI (tab. 2). Evaluation is made regarding their representativity as speleological areas, their degree of conservation of structure and restoration possibilities, as well as to their global assessment as speleological sites (value of their speleological and biospeleological characteristics comparing to other similar sites in the Europe and World). In the table (tab. 2), we listed KBAs scoring them according to the SDF (Standard data form) criteria.

TABLE 2: Ranking of KBAs according to the evaluation of their speleological and biospeleological characteristics.

	KBA	Caves (number)	Data quality	Representativity	Conservation	Global
1.	Durmitor	415	M	A	A	A
2.	Maglić, Piva, Volujak	161	M	A	A	A
3.	Prokletije	> 70	M	A	A	A
4.	Moračke planine	> 50	P	A	A	B
5.	Ljubišnja, Ćehotina	43	P	B	B	B
6.	Platije, Mrtvica	7	M	B	B	C
7.	Hajla	2	G	C	B	B
8.	Cijevna, Ćemovsko polje	1	G	C	B	C
9.	Komovi, Mala Rijeka	/	/	D	/	/

CONCLUSIONS

KBA Durmitor and Tara Canyon with Komarnica river has the greatest speleological value among those KBAs analysed under the project. According to the published results the most important speleological object is Jama u Vjetrenim Brdima pit, Durmitor. Further, KBA Durmitor and Tara Canyon with Komarnica river is the most investigated area, but biodiversity is still far from complete inventory. Speleological objects in this KBA are great in number, in morphological diversity and in biological richness.

According to our knowledge and experience, and in spite of relatively poor investigation of biodiversity, we conclude that two more KBAs have the same score of the SDF values. They are KBA Maglić, Volujak, Piva and KBA Prokletije and Lim valley.

Some other KBAs (Moračke planine, Ljubišnja Mn and Ćehotina valley, Platije and Mrtvica canyon) have less scored value. Separate reports for each KBA content details. We expect that future investigations will improve importance of these sites in biospeleological sense. The area of Dinarides, where our sites belong, has the highest level of biodiversity of cave dwelling fauna in the world. We expect that number of new species for science or for the fauna of Montenegro will be result of the future field researches.

Together with improve of knowledge about biodiversity, the investigation of new speleological objects might be a result of future field works in some KBAs, as Cijevna Canyon, Hajla Mn and Mala rijeka Canyon. We expect that future investigations will show higher importance for KBA Ljubišnja and Ćehotina valley, KBA Cijevna Canyon, KBA Platije, as well as KBA Moračke planine.

It is evident that biodiversity of speleological objects in Montenegro is not explored enough including basic speleological characteristics. Register of speleological objects in Montenegro (Environmental Protection Agency) contain more than 1600 objects. However, the biodiversity is known for about 5-10 % of that number. The common opinion among the biospeleologists is that the huge number of new invertebrate species for science can be expected as a result of future investigations.

FINAL CONCLUSION

Our suggestion is to propose KBAs with a global value A to be included in the future Natura 2000 network as sites with target habitat type “8310 Caves not opened to the public”. They are:

1. KBA Durmitor, ASCI Durmitor and valleys of rivers Komarnica and Pridvorica
2. KBA Maglić, ASCI Ostatak kanjona Pive and ASCI Bioc, Maglić i Volujak
3. KBA Prokletije

We are sure that future investigations will prove importance of one more KBA as site with global representativity A, both at speleological and biospeleological level. It is KBA Moračke planine. Nonetheless, limited capacities of the project did not allow to gather sufficient data in this KBA in the field.

REPORT ON CAVE HABITAT TYPE

KBA **Morača Valley upstream to Monastery Morača (Platije) and Mrtvica**

Author: Dr Marko G. Karaman

Contributor: Miloš Pavićević

Date: 23. November 2018.

INTRODUCTION

This report is one of outputs of the IPA project "Establishment of NATURA 2000 network in Montenegro". General goal of the project is to build foundations of the future Natura 2000 network in Montenegro. Activities covered by the project are besides capacity building extensive field mapping in preselected areas (so called Key Biodiversity Areas - KBAs) combined with comprehensive desktop research. Project areas (KBAs) are located mostly in the Alpine Biogeographical Region.

This report is an output of the caves inventory aiming to collect both speleological and biological data from the speleological objects located in KBAs and ASCIs incl. 2-3 km wide buffer zone. The inventory was focused only on the habitat type "8310 Caves not opened to the public" listed in the Annex I of the EU Habitats Directive.

According to experience from the establishment of NATURA 2000 network in Slovenia and Croatia, we prepared selection tailor made criteria to determine speleological objects that might be target habitat type in the future Natura 2000 sites in Montenegro. There are no species listed in Annex II of the EU Habitat Directive found in speleological objects in Montenegro. Therefore, selection is based on whether it is type locality for new species, endemic species, or relict and rare species. Further, preference is given to those objects that offer higher biological diversity (exp. with large populations of endemic, relict and/or rare species).

Criteria are available as a separate document.

SHORT DESCRIPTION

GEOGRAPHY

THE MORAČA RIVER originates at the altitude of 975 m a.s.l. from the series of streams flowing from the east slopes of Zebalac (2150 m a.s.l.), Šuplja Greda and northern slopes of Kapa Moračka (2227 m a.s.l.). The length of the river is around 102 km counted to the mouth to the Lake Skadar. The area of source has relevantly widened valley made of Upper Cretaceous flysch, while in its central section, which is 31.5 km long, it carves the riverbed in Mesozoic limestone, wiggling through Platije Canyon. The highest point of the Canyon is at 1168 m altitude. This central part is an area of our investigation.

THE MRTVICA CANYON is 6.6 km long and 1247 m deep. Mrtvica River is right tributary of Morača River, and their confluence is near the northern end of Platije. The geological structure of Mrtvica Canyon is the similar to Platije and is made of limestone and dolomite.

.

CLIMATE CONDITION

Morača Canyon is under the great influence of Mediterranean climate conditions that mixed with subAlpine conditions at higher altitudes. It results in high level of precipitation, more than 2000 mm during the year. Largest part of the canyon has subMediterranean clime with warm and dry summers and humid, not very cold winters. Podgorica city, at southern end of the canyon, has average annual temperature of air 15.5°C. Upper part of Morača River has annual water temperature about 8°C, while in the middle part the water temperature is about 15°C.

Somewhat colder, but still subMediterranean climate conditions are in the Mrtvica Canyon.

BIOTA

VEGETATION

Oak forests of *Quercetum trojanae* floristic community inhabit up to 1000 m altitude. At higher altitudes it traverses into *Ostryo-Quercetumpubescentis* and *Fagetum montanum* floristic types. The most intense is the *Seslerio-Fagetum Abieti-Fagetum* floristic type as the belt of mixed forest of beach and fir from 700 until 1600 m a.s.l. These forests are under the influence of both Mediterranean and Alpine climate conditions.

In terms of plant diversity, 1600 plant species have been registered in the Morača Canyon, of which 60 plant species are endemic to the Balkan Peninsula and more than 85 species are protected at the national level.

FAUNA

During the research in 2008, excluding the winter aspect, in total 115 bird species were registered in Morača Canyon. Nesting species of birds are 84 which represent 42% of the total number of species breeding in Montenegro. 108 species listed in the Annexes of Bern Convention. Ichthyofauna is well investigated, as well as some invertebrate groups, but data are scattered.

SPELEOLOGICAL OBJECTS

Data in Register of speleological objects (Environmental Protection Agency of Montenegro), does not content geographical coordinates of speleological objects in Platije. About ten speleological objects that are in or near the border of Mrtvica Canyon (about 1-4 km distance) are listed in the Register. Most of them are pits.

There is no literature data regarding to cave dwelling invertebrates collected in speleological objects inside the KBA Platije. In the table 1. we gave the list of speleological objects from KBA Platije and Mrtvica, both from the Register of speleological objects (Environmental Protection Agency of Montenegro) and from our fieldwork.

We investigated three speleological objects. **Žlijeb** is inside the borders of KBA Morača valley, while **Vranštica** and **Dulo** are inside the borders of Mrtvica Canyon.

Žlijeb is morphologically partly cave, partly pit as syphon. The entrance of the object is at the right side of Platije Canyon, about 40 m above the main road. Entrance has irregular shape, dimensions 4x2 m. From the small space at the entrance, starts siphon which is directed to the down. This channel is about 100 m long with 30 m difference in altitude from the entrance. The channel is connected with the Morača River. At the bottom of the channel, only speleothems are salive. The strong hydrological activities during the rainfall disable invertebrates to inhabit this speleological object.

Vranštica cave is near the village Mrtvo Duboko. The cave is periodical spring and it is used by men in the past. The total length of the channels is more than 2 km. The entrance is at the vertical cliff, NE exposition. Entrance is large in first few meters. It is up to 20 m high and 15 m wide. It gradually narrows into the channel.

Speleological object **Dulo** is located in the region of Mrtvica Canyon, Maganik massive, near the village Trešnjica. The main entrance has SW exposition, 2.32 m height and 1.79 m width. Several meters above the main entrance is another, pit's entrance formed when the roof collapsed down, probably because of cutting trees around the entrance. Pit's entrance is 2.35 m high and 2.4 m wide. Third, lowest entrance is at distance of 20 m from the main entrance. There water flows out. It is 4.12 m high and 1.98 m wide. Dulo is spring's cave with continuous water flow during the year. Total length of channels are 410 m, and altitudinal diference is 29.5 m.

Table 1: List of speleological objects inside the KBA Platije and Mrtvica

	NAME	LOCALITY	TYPE	LENGTH	DEEP	SOURCE
1.	Smrduša	Smokovac	cave			Register
2.	Rupica	Smokovac	cave			Register
3.	Gundulija	Platije	cave	231 m	34 m	Register
4.	Žlijeb	Platije	cave	100 m	30 m	Fieldwork
5.	Jama Piperska	Kopilje, Piperi	pit		40 m	Register
6.	Vranštica	Mrtvo Duboko	cave	2 km		Register and fieldwork
7.	Dulo	Mrtvica canyon	cave	410 m	29.5 m	Fieldwork

EVALUATION OF SPELEOLOGICAL OBJECTS ACCORDING TO THE CRITERIA

According to the criteria, there are no speleological objects that are habitats for species from the Annex list of Habitat Directive. During our investigation we collected some cave dwelling invertebrate species: Amphipoda (Crustacea), Opiliones, Aranea. Definitive scientific results will be known after the determination, which is in the process.

Biodiversity of known speleological objects are not investigated or data are very poor and scattered. There are no type localities for new described species. But, some of speleological objects are habitat for rare species. We expect that future investigations will results in much richer biodiversity and some rare or endemic species could be find.

The regions of Platije and Mrtvica canyons are mostly unapproachable, especially higher parts made of bare cliffs, only. Our expectation is that there are more speleological objects that are known till now.

DATA FOR THE STANDARD DATA FORM - SDF (chart 3.1 in the SDF)

The table 2. is attached as an annex I at the end of the document. Criteria are scoring a value of the whole KBA area.

REPRESENTATIVITY **(B)** – Good representativity. Although we have data only about several objects, we suppose that this KBA as whole has good representativity. About 2/3 are pits, others are caves.

Conservation status **(B)** good conservation – While objects at higher altitudes have excellent conservation status, without any pressure, lower objects might be under the high anthropogenic influence in the future.

Global assessment **(C)** significant value – this is the lowest value. It is in line with above described representativity, known biodiversity and conservation status. We expect that future investigation would change this ranking to B at least.

THREATS AND PRESSURES

The rail road and the motorway Podgorica – Beograd pass through the Platije Canyon. Consequences of their use result in high pressure on the ecosystem in the Canyon Platije. Canyon Mrtvica is partly inhabited and development of ecotourism has an increasing negative influence.

The biggest threat to the Platije Canyon is the Government's plan to build a series of four hydropower plants. The construction of dams and reservoirs along the Platije would flood large upstream areas.

COMPARISON WITH OTHER KBAS

According to the published data, this KBA has medium value as speleological region. We suppose, related to our experience and knowledge, that future investigations will increase importance of this KBA because it is located in the typical karst region, which is full in speleological objects commonly. The KBA importance is less than Prokletije, Durmitor or Piva, but more than Komovi.

CONCLUSIONS

Although Platije and Mrtvica are in the typical Dinaric karst, speleological wealth is not related. One of the reasons is that the border of KBA is strictly around the river flow. We

suppose that there must be more objects that are still unknown. Biodiversity in some of the speleological objects, due to their morphology, could not be richer because during the hard precipitations all fauna of small invertebrate specimens washed away. Pits at higher altitudes perhaps hiding more interesting and endemic species.

ANNEX II: Map with overview of the caves in the area.

REFERENCES:

Bešić, Z. 1969: Geologija Crne Gore, knjiga II. Karst Crne Gore. – Zavod za geološka istraživanja Crne Gore, 304pp.

Bešić, Z. 1980: Geologija Crne Gore. Stratigrafija i facijalni sastav Crne Gore. – Crnogorska akademija nauka i umjetnosti. Posebna izdanja, knjiga IX. Odjeljenje prirodnih nauka, knjiga 8, 379pp.

Bešić, Z. 1983: Geologija Crne Gore. Geotektonika i paleogeografija Crne Gore. – Crnogorska akademija nauka i umjetnosti. Posebna izdanja, knjiga XVI. Odjeljenje prirodnih nauka, knjiga 10, 212pp.

Culver D.C. and White W.B. (Eds.) 2005: Encyclopedia of Caves. - Elsevier Academic Press, 662pp.

Cvijić, J. 1994: Glacijacija na balkanskim planinama. – Sabrana dela Jovana Cvijića, knjiga 10. Srpska akademija nauka i umjetnosti, Zavod za udžbenike i nastavna sredstva, Beograd, 231pp.

Đurović, P. & Petrović A. 2007: Large canyons in Dinaric and Prokletije mountains region of Montenegro. – Geographica Pannonica, 11/2007, 14-18 pp.

Environmental Protection Agency: Registry of speleological objects, excel document, available for download at www.epa.me.

Glavni grad Podgorica, 2010: Lokalni plan zaštite životne sredine Glavnog grada Podgorice, 2010-2014. 98 pp

Glavni grad Podgorica, 2014: Prostorno-urbanistički plan Glavnog grada Podgorica do 2025. godine. – Urbi Montenegro, Urbanistički institut Republike Slovenije, WINsoft Podgorica, 488 pp.

Karaman M. 2018: Establishment of criteria for cave selection as a part of the future network of Natura2000 habitats. - Part of the IPA Project “Establishment of NATURA 2000 network” in Montenegro.

Natura 2000, Standard Data Form. Explanatory Notes, 32 pp.

Opština Kolašin, 2011: Prostorno-urbanistički plan Kolašin 2011-2020. – LAMP i Opština Kolašin, 254 pp.

Petrović, D. (Ed.) 2009: Important Plant Areas (IPA) in Montenegro. Važna biljna staništa u Crnoj Gori. – NU Zelena Gora, Podgorica, 79pp.

WWF 2014: Rivers: lifelines of the Dinaric Arc Conservation of the most valuable rivers of South-Eastern Europe

ANNEX I, Table 2.

3. ECOLOGICAL INFORMATION

3.1 Habitat types present on the site and site evaluation for them:

Annex I Habitat types						Site assessment			
Code	PF	NP	Cover (ha)	Caves (number)	Data quality	AIBICID	AIBIC		
						Representativity	Relative Surface	Conservation	Global
8310				7	M	B		B	C

PF: for the habitat types that can have a non-priority as well as a priority form (6210, 7130, 9430) enter „x“ in the column PF to indicate the priority form.
NP: in case that a habitat type no longer exists in the site enter X (optional);
Cover: decimal values can be entered;
Caves: for habitat types 8310, 8330 (caves) enter the number of caves if estimated surface is not available;
Data quality: G – good (based on surveys); M-moderate (based on partial data with some extraplation); P – poor (rough estimation.

REPORT ON CAVE HABITAT TYPE

KBA **Komovi** and ASCI **Kanjon Male rijeke**

Author: Dr Marko G. Karaman

Contributor: Miloš Pavićević

Date: 10. November 2018.

INTRODUCTION

This report is one of outputs of the IPA project "Establishment of NATURA 2000 network in Montenegro". General goal of the project is to build foundations of the future Natura 2000 network in Montenegro. Activities covered by the project are besides capacity building extensive field mapping in preselected areas (so called Key Biodiversity Areas - KBAs) combined with comprehensive desktop research. Project areas (KBAs) are located mostly in the Alpine Biogeographical Region.

This report is an output of the caves inventory aiming to collect both speleological and biological data from the speleological objects located in KBAs and ASCIs incl. 2-3 km wide buffer zone. The inventory was focused only on the habitat type "8310 Caves not opened to the public" listed in the Annex I of the EU Habitats Directive.

According to experience from the establishment of NATURA 2000 network in Slovenia and Croatia, we prepared selection tailor made criteria to determine speleological objects that might be target habitat type in the future Natura 2000 sites in Montenegro. There are no species listed in Annex II of the EU Habitat Directive found in speleological objects in Montenegro. Therefore, selection is based on whether it is type locality for new species, endemic species, or relict and rare species. Further, preference is given to those objects that offer higher biological diversity (exp. with large populations of endemic, relict and/or rare species).

Criteria are available as a separate document.

SHORT DESCRIPTION

GEOGRAPHY

Komovi Mountain is settled in eastern Montenegro. It is made of two well defined calcareous ridges. Eastern is Vasojevićki Kom (2480 m a.s.l.) and western is Kučki Kom (2484 m a.s.l.). Shale and sandstones make the base for large limestone masses over them. Contact zone between these two types of soils is rich in sources and small water flows. Curiosity is that some springs apear at 2000 m altitude. The limestone layers of the Komovi Mountain are not affected by karstification, resulting in not developed typical morphology of Dinaric karst. This is the reason why there are no speleological objects.

Mala rijeka River is the left tributary of Morača River, and their confluence is near the southern end of Platije Canyon. The geological structure of Mala rijeka Canyon is the similar to Platije and is made of limestone and dolomite. The Canyon is 11391 m long and 814 m deep. It is hardly accessible. During the summer the riverbed dries, water flows underground. During the autumn and winter it begins flash flood.

CLIMATE CONDITIONS

Komovi Mountain is the border zone between two clime types. Influences of the continental climate conditions come from NE, while Mediterranean climate conditions come from SW. This results in high average annual precipitation that is more than 2000 mm. Above 1800 m altitude alpine climate conditions prevail, but still with some influences of sub-Mediterranean.

Largest part of Mala rijeka Canyon has typical Mediterranean clime with warm and dry summers and humid, not very cold winters. Podgorica city, near the southern end of the canyon, has average annual temperature of air 15.5°C. Higher parts of the canyon has sub-Mediterranean climate conditions with little impact of alpine clime from nearby mountains Žijevo, Komovi, Prokletije.

BIOTA

VEGETATION

Forest belt reaches 1700-1800 m a.s.l. It is made of well developed beech forests, which are changed with coniferous forest at higher altitudes. Endemic pine species *Pinus heldreichii* makes different plant communities through the forests from 1500 until 2000 m a.s.l. At altitudes above the forest belt, open habitats are present, as alpine meadows and bare stones. 36 taxa are Dinaric or Balkan endems.

Vegetation and fauna of the Mala rijeka Canyon is similar to the same of Platije.

FAUNA

Faunistical investigations of Komovi Mountain were not been detailed. Several rare insect species were registered (*Libelula quadrimaculata, Aeshna juncea, Cordulia aenea, Somatochlora metalica Coenagrion hastulatum*). Herpetofauna is rich and consists of 5 amphibian and 9 reptilian species (*Bombinea variegarta scabra, Mesotriton alpestris, Rana graeca and Lacerta viridis* are endangered and protected species). Bird fauna consists of 97 species. Mammal fauna is not investigated, but according to the knowledge about fauna of surrounding areas, mammal specialists made one list with more than 30 species, mostly small mammals and bats.

SPELEOLOGICAL OBJECTS

As we noted in the aforesaid text, limestone on Komovi Mountain were not been under the influence of karstification. There are no typical karst formations. In the line with that, there are no speleological objects.

Mala rijeka Canyon is typical canyon originate from carves the riverbed through the Mesozoic limestone. Speleological objects are poor known. However, we expect that the situation is similar to that in Platije and Cijevna Canyons. Register of speleological objects (Environmental Protection Agency of Montenegro) does not content any data about speleological objects in Mala rijeka Canyon.

EVALUATION OF SPELEOLOGICAL OBJECTS ACCORDING TO THE CRITERIA

Evaluation is almost meaningless. KBA Komovi does not contents speleological objects, while there are no published data for Mala rijeka Canyon. We suppose that some speleological objects must be developed there. But we did not check it with field work.

DATA FOR THE STANDARD DATA FORM - SDF

The table is attached as an annex I at the end of the document. Criteria are scoring a value of the whole KBA area.

Representativity – D non-significant presence. As presence of cave habitat type is in question on this KBA, representativity is indicated in a fourth category, least valuable.

Conservation status and Global assessment could not be evaluated.

THREATS AND PRESSURES

Illegal forestry, wood processing, collecting of medicinal plants and punching forest roads are the major threats to the nature of Komovi Mn. Development of so-called ecotourism, followed with illegal construction and no wastewater treatment are also negative influences on the environment in the Komovi region. Mala rijeka Canyon is unreachable in it's most part. Through the lower part of the Canyon railway Bar – Beograd passes, and relatively near the border of the canyon highway is under the construction. These have some negative pressure on the ecosystem, but it is limited on last several kilometres of the canyon.

COMPARISON WITH OTHER KBAS

KBA Komovi and Mala rijeka Canyon has the lowest value regarding to the speleological objects, comparing with other regions, included in this project. Future investigations through the Canyon of Mala rijeka might give some positive results, as we expect that there must be some speleological objects.

CONCLUSIONS

KBA Komovi and Mala rijeka Canyon has no values as speleological region, especially if we compare it with other KBAs and ASCIs treated in this project. We suppose that some speleological objects must be developed through the canyon of Mala rijeka, because it is carved through the Mesozoic limestone.

REFERENCES:

Bešić, Z. 1969: Geologija Crne Gore, knjiga II. Karst Crne Gore. – Zavod za geološka istraživanja Crne Gore, 304pp.

Bešić, Z. 1980: Geologija Crne Gore. Stratigrafija i facijalni sastav Crne Gore. – Crnogorska akademija nauka i umjetnosti. Posebna izdanja, knjiga IX. Odjeljenje prirodnih nauka, knjiga 8, 379pp.

Bešić, Z. 1983: Geologija Crne Gore. Geotektonika i paleogeografija Crne Gore. – Crnogorska akademija nauka i umjetnosti. Posebna izdanja, knjiga XVI. Odjeljenje prirodnih nauka, knjiga 10, 212pp.

Culver D.C. and White W.B. (Eds.) 2005: Encyclopedia of Caves. - Elsevier Academic Press, 662pp.

Cvijić, J. 1994: Glacijacija na balkanskim planinama. – Sabrana dela Jovana Cvijića, knjiga 10. Srpska akademija nauka i umjetnosti, Zavod za udžbenike i nastavna sredstva, Beograd, 231pp.

Environmental Protection Agency: Registry of speleological objects, excel document, available for download at www.epa.me.

Glavni grad Podgorica, 2014: Prostorno-urbanistički plan Glavnog grada Podgorica do 2025. godine. – Urbi Montenegro, Urbanistički institut Republike Slovenije, WINsoft Podgorica, 488 pp.

Karaman M. 2018: Establishment of criteria for cave selection as a part of the future network of Natura2000 habitats. - Part of the IPA Project "Establishment of NATURA 2000 network" in Montenegro.

Natura 2000, Standard Data Form. Explanatory Notes, 32 pp.

Petrović D. (Ed.) 2009: Important Plant Areas in Montenegro – IPA Programme. – NU Zelena Gora, Podgorica, 79 pp.

Republički zavod za urbanizam i projektovanje, 2009: Prostorni plan posebne namjene "Bjelasica i Komovi". – Ministarstvo za ekonomski razvoj Crne Gore, 403 pp.

Zavod za zaštitu prirode Crne Gore, 2013: Studija zaštite za zaštićeno prirodno dobro – Regionalni park "Komovi". – Glavni grad Podgorica, Opštine Kolašin i Andrijevica, 140 pp.

Annex I

3. ECOLOGICAL INFORMATION for KBA Komovi and Mala rijeka Canyon.

3.1 Habitat types present on the site and site evaluation for them:

Annex I Habitata types						Site assessment			
Code	PF	NP	Cover (ha)	Caves (number)	Data quality	AIBICID	AIBIC		
						Representativity	Relative Surface	Conservation	Global
8310				/		D		/	/

PF: for the habitat types that can have a non-priority as well as a priority form (6210, 7130, 9430) enter „x“ in the column PF to indicate the priority form.
NP: in case that a habitat type no longer exists in the site enter X (optional);
Cover: decimal values can be entered;
Caves: for habitat types 8310, 8330 (caves) enter the number of caves if estimated surface is not available;
Data quality: G – good (based on surveys); M-moderate (based on partial data with some extraplation); P – poor (rough estimation.

REPORT ON CAVE HABITAT TYPE

KBA Ćemovsko polje – Cijevna and

ASCI Cijevna Rijeka – canyon

Author: Dr Marko G. Karaman

Contributor: Miloš Pavićević

Date: 19. November 2018.

INTRODUCTION

This report is one of outputs of the IPA project "Establishment of NATURA 2000 network in Montenegro". General goal of the project is to build foundations of the future Natura 2000 network in Montenegro. Activities covered by the project are besides capacity building extensive field mapping in preselected areas (so called Key Biodiversity Areas - KBAs) combined with comprehensive desktop research. Project areas (KBAs) are located mostly in the Alpine Biogeographical Region.

This report is an output of the caves inventory aiming to collect both speleological and biological data from the speleological objects located in KBAs and ASCIs incl. 2-3 km wide buffer zone. The inventory was focused only on the habitat type "8310 Caves not opened to the public" listed in the Annex I of the EU Habitats Directive.

According to experience from the establishment of NATURA 2000 network in Slovenia and Croatia, we prepared selection tailor made criteria to determine speleological objects that might be target habitat type in the future Natura 2000 sites in Montenegro. There are no species listed in Annex II of the EU Habitat Directive found in speleological objects in Montenegro. Therefore, selection is based on whether it is type locality for new species, endemic species, or relict and rare species. Further, preference is given to those objects that offer higher biological diversity (exp. with large populations of endemic, relict and/or rare species).

Criteria are available as a separate document.

SHORT DESCRIPTION

GEOGRAPHY

The region of the Cijevna River is refugium of rare, endemic and relict flora and fauna. Great biodiversity and landscape values classify the area to the group of the most attractive canyons in the Balkan region.

KBA Ćemovsko polje includes only small part of Ćemovsko polje field. KBA includes Northeastern part of the field at the foothill of Kakaricka Gora Hill. This hill continues into the higher massive where the crag of Cijevna River is located. KBA Ćemovsko polje is mostly flat land with springs of Ribnica River. There are no speleological objects inside the KBA borders.

River Cijevna originates from two rivers – Selcanska Cijevna and Vuklitska Cijevna with junction below the village Tamara (Albania). Total length of the Cijevna river is 58.8 km, with height drop/height difference of 1350 m. Length of the Canyon through the Montenegro, from the border of Albania, is 17 km. Than, the river goes over into the Ćemovsko polje. Here, the Canyon is sliced into the surface, forming several meters deep Canyon. At some points, it is wide 2 metres.

CLIMATE CONDITIONS

The Cijevna Canyon is under the strong influence of the Mediterranean climate. This influence comes from the Adriatic Sea through Bojana River and Skadar Lake. Continental climate prevails in upper parts in Albania. Precipitation is of Mediterranean type, about 2/3 is during the autumn and winter, while August has a lowest amount in the year.

During summer, temperature of water varies from 5°C at the spring, 12-13°C at the country border, and over the 20°C at the mouth to Morača River. Method of colouring of water proved the connection of Cijevna River with springs in the Eastern border of Zetska ravnica plain (Krevenica, Mileška vrela) and Northwestern border of Skadar Lake (Vitoja). The same method showed that water that sink at the end of the Canyon is in the connection with Ribnička vrela (springs of the Ribnica river) at the Northern border of Zetska ravnica plain (Ćemovsko polje KBA).

Calcareous and water permeable rocks allow seepage of a water. After leaving the Canyon and passing Zetska ravnica plain, Cijevna River has only occasional flow during the summer. It ends up in the Morača River only when higher level of water is in the stream (at least $5m^3/s$ in the mouth of the Canyon).

BIOTA

VEGETATION

Geographic position and a role as refugium for species, during the last Ice age, result in the great varieties of vegetation types. Presence of Glacial and Tertiary relicts is significant. Canyon was isolated area with favourable microclimate conditions during the last ice age, which supported an isolated populations of once more widespread species. These species are relict species, now.

The area hosts 813 species of flora. This represents 30% of the Montenegrin flora richness. More than 60 species are endemic for Balkan region or South-western Dinarides, and more than 50 are relicts. According to the Montenegrin Law, 24 species are protected and 50 more are suggested to be protected.

FAUNA

Only several animal groups are well investigated in the Canyon. Cijevna Canyon is important habitat for birds of pray and also as a part of the Adriatic bird migration corridor. Amphibian fauna is very rich, which we consider as an indicator of good state of the site. Reptiles and mammals are not investigated in detail as well as the fauna of invertebrates.

SPELEOLOGICAL OBJECTS

According to the Register of speleological objects, there are no speleological objects inside the KBA Cijevna Canyon or close to the border. There are many speleological objects north and West direction from Cijevna Canyon in the region of Kuči and Korita. These objects are in 4 km distance or even more the North direction.

Only one speleological object is found inside the Cijevna Canyon, but outside of the KBA border (1 km away). It is Mačija cave, located on the Northern cliffs at about 900 m altitude, near the village Selište. The cave was inventoried at 15th June 2018.

Cave Mačija (Mačija pećina), village Selišta: The opening is 5 m wide, with various heights from 1.5 to 2.3 m. It leads to the large hall with muddy ground. The stonewall was made in the entering part, 2 m from the opening. It is 80-100 cm height and 2.5 m length, half width of the hall. Some speleothems are developed here – stalagmites and stalactites. Both types are small in dimension, from several to not more than 20 cm height. Larger were probably damaged by visitors. From the muddy bottom, two roots protrude. They are alive and origin from the surrounding trees above the cave and around the entering.

The hall is slightly sloped down, 40 m long and 15 m wide. It leads to the narrow passage that connects the hall with another large hall. Total length of the object is 251 m, and 72 m deep (difference in altitude from opening till the end of the channels).

Surprisingly, the nest of one ant species *Lasius* sp. spreads along the one root. Other invertebrates recorded there are as follows:

Aranea - 4 specimens belonging to one species in the back part of the first hall;

Diplopoda - 2 species; one is *Apfelbeckia lendenfeldii* with one specimen, the second was not recognized

Isopoda - 1 species, 2 specimens, under the stones.

Opiliones - 1 species, several individuals, on stonewalls around the hall.

No cave crickets, no bats.

Krevenica speleological object, the only one object in the Northern part of Ćemovsko polje (4 km East from the KBA) was also investigated. Krevenica is a spring occurring only in rainy periods. During the summer, there is 15 m long dry part and permanent lake, which is 25 m long. The lake continues to the about 60 m long siphon. Because it is occasional spring, there is no invertebrate cave dwelling fauna. The water washes away any specimens that try to inhabit the dry part of the object. In the lake, no one *Bivalvia* species was found. We found only one species of Amphibians and one species of Pisces, but they are not underground species. The cave was inventoried at 23. June 2017.

EVALUATION OF CAVE OBJECTS ACCORDING TO THE CRITERIA

According to the criteria, there are no speleological objects that are habitats for species from the Annex list of Habitat Directive. There are no literature data about cave dwelling or other animals from speleological objects in the Cijevna Canyon or Ćemovsko polje field. We recorded several above noted Invertebrate species.

Known speleological objects have very different morphology. This could result in rich biodiversity, despite the low number of objects. Especially, because Cijevna Canyon was been refugium during the last Ice age.

DATA FOR THE STANDARD DATA FORM - SDF (chart 3.1 in the SDF)

The table is attached as an annex at the end of the document. Criteria are scoring a value of the whole KBA and ASCI area. We include our hypothesis that Cijevna Canyon contents much more speleological objects that are known till now.

Representativity: C significant representativity – Lowest value of representativity of KBA Cijevna and Ćemovsko polje is due to the small number of known speleological objects. The only known is Mačija pećina cave which is poor in morphology with common biodiversity.

Conservation status: B good conservation - Structure is well conserved and with threats and pressures that will not have significant influence.

Global assessment: C significant value – this is the lowest value. It is in line with above described representativity and conservation status.

THREATS AND PRESSURES

Thanks to its location at the border between Montenegro and Albania, region of Cijevna Canyon was forbidden area for public during the long period. Therefore, it was spared from significant negative anthropogenic influence. There are no industrial pollutants inside or near the Canyon. Only increasing local population have been influencing the area through the waste disposal, discharge of wastewater and by use of herbicides and pesticides in larger quantities. In lower part of the Cijevna River, gravel and sand mining has large negative influence, as well as urbanisation near the river bank.

The latest news is that in Albanian part of the Canyon, several mini hydropower plants are under the construction. Total number of planned mini hydro power plants is 14. Those are building contrary to the signed bilateral agreement, which obliges both sides to inform each other about every project that can influence the other country.

COMPARISON WITH OTHER KBAS

According to the known published data KBA Ćemovsko polje – Cijevna and ASCI Cijevna Rijeka – canyon has not significant value regards to the speleological objects, in compare with other regions of Montenegro. But geological history and current structure give us a reason to suppose that future investigations will determine Cijevna Canyon as much richer and more significant area concerning speleological and biospeleological diversity, not only in Montenegro.

CONCLUSIONS

It is supposed that there are more speleological objects in the Cijevna Canyon than listed in the Register of speleological objects (Environmental Protection Agency of

Montenegro). They are unknown because this region was a forbidden area during the long period. Another fact is that local people are reluctant to share information about speleological objects. They used them as shelters during the wars.

ANNEXES:

I. SDF – chart no 3.1

II. Map with overview of the caves in the area

KMZ file of speleological objects in the area

REFERENCES:

Bešić, Z. 1969: Geologija Crne Gore, knjiga II. Karst Crne Gore. – Zavod za geološka istraživanja Crne Gore, 304pp.

Bešić, Z. 1980: Geologija Crne Gore. Stratigrafija i facijalni sastav Crne Gore. – Crnogorska akademija nauka i umjetnosti. Posebna izdanja, knjiga IX. Odjeljenje prirodnih nauka, knjiga 8, 379pp.

Bešić, Z. 1983: Geologija Crne Gore. Geotektonika i paleogeografija Crne Gore. – Crnogorska akademija nauka i umjetnosti. Posebna izdanja, knjiga XVI. Odjeljenje prirodnih nauka, knjiga 10, 212pp.

Cvijić, J. 1994: Glacijacija na balkanskim planinama. – Sabrana dela Jovana Cvijića, knjiga 10. Srpska akademija nauka i umjetnosti, Zavod za udžbenike i nastavna sredstva, Beograd, 231pp.

CZIP, 2011: Studija zaštite kanjona Cijevne. – Centar za zaštitu i proučavanje ptica, Podgorica. 40pp.

Đurović, P. & Petrović A. 2007: Large canyons in Dinaric and Prokletije mountains region of Montenegro. – Geographica Pannonica, 11/2007, 14-18 pp

Glavni grad Podgorica, 2014 Prostorno-urbanistički plan Glavnog grada Podgorica, do 2025. godine. – URBI Podgorica, Montenegro, Urbanistički institut Republike Slovenije, WINsoft Podgorica, 488 pp.

Group of authors, 2011: Studija zaštitte kanjona Cijevne. – Centar za zaštitu i proučavanje ptica, Podgorica, 40pp.

Karaman M. 2018: Establishment of criteria for cave selection as a part of the future network of Natura2000 habitats. - Part of the IPA Project "Establishment of NATURA 2000 network" in Montenegro.

Marojević J. and Karakači V. (Coordinators) 2008: Održivi razvoj basena rijeke Cijevne, studija. – NU Green Home, Podgorica; Albanska Asocijacija za Ekološku Edukaciju; Fond za otvoreno društvo, predstavništvo u Crnoj Gori, 99pp.

Natura 2000, Standard Data Form. Explanatory Notes, 32 pp.

Petrović, D. (Ed.) 2009: Important Plant Areas (IPA) in Montenegro. Važna biljna staništa u Crnoj Gori. – NU Zelena Gora, Podgorica, 79pp.

ANNEX I

3. ECOLOGICAL INFORMATION

3.1 Habitat types present on the site and site evaluation for them:

Annex I Habitata types						Site assessment			
Code	PF	NP	Cover (ha)	Caves (number)	Data quality	AIBICID	AIBIC		
						Representativity	Relative Surface	Conservation	Global
8310				1	G	C		B	C

PF: for the habitat types that can have a non-priority as well as a priority form (6210, 7130, 9430) enter „x“ in the column PF to indicate the priority form.
NP: in case that a habitat type no longer exists in the site enter X (optional);
Cover: decimal values can be entered;
Caves: for habitat types 8310, 8330 (caves) enter the number of caves if estimated surface is not available;
Data quality: G – good (based on surveys); M-moderate (based on partial data with some extraplation); P – poor (rough estimation.

REPORT ON CAVE HABITAT TYPE

KBA **Durmitor and Tara Canyon**, ASCI Durmitor and valleys of rivers **Komarnica and Pridvorica**

Author: Dr Marko G. Karaman

Contributor: Miloš Pavićević

Date: 1. November 2018.

INTRODUCTION

This report is one of outputs of the IPA project "Establishment of NATURA 2000 network in Montenegro". General goal of the project is to build foundations of the future Natura 2000 network in Montenegro. Activities covered by the project are besides capacity building extensive field mapping in preselected areas (so called Key Biodiversity Areas - KBAs) combined with comprehensive desktop research. Project areas (KBAs) are located mostly in the Alpine Biogeographical Region.

This report is an output of the caves inventory aiming to collect both speleological and biological data from the speleological objects located in KBAs and ASCIs incl. 2-3 km wide buffer zone. The inventory was focused only on the habitat type "8310 Caves not opened to the public" listed in the Annex I of the EU Habitats Directive.

According to experience from the establishment of NATURA 2000 network in Slovenia and Croatia, we prepared selection tailor made criteria to determine speleological objects that might be target habitat type in the future Natura 2000 sites in Montenegro. There are no species listed in Annex II of the EU Habitat Directive found in speleological objects in Montenegro. Therefore, selection is based on whether it is type locality for new species, endemic species, or relict and rare species. Further, preference is given to those objects that offer higher biological diversity (exp. with large populations of endemic, relict and/or rare species).

Criteria are available as a separate document.

SHORT DESCRIPTION

GEOGRAPHY

Durmitor massive is bordered by Tara Canyon on the North, Komarnica and Pridvorica Canyons on the South and with Sinjavina on the East. Numerous canyons and streams cross the area. Many remarkable karst phenomena shape the landscape. A few dozen peaks higher than 2.000 m a.s.l. rise above plateaus, alpine meadows and forests. The highest is Bobotov kuk with 2.525 m a.s.l., and lowest part is downstream of confluence between Sušica and Tara rivers (515 m a.s.l.).

Dominant geological features are very thick, often savagely contorted limestone formations of the Middle and Upper Triassic, Upper Jurassic and Upper Cretaceous, though more recent rocks are also present. Durmitor flysch is a term used for tectonic layers inclined at an angle of 90°, present on several localities through the massif. Due to the

widespread of limestone, there are many pits, sinks, caves and other speleological objects. The largest sinks in which water disappears are Ponori and Klještina in Žabljak, abysses at the bottoms of glacial lakes and pit Simina pećina in Bare Žugića.

Tara Canyon is deepest canyon in Europe. Average deep is 1000 m, the deepest part about 1300 m. The Canyon is 78 km long and is incised in Triassic and Jurassic limestone.

Komarnica River is the most important tributary of Piva River. It is made of numerous springs located between southern peaks of Durmitor and Štit and Uvita greda on the North. Pridvorica River originates from several streams - Pošćanski potok, Šavnička glava, Bukovica and Bijela, near the Šavnik. It influences in Komarnica at 718 m altitude.

CLIMATE CONDITIONS

Due to the large diversity in relief and altitudes, climate conditions, especially microclimate, are also very diverse. Subalpine climate is dominant till 1200 m a.s.l. Alpine climate conditions are prevailing above this altitude. Both types of climate have long cold winters with large quantities of snow, and short and fresh summer. Autumn is warmer than spring.

Between 1949 and 1991, the average temperature in Žabljak was 4.7°C. Average annual temperature in Tara Canyon is 6-8°C. Average precipitation is 1450 mm.

BIOTA

VEGETATION

Five types of main biotopes are present on Durmitor massif: Alpine meadows and rocky grounds, biotope of stones and cliffs, biotope of pine forests, biotope of deciduous forests and biotope of water bodies. Forest covers about 20% of the territory.

Canyons of Tara and Piva host endemic flora. Many of roughly 700 vascular plant species are floristically of Alpine and Alpine-arctic origin. On the southern slopes, especially in canyons some species of Sub-Mediterranean origin might be found. Overall, 37 endemic plant species are reported in the wider area and six specifically to Durmitor.

FAUNA

Mammal fauna consists of typical species for northern Montenegrin mountains [European rabbit (*Lepus Europeus*), deer (*Capreolus Capreolus*), chamois (*Rupicarpa rupicarpa*), wild boar (*Sus scrofa*), fox (*Vulpes vulpes*), brown bear (*Ursus agrostis*), wolf (*Canus lupus*), lynx (*Lynx lynx*), badger (*Meles meles*), and squirrel (*Scuridae*)].

Ornithofauna of Durmitor massif is one of the richest regarding species in Balkan Peninsula and also Europe. 163 bird species are recorded there including Tara Canyon. Most species are west-Palaearctic origin, but oro-Mediterranean and Mediterranean species are recorded, too. Herpetofauna and Ichtyofauna are well investigated and they are rich in biodiversity. Entomofauna is well known. Different groups were been intensely investigated during the 1980-1990. Results showed that 56 endemic species inhabit this area, most are endemic for Balkan, and five are endemics of Durmitor massif only. According to the

national legislation, six species of insects are protected (*Formica rufa* ant, two species of Coleoptera and three species of butterflies).

SPELEOLOGICAL OBJECTS

Durmitor massif is one of the most investigated areas in Montenegro. In the Register of speleological objects (from Environmental Protection Agency of Montenegro) 415 speleological objects are listed for Žabljak municipality. In Tara Canyon are more than 100 objects; on plateau Jezerska površ about 40, and other are in the mountain range. Most of them are pits.

On Surutka locality several pits are present, among them Jama na Vjetrenim brdima, 897 m deep and 4528 m long and it is one of the deepest on the Balkan. Other important speleological objects are Jama u Malom dolu pit (605 m deep, 1870 m long), Jamski system in northern Obručine (467 m deep, 2680 m long); Zelenovirska pećina cave (440 m long, 180 m deep). Whole locality "Surutka" with these four speleological objects is protected by national law as Special speleological reserve "Surutka".

In Tara Canyon, at Sedlena greda and Ranisava, in Škrke, on Prutaš, Planinica, in Todorov do, caves prevailed. On plateau Jezerska površ syphon caves prevailed, while in the rest of the area pits are the most numerous.

Below is a list of caves, mentioned in scientific papers, together with cave dwelling species collected in them.

Speleological object	Collected species
Pećina na Splavištu, Tara Canyon (Cave at Splavište)	**loc.typ.**: *Niphargus carcerarius* Karaman, 1988 *Troglophylus cavicola* (Kollar, 1833) Orthoptera *Troglophilus brevicauda* Chopard, 1934 *Seracamaurops* (Cordiamaurops) *fritschi* Besuchet, 1986
Arapova Pećina cave, Grabovica, Durmitor	**loc.typ.**: *Neobisium goldameirae* Ćurčić & Dimitrijević, 2002 *Troglophilus ovuliformis* Karny, 1907 Orthoptera *Troglophylus cavicola* (Kollar, 1833)
Crna jama pit (=Jama u Podu), Poda, Mala Crna Gora, Durmitor	**loc.typ.**: *Anthroherpon cecai* Njunjić et al. 2015; *Neobisum* sp. *Leonhardella antennaria antennaria* Apfelbeck, 1907
Čorda pećina cave and Pogorelica jama pit, Čvorov Bogaz, Durmitor	*Leonhardella antennaria antennaria* Apfelbeck, 1907
Dvogrlica pećina cave, Grabovica, Durmitor	*Troglophylus cavicola* (Kollar, 1833)
pećina Gornja Ališnica cave Godijelji, Durmitor;	**loc.typ.**: *Neobisium mendelssohni* Ćurčić & Ćurčić, 2002
Ledena pećina na Obloj glavi cave, Durmitor	**loc.typ.**: *Neotrechus hilfi grossi* Jeannel, 1928 **loc.typ.**: *Leonhardella antennaria antennaria* Apfelbeck, 1907

	Neotrechus suturalis
Pećina u Pleću cave, Tara Canyon, Pirlitor, Durmitor	**paratype**: *Neobisium goldameirae* Ćurčić & Dimitrijević, 2002 *Troglophylus cavicola* (Kollar, 1833)
Pećina pod Lipom cave, Komarnica, Durmitor	*Troglophilus ovuliformis* Karny, 1907
Small Cave Tara Canyon	*Troglophilus brevicauda* Chopard, 1934
Urdoj pećina cave, Durmitor, Vjetrena Greda	*Leonhardella antennaria antennaria* Apfelbeck, 1907
Vidi pećina cave, Durmitor, jama na Vjetrena Greda pit	*Obisium* sp.
Jama u Vjetrenim Brdima pit, Durmitor	**loc.typ.**: *Neobisium davidbengurioni* Ćurčić & Dimitrijević, 2002 *Trogulus banaticus* Avram, 1971 **loc.typ.**: *Tartariella durmitoriensis durmitoriensis* Nonveiller & Pavićević, 1999 **loc.typ.**: *Adriaphaenops zupcense tartariensis* (Pavićević, 2001
Vodena pećina cave, Komarnica, Durmitor; **Nade pećina cave,** Vodeni Do, Komarski Gaj, Durmitor.	**loc.typ.**: *Neobisium bozidarcurcici* Dimitrijević, 2009 *Trogulus banaticus* Avram, 1971 *Troglophylus cavicola* (Kollar, 1833) **loc.typ.**: *Anthroherpon zariquieyi* Jeannel *Leonhardella antennaria brevis* Jeannel
Zelenovirska pećina cave, Zeleni Vir, Durmitor	*Anthroherpon cecai* *A. zariquieyi* *Leonhardella antennaria* *Tartariella durmitorensis* *Linopodes* sp. *Collembola* *Proasellus* sp. *Neobisium davidbengurioni* Ćurčić & Dimitrijević, 2002
Pećina u Zupcima cave, Zupci, Durmitor.	*Adriaphaenops zupcense zupcense* (Pavićević, 1990)

About 350 of 415 speleological objects in the official Register are pits registered by Polish speleologists in the last few years. These objects are small in size, from 1 m to 10 m deep, mostly. Less than 10% of them are deeper. I inserted on the map the largest objects of them (YF10, YF11, YF1-JVC etc), they are more than 100 m deep. YG20 – Bunda jama is 612 m long, and 283 m deep; YG2 in Gornja Ališnica is 2197 m long and 8 m deep; They are mentioned in the Register as pits, but according to their length and depth they should be mentioned as caves (if Polish speleologists fulfill correctly the Register).

The Register of speleological objects, made by Environmental protection Agency, does not contain geographical coordinates for most other speleological objects.

During the inventory, we visited three speleological objects in the KBA Durmitor and Tara Canyon: Arapova cave, Splavište cave and Small cave.

Cave Arapova pećina is in the region of Komarnica river, near the village Grabovica. It is 150 m long, without speleothems. Entrance opening is on the cliffs at the left side of the Komarnica river, in the mixed forest. Opening is 3 m high and 2.8 m wide. The channel gradually narrows and after 25 m, the man can pass crawling only.

Splavište cave is speleological object where spring Šljivarski potok come from. The opening is about 15 m wide and 1.5 to 2.5 m high. Main chamber is 20 m long and 15 m wide. It continues into syphon and flooded channel.

Small cave in the Tara Canyon is near the main road. It consist from one rounded chamber with diameter of about 25 m. Opening is large, so there is no totaly dark space inside the speleological object. Troglobite species could not inhabit this object, only troglophyle.

EVALUATION OF OBJECTS ACCORDING TO THE CRITERIA

According to the criteria, there are no speleological objects that are habitats for species from the Annex list of Habitat Directive. Several speleological objects meet some of established criteria.

According to the criteria **Jama u Vjetrenim Brdima, Vodena pećina**, **Nade pećina** and **Zelenovirska pećina** are most important speleological objects in KBA Durmitor and Tara canyon.

Seven speleological objects are type localities (locus typicus) for one or more species. **Jama u Vjetrenim Brdima** is locus typicus for three species.

Zelenovirska pećina is not type locality, but is the most reach in biodiversity, eight species register in it. According to criteria it has high total genetically biodiversity. There are several other objects that have high genetically biodiversity, also.

Some speleological objects have large population of endemic or rare species and it is one of established criteria.

Despite that the biodiversity of speleological objects on Durmitor massif is the best known, comparing with other regions of Montenegro, we still know fauna of cave dwelling species from less than 10% of speleological objects. In the line with large morphological variability of speleological objects, we expect that biodiversity of other objects are very rich, also.

DATA FOR THE STANDARD DATA FORM - SDF

The table is attached as an Annex I at the end of the document. Criteria are scoring a value of the whole KBA and ASCI area.

Excellent representativity **(A)** – speleological objects are very diverse in morphology (pits, caves, syphon caves, shafts), inside structure (stalagmites, stalactites and other

speleothems), in humidity from totally dry to totally wet or with subterranean groundwater flows.

Conservation status is excellent **(A)** – most objects are without any threat or anthropological influence.

Global assessment **(A)** – richness in morphological and biological diversity give excellent value in global importance to these speleological objects.

THREATS AND PRESSURES

Whole area is characterized with stagnant industry. Žabljak settlement is one of only four cities in Montenegro with wastewater treatment plant. But Tara flows through Mojkovac, Kolašin and other settlements throughout the Canyon where waste water directly inflows into Tara river. As there are no industry, the waste water consist mostly from communal water from houses, hotels and restaurants.

Remarkable infuence on landscape originate from stone mining on several localities (Njegovuđe), erosion in the Tara and Sušica canyons and landslides. Last 10 years, pressure on constructions of cottages and hotels is growing fast, even illegaly.

Pits and caves are mostly outside of interest of tourists. Others are relatively hard to reach, most of them are above 1800 m a.s.l. , located at the clifs or near the peaks. Anthropogenic influence is minimal or totaly absent. My opinion is that in the future the situation will be the same, most of the speleological objects will be outside of tourist interest. Exeptions might be several caves in Tara Canyon.

COMPARISON WITH OTHER KBAS.

KBA Durmitor and Tara Canyon, in line with published data, is the most important among those treated in this research. Similar significant, concerning speleological objects and their biodiversity, has KBA Maglić, ASCI rest of Piva Canyon and ASCI Bioč, Maglić, Volujak. We emphasize that many of known speleological objects in KBA Durmitor and Tara Canyon are not investigated in their biodiversity. According to our knowledge and experience KBA Prokletije will be added to these most important areas, after future detailed investigations of biodiversity.

CONCLUSIONS

KBA Durmitor and Tara Canyon with its tributaries belongs to the very important speleological areas in Montenegro. It has global importance both in biodiversity and in morphological diversity and karst phenomena. Several speleological objects belong to deepest or longest objects in Balkan. Biological diversity of more than 400 speleological objects is far from well investigated. Numerous new species were recorded there and we expect that number of new species for science or for the fauna of Montenegro will be result of the future field research.

ANNEX:

Annex I. SDF – Chart no 3.1

Annex II. Map with overview of the caves in the area.

REFERENCES:

Bešić, Z. 1969: Geologija Crne Gore, knjiga II. Karst Crne Gore. – Zavod za geološka istraživanja Crne Gore, 304pp.

Bešić, Z. 1980: Geologija Crne Gore. Stratigrafija i facijalni sastav Crne Gore. – Crnogorska akademija nauka i umjetnosti. Posebna izdanja, knjiga IX. Odjeljenje prirodnih nauka, knjiga 8, 379pp.

Bešić, Z. 1983: Geologija Crne Gore. Geotektonika i paleogeografija Crne Gore. – Crnogorska akademija nauka i umjetnosti. Posebna izdanja, knjiga XVI. Odjeljenje prirodnih nauka, knjiga 10, 212pp.

Culver D.C. and White W.B. (Eds.) 2005: Encyclopedia of Caves. - Elsevier Academic Press, 662pp.

Cvijić, J. 1994: Glacijacija na balkanskim planinama. – Sabrana dela Jovana Cvijića, knjiga 10. Srpska akademija nauka i umjetnosti, Zavod za udžbenike i nastavna sredstva, Beograd, 231pp.

Đurović, P. & Petrović A. 2007: Large canyons in Dinaric and Prokletije mountains region of Montenegro. – Geographica Pannonica, 11/2007, 14-18 pp.

Environmental Protection Agency: Registry of speleological objects, excel document, available for download at www.epa.me.

Karaman M. 2018: Establishment of criteria for cave selection as a part of the future network of Natura2000 habitats. - Part of the IPA Project "Establishment of NATURA 2000 network" in Montenegro.

Levin P. (Ed.) 2012: Prostorni plan posebne namjene Nacionalni park Durmitor. – Vlada Crne Gore, obrađivač: IBI Group i CAU Centar za planiranje i urbanizam, Podgorica. 190pp.

Natura 2000, Standard Data Form. Explanatory Notes, 32 pp.

Petrović, D. (Ed.) 2009: Important Plant Areas in Montenegro – IPA Programme. Važna biljna staništa u Crnoj Gori. – NU Zelena Gora, Podgorica, 79pp.

Pretner, E. 1977: Pregled podtemne faune koleoptera Crne Gore. - The Montenegrin Academy of Sciences and Arts, Glasnik of the section of natural Sciences, 2: 91-186.

Pretner, E. 2011 (posthumously): The contribution of Leo Weirather to the study of biospeleology, particularly in Yugoslavia, with his list of caves and above-ground collecting sites. – Beriche des naturwissenschaftlich-medizinischen Vereins in Innsbruck, 97: 85-234.

Stojčić Z. 2012: Strateška procjena uticaja na životnu sredinu za Prostorni plan posebne namjene za durmitorsko područje. - Vlada Crne Gore, obrađivač: IBI Group i CAU Centar za planiranje i urbanizam, Podgorica. 88pp.

Annex I.

3. ECOLOGICAL INFORMATION: KBA Durmitor and Tara Canyon, ASCI Durmitor and valleys of rivers Komarnica and Pridvorica

3.1 Habitat types present on the site and site evaluation for them:

Annex I Habitata types						Site assessment			
Code	PF	NP	Cover (ha)	Caves (number)	Data quality	AIBICID	AIBIC		
						Representativity	Relative Surface	Conservation	Global
8310				415	M	A		A	A

PF: for the habitat types that can have a non-priority as well as a priority form (6210, 7130, 9430) enter „x“ in the column PF to indicate the priority form.
NP: in case that a habitat type no longer exists in the site enter X (optional);
Cover: decimal values can be entered;
Caves: for habitat types 8310, 8330 (caves) enter the number of caves if estimated surface is not available;
Data quality: G – good (based on surveys); M-moderate (based on partial data with some extraplation); P – poor (rough estimation.

REPORT ON CAVE HABITAT TYPE

KBA **Hajla**

Author: Dr Marko G. Karaman

Contributor: Miloš Pavićević

Date: 10. November 2018.

INTRODUCTION

This report is one of outputs of the IPA project "Establishment of NATURA 2000 network in Montenegro". General goal of the project is to build foundations of the future Natura 2000 network in Montenegro. Activities covered by the project are besides capacity building extensive field mapping in preselected areas (so called Key Biodiversity Areas - KBAs) combined with comprehensive desktop research. Project areas (KBAs) are located mostly in the Alpine Biogeographical Region.

This report is an output of the caves inventory aiming to collect both speleological and biological data from the speleological objects located in KBAs and ASCIs incl. 2-3 km wide buffer zone. The inventory was focused only on the habitat type "8310 Caves not opened to the public" listed in the Annex I of the EU Habitats Directive.

According to experience from the establishment of NATURA 2000 network in Slovenia and Croatia, we prepared selection tailor made criteria to determine speleological objects that might be target habitat type in the future Natura 2000 sites in Montenegro. There are no species listed in Annex II of the EU Habitat Directive found in speleological objects in Montenegro. Therefore, selection is based on whether it is type locality for new species, endemic species, or relict and rare species. Further, preference is given to those objects that offer higher biological diversity (exp. with large populations of endemic, relict and/or rare species).

Criteria are available as a separate document.

SHORT DESCRIPTION

GEOGRAPHY

Hajla range is connected to Prokletije mountain range on its North part. It is 10 km long massif with peaks above 2000 m a.s.l.

Geological composition of range varies from limestone to volcanic silicates, which created a jagged relief and variety of formations. Limestone and volcanic silicates at higher altitudes are covered by soil and thus by a vegetation. The smaller part of Hajla is made of Palaeozoic shale, which is water impermeable. The border between these geological parts is rich in many water springs. The limestone under the 1200 m a.s.l. is porous and full of underground water courses.

CLIMATE CONDITIONS

Region of Rožaje municipality belongs to the moderate continental climate zone. In Rožaje, the average annual temperature is 7.5 °C. Precipitation average is 1072 mm. Hot and dry period is from June to September. The rest of the year cold and wet conditions prevail.

Moderate continental type of climate is mixed with subalpine at higher altitudes and turns into alpine climate conditions above 1200 m a.s.l. This type of climate is distinguished by long, cold winter with large quantity of snow, and short and fresh summer.

BIOTA

VEGETATION

Hajla range is suitable for unmixed and mixed forests of fir and beech, from 1200 till 1900 m a.s.l., and fir and spruce in higher altitudes. *Pinus peuce* – molika, Tertiary relict and endemic species of Central Balkan is dominant. At some parts of Hajla, populations of this species can be found at 1150 m a.s.l., but typical altitude is from 1500 to 2000 m a.s.l.

Above this belt of fir and spruce, forest is underbrush of *Pinus mugo*, from 1900 till 2200 m altitude. Highest regions of Hajla are covered with alpine meadows with *Vaccinium mirtyllus*.

FAUNA

Large forests and higher alpine grasslands are habitat for some mammal species which can be found on the other Montenegrin northern mountains, also (European rabbit (*Lepus Europeus*), deer (*Capreolus Capreolus*), chamois (*Rupicarpa rupicarpa*), fox (*Vulpes vulpes*), badger (Meles meles), while wolf and brown bear use them as a part of their larger living space).

We did not find any published data about invertebrates.

SPELEOLOGICAL OBJECTS

Register of speleological objects (Environmental Protection Agency of Montenegro) does not contain any object in Rožaje municipality. Hajla range is located in SE part of Rožaje municipality. In some cases speleological objects on some area are known, but not fulfilled in the Register. But, there are not known speleological objects inside or near the borders of KBA Hajla. One shepherd mentioned one pit near the top of the Hajla, without any more precise data about its size or other characteristics.

Nearest known speleological object is Ledena pećina cave, about 3 km northern from the KBA border. We investigated this object at 5th July 2018. It is small abyss with a little water flow. Mouth is about 3m wide and 2.7 m high. It leads to the channel with scarce speleothemes. The channel gradually narrows and after about 45 m it finishes with the hole into which water from the spring flows, but man cannot pass through. Several lateral channels are present, but they are very short, up to 2 m, only. Surprisingly, one species of Coleoptera is only invertebrates that we collected here. There are no Aranea, Opiliones, Diplopoda or cave crickets.

The most important speleological object in the region of Rožaje is Pećina u Dubokom potoku (Cave in the Deep spring), near the village Bijela Crkva, 4 km north from the Rožaje and 9 km from the border of KBA. This speleological object is locus typicus for two

Coleoptera species: *Rozajella jovanvladimiri* and *Serboduvalius gejzadunayi*. In the same object 8 other Invertebrate species were collcted, according to the literature data.

Below is a list of caves in Rožaje municipality, mentioned in scientific papers, together with collected cave dwelling species.

Speleological object	Collected species
Bezimena jama Šoljani village, 11.4 km from Rožaje to Peć	**loc.typ.** for *Fageiella ansiger* Deeleman-Reinhold, 1976 *Nonveilleriella ognjenovici* (Coleoptera)
Deljina pećina, Biševo village, Rožaje.	*Porrhomma pygmaeum convexum* (Westring)
Pećina u Dubokom Potoku, Bijela crkva village, Rožaje	*Arrhošalites principalis* Stach, 1945; *Megalothorax* sp.; *Heteromurus (Verhoeffiella) nitidus* (Templeton, 1835); *Heteromurus (Verhoeffiella) media* (Loksa et Blagojević, 1967); *Tomocerus* sp. (Collembola) *Neobisium umbratile* Beier, 1938 Pseudoscorpiones *Melogona broelemenni* (Verhoeff) Diplopoda **loc.typ.** for *Serboduvalius gejzadunayi* (Lohaj, Čeplik & lakota, 2013) **loc.typ.** for *Rozajella jovanvladimiri* Ćurčić, Brajković, Ćurčić and Waitzbauer *Brachydesmus* sp.

EVALUATION OF SPELEOLOGICAL OBJECTS ACCORDING TO THE CRITERIA

There are no speleological objects inside the KBA or less than one kilometer near the borders. If we consider broader area, there are three speleological objects, among them two are significant.

According to the criteria, there are no speleological objects that are habitats for species from the Annex list of Habitat Directive.

Two objects are type localities for new described species. Bezimena jama is type locality for one species, Pećina u Dubokom Potoku is type locality for two species.

The second one has high total genetically biodiversity. It is habitat for eight more cave dwelling invertebrate species. In first object, one more species was found. One species was found in the third object (Deljina pećina), also.

DATA FOR THE STANDARD DATA FORM - SDF (chart 3.1 in the SDF)

The table, attached as an Annex I at the end of the document, is related to the criteria applied to **WHOLE** Rožaje municipality. The criteria could not be applied on KBA Hajla because there are no speleological objects inside the KBA borders.

Explanation for the table:

REPRESENTATIVETY **(C)** – Significant representativity. Because there are only three caves, in compare with other richer regions, this one is ranking as significant representativity, only.

CONSERVATION **(B)** – Good conservation. Each of speleological objects is near the places with direct anthropological influence. We do not expect that objects will be endangered in the future, but this option is not totally exclude.

GLOBAL ASSESSMENT **(B)** – In spite that there are only two speleological objects, they are locus typicus for three species of cave dwelling invertebrates.

THREATS AND PRESSURES

Forestry, wood processing, collecting of medicinal plants, punching forest roads, winter tourism are the major threats to the nature of Hajla Mn. Illegal construction and no wastewater treatment are major negative influences on the environment in the Hajla broader region.

COMPARISON WITH OTHER KBAS.

KBA Hajla, according to the known data, is not significant area with respect to the speleological objects and their biodiversity. There are no published data about any speleological object inside the KBA Hajla and our field work confirm that.

CONCLUSIONS

True value of speleological objects on Hajla and surround area requires new investigations. We expect that Hajla must host several speleological objects. But their discovery needs field work with local guides. Hajla is not much differing geologically in compare with the main part of Prokletije massif. Having in mind that Prokletije has numerous speleological objects, many of them are still unexplored, we expect on Hajla massif more than one or two speleological objects. This region is at the border which was been forbidden area for a long time.

ANNEX II: Map with overview of the caves in the broader area of Hajla Mn.

REFERENCES:

Bešić, Z. 1969: Geologija Crne Gore, knjiga II. Karst Crne Gore. – Zavod za geološka istraživanja Crne Gore, 304pp.

Bešić, Z. 1980: Geologija Crne Gore. Stratigrafija i facijalni sastav Crne Gore. – Crnogorska akademija nauka i umjetnosti. Posebna izdanja, knjiga IX. Odjeljenje prirodnih nauka, knjiga 8, 379pp.

Bešić, Z. 1983: Geologija Crne Gore. Geotektonika i paleogeografija Crne Gore. – Crnogorska akademija nauka i umjetnosti. Posebna izdanja, knjiga XVI. Odjeljenje prirodnih nauka, knjiga 10, 212pp.

Cvijić, J. 1994: Glacijacija na balkanskim planinama. – Sabrana dela Jovana Cvijića, knjiga 10. Srpska akademija nauka i umjetnosti, Zavod za udžbenike i nastavna sredstva, Beograd, 231pp.

Čolović N. & Marković I. (Eds.) 2017: Lokalna studija lokacije Hajla i Štedim. – Opština Rožaje. Obrađivač plana: Arhedesign doo Rožaje, Juginus doo Beograd, 235pp.

Karaman M. 2018: Establishment of criteria for cave selection as a part of the future network of Natura2000 habitats. - Part of the IPA Project "Establishment of NATURA 2000 network" in Montenegro.

Natura 2000, Standard Data Form. Explanatory Notes, 32 pp.

Opština Rožaje, 2011: Prostorno urbanistički plan opštine Rožaje. - Urban Design Institute Rožaje. (partim) 44 pp.

Opština Rožaje, 2013: Strateški plan razvoja opštine Rožaje za period 2014-2020. godine. 130 pp.

Petrović D. (Ed.) 2009: Important Plant Areas in Montenegro – IPA Programme. – NU Zelena Gora, Podgorica, 79 pp.

Skenderović I. Human factors in biodiversity and ecosystem of Rozaje's side of Prokletije. - Academy of Sciences and Arts of Bosnia and Herzegovina. Special Editions CXLIX Department of Natural Sciences and Mathematics Proceedings 23, 73-88.

ANNEX I

3. ECOLOGICAL INFORMATION

3.1 Habitat types present on the site and site evaluation for them:

Annex I Habitata types						Site assessment			
Code	PF	NP	Cover (ha)	Caves (number)	Data quality	AIBICID	AIBIC		
						Representativity	Relative Surface	Conservation	Global
8310				2	G	C		B	B

PF: for the habitat types that can have a non-priority as well as a priority form (6210, 7130, 9430) enter „x“ in the column PF to indicate the priority form.
NP: in case that a habitat type no longer exists in the site enter X (optional);
Cover: decimal values can be entered;
Caves: for habitat types 8310, 8330 (caves) enter the number of caves if estimated surface is not available;
Data quality: G – good (based on surveys); M-moderate (based on partial data with some extraplation); P – poor (rough

REPORT ON CAVE HABITAT TYPE

KBA **Ljubišnja** and ASCI **Dolina Ćehotine**

Author: Dr Marko G. Karaman

Contributor: Miloš Pavićević

Date: 20. November 2018.

INTRODUCTION

This report is one of outputs of the IPA project "Establishment of NATURA 2000 network in Montenegro". General goal of the project is to build foundations of the future Natura 2000 network in Montenegro. Activities covered by the project are besides capacity building extensive field mapping in preselected areas (so called Key Biodiversity Areas - KBAs) combined with comprehensive desktop research. Project areas (KBAs) are located mostly in the Alpine Biogeographical Region.

This report is an output of the caves inventory aiming to collect both speleological and biological data from the speleological objects located in KBAs and ASCIs incl. 2-3 km wide buffer zone. The inventory was focused only on the habitat type "8310 Caves not opened to the public" listed in the Annex I of the EU Habitats Directive.

According to experience from the establishment of NATURA 2000 network in Slovenia and Croatia, we prepared selection tailor made criteria to determine speleological objects that might be target habitat type in the future Natura 2000 sites in Montenegro. There are no species listed in Annex II of the EU Habitat Directive found in speleological objects in Montenegro. Therefore, selection is based on whether it is type locality for new species, endemic species, or relict and rare species. Further, preference is given to those objects that offer higher biological diversity (exp. with large populations of endemic, relict and/or rare species).

Criteria are available as a separate document.

SHORT DESCRIPTION

GEOGRAPHY

Ćehotina valley is 80 km long and 25 km wide (max.). It is spread in NW-SE direction. It consists of many widenings (Maoče, Mataruge, Otilovići, Pljevlja, Brvenica, Glisnica, Fladevići and Gradac) accompanied by crags. Similar to the limestone in the Lim valley, limestone in Ćehotina valley and surrounding area is not typical Dinaric karst. Here, it is in shape of small, shallow layers, mixed with dolomite and cover with vegetation. Bellow these layers are water resistant substrates. This results in many small or larger streams in the area. Through these karst waters flows made narrow crags and some of them are spreading into the canyons.

Speleological objects are very rare in Trias limestone that is present on Ljubišnja. Ljubišnja is morphologically very simple mountain, spreads clearly in Dinaric (NW-SE) direction. The highest peak is at 2238 m a.s.l.

On SW sides of Ljubišnja, water flows out at the contact zone between limestone and water resistant layer and flows into Draga River. In major, underground water flows have NE direction and charge Ćehotina River.

CLIMATE CONDITION

Region Pljevlja municipality belongs to the continental climatic zone somewhat changed with alpine influences. Average annual temperature in Pljevlja is 8.2 °C. Precipitation average is 795 l/m^2. Precipitation is distributed relatively evenly during the year. Minimum is during the winter, maximum is during the summer. The main characteristic of clime regime in the Pljevlja is more than 80 fogy days during the year. But, fog is not usual on Ljubišnja and higher parts of Ćehotina valley.

BIOTA

VEGETATION

Similar to other Montenegrin mountains, Ljubišnja is rich in biodiversity. The most important biological data from Ljubišnja is habitat "Montenegrin spruce forests". These forests are developed in different ecological conditions comparing them with other spruce forests in Montenegro. Here, they are developed in separate layer 400-800 m wide. Besides spruce, there are beech forests and alpine meadows, also.

FAUNA

Typical species of mammal fauna of Montenegrin northern mountains are present. Ornithofauna, especially forest species, is rich, too. There are 11 species of Reptilia and 9 species of Amphibians. Data about invertebrates are insufficient.

SPELEOLOGICAL OBJECTS

According to the Register of speleological objects (Environmental Protection Agency of Montenegro), there are 43 speleological objects in the Pljevlja municipality. Most of them might be include in or near the borders of KBA Ljubišnja and Ćehotina River valley. But, no one has data about geographical coordinates. Some of the objects have data about length and depth, but other information is not available. Several maps that we found have marked some of mentioned speleological objects. Without field work we could not confirm presence of objects from the map exactly on specified location.

According to the literature data, only two caves and one pit are mentioned. Below is the list of caves mentioned in scientific papers as localities where cave dwelling species were collected.

Speleological object	**Species**
Poglenica Cave, Bjeloševina, Pljevlja	*Troglophylus cavicola* (Kollar, 1833) *Troglophilus brevicauda* Chopard, 1934
Cave Mala Ledenica and pit	*Quedius (Raphirus) lateralis*

Ledednice, village Ledenice, Rudnica, Pljevlja	(Gravenhorst, 1802) *Dinotheranus (Parabemus) fossor* (Scopoli, 1771)

Poglenica cave is inside the ASCI Ćehotina valley borders. There is no data about morphology of the cave and without fieldwork we are not able to give more information about it. Village Rudnica is near the border of ASCI Ćehotina valley, about 3 km distance. In the Register are mentioned caves Lednice 2 (52 m long) and Lednice 3 (125 m long). One of them might be the cave Mala Ledenica mentioned in the literature. Pit Ledenice jama is not mentioned in the Register of speleological objects.

On the other side, speleological objects in the Register of speleological objects are on the Ljubišnja Mountain, mostly. But, without coordinates or field work we cannot give more information.

EVALUATION OF SPELEOLOGICAL OBJECTS ACCORDING TO THE CRITERIA

According to the criteria, there are no speleological objects that are habitats for species from the Annex list of Habitat Directive.

Published data did not cite any speleological object as type locality for cave dwelling invertebrate species. Based on my experience from previous field works I assume that some speleological objects have high genetically biodiversity, and some of them are habitats for rare species.

DATA FOR THE STANDARD DATA FORM - SDF (chart 3.1 in the SDF)

The table is attached as an annex at the end of this document. Criteria are applied regard to the data from the Register of speleological objects made in Environmental Protection Agency of Montenegro. According to given localities, most part of the speleological objects is inside or near the KBA Ljubišnja and ASCI Ćehotina River valley.

REPRESENTATIVETY **(B)** – Good representativity. Although we have data only about part of the objects, we suppose that this KBA and ASCI as whole has good representativity. About 1/3 are pits, others are caves. Whole area is rich in springs and underground water, and this must affect on speleological objects, too. Longest cave has 157 m length.

CONSERVATION **(B)** – Good conservation. Each of speleological objects is relatively near the places with direct anthropological influence. We do not expect that high number of objects will be endangered in the future, but this option is not totally excluded.

GLOBAL ASSESSMENT **(B)** – Although there are 43 registered speleological objects, scarce investigation of biodiversity does not give enough information about possibly presence of rare and endemic species. We expect that future investigation would change this ranking to A – excellent value in global assessment.

THREATS AND PRESSURES

Forestry, timber harvest and development of winter tourism are the major threats to the water flows, consequently for underground water and it might have negative impact for fauna in underground habitats. Illegal forestry is, in general, a challenge for Ljubišnja. The waste disposal in rural areas might have impact on speleological objects in Ćehotina valley.

COMPARISON WITH OTHER KBAS.

Biodiversity data from most of the objects in KBA Ljubišnja and ASCI Dolina Ćehotine are completely absent. Some of them are poor investigated, only. According to the published data, KBA Ljubišnja and ASCI Dolina Ćehotine have moderate importance with respect to known speleological objects and their biodiversity. Our experience and knowledge give us a reason to suppose that future investigation of biodiversity in speleological objects will improve importance of this region.

CONCLUSIONS

Scarce investigation of biodiversity in speleological objects does not give true image about richness of cave dwelling invertebrate fauna. There are no data about Ljubišnja underground fauna and data are also very scarce from Ćehotina valley. We can conclude that future investigation will give more importance of this region for cave dwelling invertebrate fauna. Thus, this report only indicates an importance of the site with a high potential.

REFERENCES:

Bešić, Z. 1969: Geologija Crne Gore, knjiga II. Karst Crne Gore. – Zavod za geološka istraživanja Crne Gore, 304pp.

Bešić, Z. 1980: Geologija Crne Gore. Stratigrafija i facijalni sastav Crne Gore. – Crnogorska akademija nauka i umjetnosti. Posebna izdanja, knjiga IX. Odjeljenje prirodnih nauka, knjiga 8, 379pp.

Bešić, Z. 1983: Geologija Crne Gore. Geotektonika i paleogeografija Crne Gore. – Crnogorska akademija nauka i umjetnosti. Posebna izdanja, knjiga XVI. Odjeljenje prirodnih nauka, knjiga 10, 212pp.

Culver D.C. and White W.B. (Eds.) 2005: Encyclopedia of Caves. - Elsevier Academic Press, 662pp.

Cvijić, J. 1994: Glacijacija na balkanskim planinama. – Sabrana dela Jovana Cvijića, knjiga 10. Srpska akademija nauka i umjetnosti, Zavod za udžbenike i nastavna sredstva, Beograd, 231pp.

Karaman M. (Ed.) 2013: Monitoring about biodiversity condition in 2012. Report. (Izvještaj monitoringa stanja biodiverziteta za 2012. godinu). – Environmental Protection Agency and Natural History Museum of Montenegro, Podgorica, 312 pp.

Karaman M. 2018: Establishment of criteria for cave selection as a part of the future network of Natura2000 habitats. - Part of the IPA Project "Establishment of NATURA 2000 network" in Montenegro.

Natura 2000, Standard Data Form. Explanatory Notes, 32 pp.

Petrović D. (Ed.) 2009: Important Plant Areas in Montenegro – IPA Programme. – NU Zelena Gora, Podgorica, 79 pp.

Smart Environmental Solution 2013: Strateška procjena uticaja na životnu sredinu detaljnog prostornog plana termoelektrana Pljevlja. - Ministarstvo održivog razvoja i turizma Crne Gore, 203 pp.

ANNEX I

3. ECOLOGICAL INFORMATION

3.1 Habitat types present on the site and site evaluation for them:

Annex I Habitata types						Site assessment			
Code	PF	NP	Cover (ha)	Caves (number)	Data quality	AIBICID	AIBIC		
						Representativity	Relative Surface	Conservation	Global
8310				43	P	B		B	B

PF: for the habitat types that can have a non-priority as well as a priority form (6210, 7130, 9430) enter „x“ in the column PF to indicate the priority form.
NP: in case that a habitat type no longer exists in the site enter X (optional);
Cover: decimal values can be entered;
Caves: for habitat types 8310, 8330 (caves) enter the number of caves if estimated surface is not available;
Data quality: G – good (based on surveys); M-moderate (based on partial data with some extraplation); P – poor (rough estimation.

REPORT ON CAVE HABITAT TYPE

KBA **Maglić**, ASCI rest of **Piva Canyon** and ASCI **Bioc, Maglić i Volujak**

Author: Dr Marko G. Karaman

Contributor: Miloš Pavićević

Date: 16. November 2018.

INTRODUCTION

This report is one of outputs of the IPA project "Establishment of NATURA 2000 network in Montenegro". General goal of the project is to build foundations of the future Natura 2000 network in Montenegro. Activities covered by the project are besides capacity building extensive field mapping in preselected areas (so called Key Biodiversity Areas - KBAs) combined with comprehensive desktop research. Project areas (KBAs) are located mostly in the Alpine Biogeographical Region.

This report is an output of the caves inventory aiming to collect both speleological and biological data from the speleological objects located in KBAs and ASCIs incl. 2-3 km wide buffer zone. The inventory was focused only on the habitat type "8310 Caves not opened to the public" listed in the Annex I of the EU Habitats Directive.

According to experience from the establishment of NATURA 2000 network in Slovenia and Croatia, we prepared selection tailor made criteria to determine speleological objects that might be target habitat type in the future Natura 2000 sites in Montenegro. There are no species listed in Annex II of the EU Habitat Directive found in speleological objects in Montenegro. Therefore, selection is based on whether it is type locality for new species, endemic species, or relict and rare species. Further, preference is given to those objects that offer higher biological diversity (exp. with large populations of endemic, relict and/or rare species).

Criteria are available as a separate document.

SHORT DESCRIPTION

GEOGRAPHY

In the north-western part of Montenegro are three mountains that make a unique geomorphologic and geological unit that belongs to drainage area of Piva River. This geological unit is Volujak Mn in broader sense and is made of Bioč, Maglić and Volujak. In Montenegro are whole mountain Bioč and NE parts of Maglić and Volujak. Other parts are in Bosnia and Hercegovina. The Piva River canyon is cuted between the mountains of Bioč, Maglič, Volujak on the west and Pivska planina on the east. It is 33 km long; deep up to 1.200 m. Canyon is used for the power station of Mratinje, built in 1975. After the dam, river Piva continues straight to the north, meets the Tara at Šćepan Polje and forms Drina River. Piva valley, including the canyon, is long about 50 km. It begins at locality Careva vrata, where Komarnica and Sinjac rivers make Piva River. The water cuts the limestone to form a valley. Thicknesses of limestone layer are somewhere only several meters until several hundred meters.

Bioč is tipycal Dinaric Mountain, the highest peak is Veliki Vitao at 2397 m a.s.l. It is located between Volujak Mn and Piva Lake, it continuous to Maglić to the North. The highest peak on Maglić is at 2386 m altitude. The highest peak Volujak is at 2336 m altitude.

Whole karst relief of highest regions is shaped with glacial erosion. The most part is made of Trias carbonate stones that content varietes of shale, sandstones and bedded tuff, also. The most significant plateaus are Vučevo and Mratinjska Gora on the west, and Pivska površ at the east. Slopes and foothills are rich in water, many springs are present and Carev Do is most important, it never dries up.

CLIMATE CONDITIONS

Average annual precipitation in Piva region varies from 1000 to 1900 mm. Summers are not very dried. The most part of the region is under the subalpine climate conditions, with influences of continental and maritime type, regard to locality.

The average annual air temperature in Plužine is 5.3 °C. The hottest month is august with average temperature of 14.3 °C, and the coldest is January with -3.8°C. At higher altitudes, above 2.000 m, average annual temperature is below zero and that areas have cold, alpine climate conditions.

BIOTA

VEGETATION

River valleys and deep canyons were been hosts for numerous relict species during the last Ice age. Total number of vascular species is estimated at about 1200. This is about 1/3 of Montenegrin flora. National legislation protects 274 species of them, 68 are from Bioč Mn. Forests cover nearly 50% of the area. Oak forests inhabit up to 1100 m altitude. Mixture forests of hornbeam and beech are settled from 500 m to 1600 m altitude. Along the Piva River and its tributaries, the fragments of wetland forests (forests of alder and white willow) and black pine forest can be found. Upper forest border is at 1600 m a.s.l. Above are alpine meadows and rocky grounds. Through the Piva canyon both, Mediterranean elements (wormwood - *Salvia officinalis* L..) and elements of the mountain climate, can be found. About 150 species of medicinal herbs and honey plants inhabit the area.

FAUNA

More detailed research of invertebrate fauna was been provided together with investigations through the Durmitor massif during the 1980-1990. Known entomofauna includes 49 species of Tipulidae, 95 species of Trichoptera, 138 species of Heteroptera, 75 species of Collembola, 260 species of Noctuidae, 130 species of Rhopalocera etc. Fauna of Mollusca in Piva Canyon contents about 50 known species. Herpetofauna is very rich. Trnovačko Lake alone is habitat for 14 species of reptilians and amphibians. Around 170 species of bird are resident in this area, notable species include black grouse (*Tetrao urogallus* L.), golden eagle (*Aquila chrysaetos*). Piva region is one of the few in Europe where you can see all 10 kinds of European woodpeckers. Mammal fauna consists of typical species for northern Montenegrin mountains. Several species of bats (Chiroptera) inhabit the area, also.

SPELEOLOGICAL OBJECTS

Piva is rich in speleological objects, because most part of territory is made of limestone. Large denivelation of limestone's masses caused that vertical speleological objects – pits and shafts - dominate, while caves are short and simple. Besides comprehensive investigations, there are still numerous unknown objects. Some of them require speleodiving.

Register of speleological objects (Environmental Protection Agency of Montenegro) contents 161 speleological objects on the territory of Plužine municipality. However, Register does not contain geographical coordinates, but according to the mentioned localities, most of them are inside or near the KBA Maglić, ASCI rest of Piva Canyon and ASCI Bioč, Maglić, Volujak. The largest speleological objects are pits Škala and Todorova jama, and cave system Tisa. Since we were not realized fieldwork in this KBA and ASCIs, I will present some literature descriptions here.

Pit Škala is most complex speleological object in Piva. Entrance is at 1550 m altitude, in locality Bešići, near Bobetin vrh. Investigated part of the pit is 498 m deep, but expectation is that it might be one of the deepest pits in Montenegro. Tisa (locality Tisov Do, Unač) speleological system consists of three caves, which are rich in speleothems. Total length of caves is 165 m, and they have many lateral channels.

Todorova jama pit is the deepest known object here, 618 m deep, and still is not investigated until end. Entrance is at the foothill of Bobetin vrh. This is a typical abyssal pit, with active hydrological flow.

Large vacillation of Piva Lake water level leads to the flushing of clay deposits through the limestone and decaying of ceilings at the end. In this way large pits formed.

As Register of speleological objects (Environmental Protection Agency of Montenegro) does not contains any geographical coordinate, we are not able to present localities of speleological objects on the map.

Below is a list of caves in Plužine municipality, mentioned in scientific papers, together with collected cave dwelling species.

Speleological object	Species
Gjorjo pećina cave, (Jama u Smrekovcu), west slopes of Bioč, 1900 m a.s.l.	**loc.typ.** for *Leonhardella (L.) montenegrina* Jeannel
Gorica pećina cave, east slopes of Ledenice Mn.	*Neotrechus suturalis suturalis* Schaufuss
Hadža pećina cave, locality Ljut, under the Kula Šejtan, Ledenice Mn, 1480m a.s.l.	**loc.typ.** for *Anillocharis tenuilimbatus* Jeannel *Anthroherpon matzenaueri matzenaueri* (Apfelbeck, 1907) *Leonardella (Victorella) roseni* (G. Muller)
Hava pećina, Ledenice	*Neotrechus suturalis suturalis* Schaufuss
Heta jama pit, Ledenice, Bijeli Dol, Ledenice	**loc.typ.** for *Blattochaeta hawelkai* Knirsch (1929)

Kostina pećina cave, Bajovo polje	**loc.typ.** for *Neobisium pluzinensis* Ćurčić, Rađa, Dimitrijević, Ćurčić, Ćurčić &Ilić, 2013
Lea pit and Leo cave, Manita Gora, above the katun Ravno, 1650 m a.s.l. (W of Piva monastery)	**loc.typ.** for *Leonardella (Victorella) roseni* (G. Muller) *Anthroherpon matzenaueri matzenaueri* (Apfelbeck, 1907) *Anillocharis tenuilimbatus* Jeannel
Lug pit, Maganik Mn, locality Riči vrh, Paukovići village, Koprivni do	*Neotrechus suturalis amplipennis* (J. Müller)
Ovdo pećina cave, locality Crtov Do (Sertov Do on the old Austrian maps) 5 km SW of Goransko, east slopes of Ledenice Mn.	*Anthroherpon matzenaueri matzenaueri* (Apfelbeck, 1907) *Blattochaeta hawelkai,* Knirsch (1929) *Leonardella (Victorella) roseni* (G. Muller)
Sniža pit, Suho Polje, Ledenice Mn., 1550 m a.s.l.	*Anthroherpon albanicum lemur* (Knirsch) *Leonardella (Victorella) roseni* (G. Muller)
Vela jama pit, Manita Gora, above the katun Ravno, 1660 m a.s.l.	*Anthroherpon albanicum lemur* (Knirsch) *Anthroherpon matzenaueri matzenaueri* (Apfelbeck, 1907)

EVALUATION OF SPELEOLOGICAL OBJECTS ACCORDING TO THE CRITERIA

According to the criteria, there are no speleological objects that are habitats for species from the Annex list of Habitat Directive. Several speleological objects meet some of established criteria.

According to the criteria Hadža pećina cave and Lea pit and Leo cave are the most important speleological objects in KBA Maglić, ASCI rest of Piva Canyon and ASCI Bioč, Maglić, Volujak.

Five speleological objects are type localities (locus typicus) for one species, each. Some of the speleological objects have great genetically biodiversity. Speleological objects, in general, have large ecological diversity.

All these data contribute to the great value of this KBA in respect to speleological objects.

DATA FOR THE STANDARD DATA FORM - SDF

The table is attached as an Annex I at the end of the document. Criteria are scoring a value of the whole KBA and ASCI area.

Excellent representativity **(A)** – speleological objects are very diverse in morphology (pits, caves, abyssal pits, syphon caves), inside structure (stalagmites, stalactites and other

speleothems), in humidity from totally dry to totally wet or with subterranean groundwater flows.

Conservation status is excellent **(A)** – most objects are without any threat or anthropological influence.

Global assessment has excellent value **(A)** – richness in morphological and biological diversity give global importance to these speleological objects.

THREATS AND PRESSURES

Stagnant industry characterized whole area. The waste disposal in rural areas might have impact on speleological objects directly or through the underground waters.

Pits and caves are mostly outside of interest of settlements and tourists. They are relatively hard to reach; most of them are above 1100 m a.s.l., located at the cliffs. Anthropogenic influence is minimal or totally absent on most of the territory.

Development of tourist infrastructure without properly treatment of wastewater might be the main anthropogenic influence in the future. Underground waters will endure first negative impacts.

COMPARISON WITH OTHER KBAS

Among treated territories in this Project, KBA Maglić, ASCI rest of Piva Canyon and ASCI Bioč, Maglić and Volujak are best investigated regard to the speleological objects, together with Durmitor massif. Diversity in structure and great biodiversity give to this region an important role as cave habitats as well as for Montenegro and for completely Dinaric karst.

These KBA and ASCIs have the great value for cave dwelling invertebrate fauna. Additionally future investigation of biodiversity will increase this value.

We could not rank which one of these three regions (KBA Durmitor and Tara Canyon; KBA Prokletije; KBA Maglić, ASCI rest of Piva Canyon and ASCI Bioč, Maglić, Volujak) has the greatest value. Each of them has global importance considering to speleological as well as biospeleological value.

CONCLUSIONS

KBA Maglić, ASCI rest of Piva Canyon and ASCI Bioč, Maglić and Volujak belongs to the very important speleological areas in Montenegro. It has global importance both in biodiversity and in morphological diversity and karst phenomena. Biological diversity is much less known compare to the speleological investigation. We expect that number of new species, for Montenegrin fauna or for science, will be result of the future field research.

REFERENCES:

Bešić, Z. 1969: Geologija Crne Gore, knjiga II. Karst Crne Gore. – Zavod za geološka istraživanja Crne Gore, 304pp.

Bešić, Z. 1980: Geologija Crne Gore. Stratigrafija i facijalni sastav Crne Gore. – Crnogorska akademija nauka i umjetnosti. Posebna izdanja, knjiga IX. Odjeljenje prirodnih nauka, knjiga 8, 379pp.

Bešić, Z. 1983: Geologija Crne Gore. Geotektonika i paleogeografija Crne Gore. – Crnogorska akademija nauka i umjetnosti. Posebna izdanja, knjiga XVI. Odjeljenje prirodnih nauka, knjiga 10, 212pp.

Cvijić, J. 1994: Glacijacija na balkanskim planinama. – Sabrana dela Jovana Cvijića, knjiga 10. Srpska akademija nauka i umjetnosti, Zavod za udžbenike i nastavna sredstva, Beograd, 231pp.

Culver D.C. and White W.B. (Eds.) 2005: Encyclopedia of Caves. - Elsevier Academic Press, 662pp.

Ćurčić B., Rađa T., Dimitrijević R., Ćurčić S., Ćurčić N. & Ilić B. 2013: Neobisium crucis n.sp. nd N. pluzinensis n.sp., two new cave-dwellers from Montenegro (Neobisiidae, Pseudoscorpiones). – Arch.Biol.Sci., Beograd, 65(3): 1261-1267.

Karaman M. 2018: Establishment of criteria for cave selection as a part of the future network of Natura2000 habitats. - Part of the IPA Project "Establishment of NATURA 2000 network" in Montenegro.

Lješević, M. 1972: Les cavernes dans le canon de Piva. - Glasnik republčkog zavoda za zaštitu prirode – prirodnjačkog muzeja, Titograd, 4, 1971 (1972): 147-155.

Natura 2000, Standard Data Form. Explanatory Notes, 32 pp.

Njunjić I., Perreau,M. & Pavićević D. 2015: Two new species of the genus *Anthroherpon* Reitter, 1889 from northern Montenegro with notes on the *„A. ganglbaueri*" species group (Coleoptera: Leiodidae: Leptodorini). – Zootaxa, 3915(3): 403-412.

Njunjić I., Schilthuizen M., Pavićević D. & Perreau M. 2017: Further clarifications to the systematics of the cave beetle genera *Remyella* and *Rozajella* (Coleoptera: Leiodidae: Cholevinae: Leptodorini). – Arthropod systematics and phylogeny, 75(1): 141-158.

Petrović D. (Ed.) 2009: Important Plant Areas in Montenegro – IPA Programme. – NU Zelena Gora, Podgorica, 79 pp.

Pretner, E. 2011 (posthumously): The contribution of Leo Weirather to the study of biospeleology, particularly in Yugoslavia, with his list of caves and above-ground collecting sites. – Beriche des naturwissenschaftlich-medizinischen Vereins in Innsbruck, 97: 85-234.

Zavod za zaštitu prirode Crne Gore, 2011: Studija zaštite za Regionalni park „Piva". Stručna podloga. - Zavod za zaštitu prirode Crne Gore, Podgorica i Opština Plužine, 126 pp.

ANNEX I

3. ECOLOGICAL INFORMATION

3.1 Habitat types present on the site and site evaluation for them:

Annex I Habitat types						Site assessment			
Code	PF	NP	Cover (ha)	Caves (number)	Data quality	AIBICID	AIBIC		
						Representativity	Relative Surface	Conservation	Global
8310				161	M	A		A	A

PF: for the habitat types that can have a non-priority as well as a priority form (6210, 7130, 9430) enter „x“ in the column PF to indicate the priority form.
NP: in case that a habitat type no longer exists in the site enter X (optional);
Cover: decimal values can be entered;
Caves: for habitat types 8310, 8330 (caves) enter the number of caves if estimated surface is not available;
Data quality: G – good (based on surveys); M-moderate (based on partial data with some extraplation); P – poor (rough estimation.

REPORT ON CAVE HABITAT TYPE – KBA **Moračke planine**

Author: Dr Marko G. Karaman

Contributor: Miloš Pavićević

Date: 25. November 2018.

INTRODUCTION

This report is one of outputs of the IPA project "Establishment of NATURA 2000 network in Montenegro". General goal of the project is to build foundations of the future Natura 2000 network in Montenegro. Activities covered by the project are besides capacity building extensive field mapping in preselected areas (so called Key Biodiversity Areas - KBAs) combined with comprehensive desktop research. Project areas (KBAs) are located mostly in the Alpine Biogeographical Region.

This report is an output of the caves inventory aiming to collect both speleological and biological data from the speleological objects located in KBAs and ASCIs incl. 2-3 km wide buffer zone. The inventory was focused only on the habitat type "8310 Caves not opened to the public" listed in the Annex I of the EU Habitats Directive.

According to experience from the establishment of NATURA 2000 network in Slovenia and Croatia, we prepared selection tailor made criteria to determine speleological objects that might be target habitat type in the future Natura 2000 sites in Montenegro. There are no species listed in Annex II of the EU Habitat Directive found in speleological objects in Montenegro. Therefore, selection is based on whether it is type locality for new species, endemic species, or relict and rare species. Further, preference is given to those objects that offer higher biological diversity (exp. with large populations of endemic, relict and/or rare species).

Criteria are available as a separate document.

SHORT DESCRIPTION

GEOGRAPHY

Moračke planine are a group of mountains and ridges that are encircled with wellhead and middle part of the Morača River flow, from the nort and east. This group of mounatins is consist of: Kapa Moračka (2226 m); Žurim (Veliki Žurim 2036 m; Mali Žurim 1962 m); Ilijin vrh (2051 m); Stožac (2141 m); Tali (Kule, 2063 m; Ruda glava, 2020 m); Lola (Veliki Zebalac, 2129 m); Lukanje Čelo (2049 m). Somewhat separate lays Maganik Mn with several almost equal peaks (Kokotov vrh - 2128 m; Međeđi vrh - 2139 m; Babin zub, 2119 m; Petrov vrh- 2123 m. Whole region is rich with meadow pastures, and farmers are present from spring to autumn in communities named "katuni".

Completely this region is typical Dinaric karst, made of thick layer of Mesozoic limestone (calcareous and dolomite). Large areas of limestone of considerable thickness and purity enabled the development of karstic process and formation of karst relief and made Maganik massif the stoniest mountain in Montenegro.

CLIMATE CONDITIONS

Through the region, three types of climate conditions interlace, regarding to locality. The most part of the region is under the continental and sub Alpine climate conditions, with influences of alpine and maritime types.

We did not find detailed values of average annual precipitation or air temperatures for localities through the region. According to the map of yearly precipitation in Montenegro, this area has average annual precipitation between 1750 mm at eastern parts until 2500 mm at south-western parts.

BIOTA

VEGETATION

Oak forests of *Quercetum trojanae* floristic community inhabit up to 1000 m altitude. It is mixed with agriculture economies and pastures. At higher altitudes, it traverses into *Ostryo-Quercetumpubescentis* and *Fagetum montanum* floristic types. The belt of mixed forest of beach and fir, isdeveloped from 700 until 1600 m a.s.l. On calcareous habitats, endemic pine (*Pinus heldreichii*) is widely present. Large parts above 1500 m a.s.l. are covered with meadows. The highest peaks, which are above 2000 m altitude, are covered with alpine meadows and clear limestone masses.

Forest communities are consists of about 220 plant species, and total number of plant species on this territory is about 2000. Balkan endems are about 20%.

FAUNA

Faunistical investigations of this area are very scarce. There are no published data which consolidate scattered data about different animal groups. The area is pretty large and diverse in morphology, climate conditions, vegetation, and only smaller localities were investigated in details. We suppose that fauna is similar of those at Sinjavina and Durmitor.

SPELEOLOGICAL OBJECTS

There are many speleological objects in the area. Most of them are pits and shifts, but several long caves are present, also. The largest object is Željezna jama (IRON DEEP M13), 3360 m long and 1156 m deep. The longest cave is Ledenica cave, 464 m long. However, small number is investigated in biodiversity. Those that were investigated have great biodiversity in cave dwelling invertebrate species.

Register of speleological objects (Environmental Protection Agency) divides the area between municipalities Nikšić, Kolašin, Šavnik and Danilovgrad. As most of the objects are fulfilled without geographical coordinates, we are not able to give neither precise list of speleological objects nor their total number.

Below is a list of caves that were mentioned in scientific papers as habitats for collected cave dwelling species, from KBA Moračke planine.

Speleological object	Species
Pit Alexander the Great jama, Konjič brdo, Kamenik planina, Prekornica	**loc.typ.** for *Acheroniotes mlejneki* Lohaj & lakota, 2010
Pit Čina jama, Zvornik, Žurim Mn	*Neotrechus suturalis suturalis* Schaufuss *Anthroherpon albanicum sydowi* (Zaroquiey)
Pit Borova jama, between Čukov vrh and chalet Markovićki Katun, 1300 m, Prekornica, Kamenik Mountain,	*Trogulus banaticus* Avram, 1971 *Acheroniotes mlejneki* Lohaj & lakota, 2010
Pit Kraj jama, Četov vrh on Zvornik, Žurimu, Štit, 2070 m a.s.l.	*Anthroherpon albanicum sydowi* (Zaroquiey)
Pit Lug jama, Riči vrh, Paukovići village, Koprivni do, Maganik Mn	*Neotrechus hilfi grossi* Jeannel, 1928 *Neotrechus suturalis amplipennis* (J. Müller) **loc.typ.** for *Anthroherpon latipenne punctipennis* Jeannel
Pit Maj jama, or Pječaljina jama on Zvornik, Žurim, 1970 m a.s.l.	*Anthroherpon albanicum sydowi* (Zaroquiey) *Anthroherpon matzenaueri taliensis (taliense)* (Zariquiey)
Pit Meka jama (Mika jama) Četov vrh Zvornik, Žurim, 2120 m a.s.l.	**loc.typ.** for *Anthroherpon albanicum sydowi* (Zaroquiey) *Anthroherpon matzenaueri taliensis (taliense)* (Zariquiey)
Pit Snežna jama, Jamski katun, Kamenik, Prekornica	*Acheroniotes mlejneki* Lohaj & lakota, 2010

EVALUATION OF SPELEOLOGICAL OBJECTS ACCORDING TO THE CRITERIA

According to the criteria, there are no speleological objects that are habitats for species from the Annex list of Habitat Directive.

Three objects are type localities for new described species (Pit Alexander the Great, Pit Meka jama and Pit Lug jama. Most of the investigated speleological objects have genetically biodiversity; they are habitats for more than one species. In general, speleological objects have large ecological diversity. They are habitats for rare or endemic species, also.

Speleological investigations were not been followed with biodiversity investigations. These speleological objects are different in morphology, environment, in their length, depth, altitude. We expect that future biological investigations will results in great biodiversity between of most speleological objects.

DATA FOR THE STANDARD DATA FORM - SDF (chart 3.1 in the SDF)

The table is attached as an Annex I at the end of the document. Criteria are scoring a value of the whole KBA and ASCI area.

Excellent representativity **(A)** – speleological objects are very diverse in morphology (pits, caves, syphon caves, shafts), inside structure (stalagmites, stalactites and other speleothems), in humidity from totally dry to totally wet or with subterranean groundwater flows.

Conservation status is excellent **(A)** – most objects are without any threat or anthropological influence.

Global assessment has good value **(B)** – this score is result that small part of the objects is biologically investigated. We expect that, in the future, richness in morphological and biological diversity will give excellent value (A) in global importance of these speleological objects.

THREATS AND PRESSURES

Illegal forestry, wood processing, collecting of medicinal plants and punching forest roads are the major threats to the nature of Moračke planine. Development of so-called ecotourism, followed with illegal construction and no wastewater treatment will have negative influences on the environment, especially near the water bodies, as some lakes and streams. Pits and caves are mostly outside of interest of settlements and of the main part of tourists. Speleological objects that are hard to reach are interesting for limited number of people, speleologists and scientists. They could not negatively influence on them. The biggest risks for these speleological objects are irresponsible collectors of rare cave dwelling animals.

COMPARISON WITH OTHER KBAS

The true value of the KBA Moračke planine, regarding to the speleological objects, can not be given without detailed investigations of biodiversity. According to the number of speleological objects and their morphology and environmental diversity, this KBA belongs to the most important areas that were treated in the Project. Now, we put it right after KBA Durmitor, KBA Prokletije and KBA Piva, Maglić.

CONCLUSIONS

Despite that biological diversity is far from well investigated, we can include this KBA in the group of the most important areas, treated in the Project, with respect to the speleological objects. We expect that number of new species for science or for the fauna of Montenegro will be result of the future field researches. The biggest challenge is that almost all objects are pits, hard reachable for ordinary scientists.

ANNEX II: Map with overview of the caves in the area.

REFERENCES:

Bešić, Z. 1969: Geologija Crne Gore, knjiga II. Karst Crne Gore. – Zavod za geološka istraživanja Crne Gore, 304pp.

Bešić, Z. 1980: Geologija Crne Gore. Stratigrafija i facijalni sastav Crne Gore. – Crnogorska akademija nauka i umjetnosti. Posebna izdanja, knjiga IX. Odjeljenje prirodnih nauka, knjiga 8, 379pp.

Bešić, Z. 1983: Geologija Crne Gore. Geotektonika i paleogeografija Crne Gore. – Crnogorska akademija nauka i umjetnosti. Posebna izdanja, knjiga XVI. Odjeljenje prirodnih nauka, knjiga 10, 212pp.

Culver D.C. and White W.B. (Eds.) 2005: Encyclopedia of Caves. - Elsevier Academic Press, 662pp.

Cvijić, J. 1994: Glacijacija na balkanskim planinama. – Sabrana dela Jovana Cvijića, knjiga 10. Srpska akademija nauka i umjetnosti, Zavod za udžbenike i nastavna sredstva, Beograd, 231pp.

Glavni grad Podgorica Prostorno-urbanistički plan Glavnog grada Podgorica, do 2025. godine. – URBI Podgorica, Urbanistički institut Republike Slovenije, 488 pp.

Glavni grad Podgorica, 2014: Prostorno-urbanistički plan Glavnog grada Podgorica do 2025. godine. – Urbi Montenegro, Urbanistički institut Republike Slovenije, WINsoft Podgorica, 488 pp.

Karaman M. 2018: Establishment of criteria for cave selection as a part of the future network of Natura2000 habitats. - Part of the IPA Project “Establishment of NATURA 2000 network” in Montenegro.

Natura 2000, Standard Data Form. Explanatory Notes, 32 pp.

Petrović, D. (Ed.) 2009: Important Plant Areas in Montenegro – IPA Programme. Važna biljna staništa u Crnoj Gori. – NU Zelena Gora, Podgorica, 79pp.

Opština Kolašin, 2011: Prostorno-urbanistički plan Kolašin 2011-2020. – LAMP i Opština Kolašin, 254 pp.

ANNEX I

3. ECOLOGICAL INFORMATION: **KBA Moračke planine**

3.1 Habitat types present on the site and site evaluation for them:

Annex I Habitata types						Site assessment			
Code	PF	NP	Cover (ha)	Caves (number)	Data quality	AIBICID	AIBIC		
						Representativity	Relative Surface	Conservation	Global
8310				> 50	P	A		A	B

PF: for the habitat types that can have a non-priority as well as a priority form (6210, 7130, 9430) enter „x“ in the column PF to indicate the priority form.
NP: in case that a habitat type no longer exists in the site enter X (optional);
Cover: decimal values can be entered;
Caves: for habitat types 8310, 8330 (caves) enter the number of caves if estimated surface is not available;
Data quality: G – good (based on surveys); M-moderate (based on partial data with some extraplation); P – poor (rough estimation.

REPORT ON CAVE HABITAT TYPE – **KBA PROKLETIJE**

and ASCI Dolina Lima

Author: Dr Marko G. Karaman

Contributor: Miloš Pavićević

Date: 1. November 2018.

INTRODUCTION

This report is one of outputs of the IPA project "Establishment of NATURA 2000 network in Montenegro". General goal of the project is to build foundations of the future Natura 2000 network in Montenegro. Activities covered by the project are besides capacity building extensive field mapping in preselected areas (so called Key Biodiversity Areas - KBAs) combined with comprehensive desktop research. Project areas (KBAs) are located mostly in the Alpine Biogeographical Region.

This report is an output of the caves inventory aiming to collect both speleological and biological data from the speleological objects located in KBAs and ASCIs incl. 2-3 km wide buffer zone. The inventory was focused only on the habitat type "8310 Caves not opened to the public" listed in the Annex I of the EU Habitats Directive.

According to experience from the establishment of NATURA 2000 network in Slovenia and Croatia, we prepared selection tailor made criteria to determine speleological objects that might be target habitat type in the future Natura 2000 sites in Montenegro. There are no species listed in Annex II of the EU Habitat Directive found in speleological objects in Montenegro. Therefore, selection is based on whether it is type locality for new species, endemic species, or relict and rare species. Further, preference is given to those objects that offer higher biological diversity (exp. with large populations of endemic, relict and/or rare species).

Criteria are available as a separate document.

As this report contents data about KBA Prokletije and ASCI Dolina Lima, which differ greatly from one another, each of them is separately presented in paragraphs Description, Speleological objects, Evaluation and Data for SDF.

SHORT DESCRIPTION OF GEOGRAPHY, GEOLOGY, CLIME, VEGETATION.

GEOGRAPHY

Whole Prokletije massif is composed of about 40 mountainous ranges with general orientation in SW-NE direction, so deviates from general orientation of Adriatic Dinarides (NW-SE). Present relief and appearance of major part of Prokletije massive is result of glacier treatment during the period of last ice age. In Europe, Prokletije was massive with the second greatest ice glaciers after the Alps (Cvijić, 1913).

Watercourses on the massive belong to the Adriatic and Black Sea basins. The most voluminous drain-away rivers are Cijevna and Drim for Adriatic and Lim for Black sea basin. Imposing hydrographical element of Prokletije are glacial lakes. Hridsko jezero Lake is the

largest, than Ropojansko (Čamerikino), Bjelajsko (Horolovačko, Avdijino) jezero and small lake on Vezirova Brada. At altitudes between 1745 and 1792 m a.s.l. at the border line with Albania, there are the system of six lakes named Buni i Jezerce. Typical kras springs are present in the Grlja valley, and most voluminous are Vrelo Savine vode (oko Skakavice) and Vrelo Vrulje. At the higher calcareous regions, underground watercourses are present in some speleological objects and they depends of precipitation. At some parts of their courses, rivers Vrulja and Dolja are undercurrents.

Prokletije Massive, as a part of Dinarides, lays mostly on calcareous substrate. It is known that, along with geological substrate, relief and clime, anthropogenic influence and a type of plant cover, lead to development of certain types of land. Various types of lands, in sense of physical and chemical characteristics as well as in fertility, on Plav's Prokletije massive are described in Fuštić & Đuretić, 2000.

LIM VALLEY: River Lim originates in broad Plav-Gusinje valley with linking of Grnčar and Vusanja rivers. Residents name that new formed river Luča River. Where glacier deposits congest riverbed it forms widening, named Plav Lake, located in the broad valley between the mountains Visitor and Prokletije Mn. Locals name watercourse that flows out from the Plav lake - Lim River. River Lim is 219 km long, and the Montenegrin part is 87 km. Than Lim River enter into Serbia. On the river coast lie several settlements, starting from the source: Plav, Brezojevica, Murino, Andrijevica, Berane and Bijelo Polje.

The river had cut its valley through diverse stones, diverse both in age and in constitution. Mostly, they consist of shale and sand. Limestone is not typical Dinaric karst. Here, it is in shape of small, shallow layers, mixed with dolomite and cover with vegetation. Bellow these layers are water resistant substrate. This results in many small or larger streams all around the area. Through these karst water flows made narrow crags and some of them are spreading into the canyons, not high or long, but easily recognizable in broad shale and sand terrain.

CLIMATE CONDITIONS

Climate in Prokletije massive has long and cold winters and short and fresh summers. But, southern slopes are under the influence of Mediterranean, and northern slopes under the influence of typical continental clime. Both types transit into subalpine with altitude. The peaks of Prokletije have annual precipitation of about 2000-2500 mm. Almost half of total precipitation falls during the period October-January. Average annual temperature in Plav is 8.6°C

LIM VALLEY: Climate characteristics in the valley belong to moderately continental with some influences of Mediterranean clime.

BIOTA

VEGETATION

According to the published literature data about high mountainous flora on Balkan Peninsula, Prokletije massive is richest Balkan's mountain, even richer than Pinda, Šarplanina, Rila and Pirin (Stevanović 1996). On the territory of National Park Prokletije grow about 1600 plant taxa, 50 species are endemic, sub-endemic and endangered. It is

almost half of Montenegrin flora, and about 1/5 of Balkan plant species. Considering to these data, Prokletije massive is one of European important biodiversity centres.

Vegetation is clearly separated to vertical zones – vegetation belts, from oak forests, as lowest, through beech, mixed beech-fir forests and spruce forests to alpine meadows and rocky peaks.

LIM VALLEY: several vegetation belts are present from the valley to the mountain peaks. Vegetation in the lowest zone along the river is made from trees and shrubs - alder (*Alnus* sp.), poplar (*Populus* sp.), willow (*Salix* sp.) etc. Higher vegetation zones are the same one as in other continental mountains in Montenegro, from deciduous oaks and maples, beech forests to evergreen spruce and pine forests and highest alpine meadows.

FAUNA

Similar fauna is present both at the mountains above the Lim valley and in the Prokletije massif. Large mammal fauna is typical for northern Montenegrin mountains. Small mammal fauna is not well known. Ornithofauna in Prokletije massif consists 163 species and it is about ¼ of European bird fauna.

Invertebrate fauna of Prokletije massife is not high endemic, except underground fauna. Some species are old tertiar, but some came here after the last ice age. Data about invertebrate fauna are very scarce. During the last decade, tendency is investigation of Albanian part of Prokletije. Various foreign scientists provide the investigation. There are more data about fauna of Albanian part of Prokletije, than of Montenegrin part. However, we can expect almost the same invertebrate fauna on both sides of Prokletije range. From the list of protected species by national legislation Prokletije inhabit *Rosalia alpina* (Coleoptera), *Osmoderma emerita* (Coleoptera), *Formica rufa* (Formicidae), *Parnasius apollo, Iphiclides podalirius* and *Papilio machaon* (Lepidoptera). We expect that Lim valley inhabit, both protected insects Coleoptera species - *Lucanus cervus* and *Oryctes nasicornis*.

The list of known cave dwelling species is given further in the text.

SPELEOLOGICAL OBJECTS

PROKLETIJE: Thanks to the calcareous substrate, there are numerous surface and underground typical forms of karst relief on Prokletije massif. Due to the pure traffic connections in the past, and vicinity of the Albanian border that was inaccessible zone for a long period, the area is very scanty investigated.

Certain number of speleological objects was discovered and partially investigated between two world wars. Next surveys were done in 1973, 1980 and 1988. They resulted in finding of entrances to the speleological objects without detailed inside investigation, both speleological and biospeleological. After 2006, more detailed and planned speleological investigation, including mapping and drawing of objects, was carried out. Mostly foreign investigators were realised these surveys (from Poland, Serbia, Slovakia, Checz etc.).

In the Register of speleological objects (Environmental Protection Agency of Montenegro), 71 objects are registered in the territory of Plav and Gusinje municipalities. There are 34 caves, and 37 pits and shifts. Polish speleologists recorded most of them (56).

Among the investigated objects, the longest one is Ledena jama pit, 1956 m long and 451 m deep. Cave Gigant is 296 m deep, and 1635 m long and is rich in speleothems. There

are two more speleological objects longer than 1000 (found on the Bjelić Mn as a part of Prokletije massif). Mostly, recorded caves are 20-30 m long. Because investigated part of those objects finished with mudslides or ice tampons, we suppose that the length of canals is in fact longer.

We investigate one pit Špela Korun. Opening is 3 m wide, than 5 m deep vertical channel follows, one narrow part of 1x0.5 m, and vertical channel 10 m deep that finishing with a bottom space 5x4 m. Bottom is fulfils with gravel and stones and we suppose that this material overwhelm the channel which is probably deeper.

The biospeleological investigations does not complement speleological one in the area. As the result, the cave dwelling fauna was only sporadically collected and investigated.

The list of speleological objects, from Prokletije KBA, that are filled in the official Register, is attached as the Annex I at the end of this report. There are several reasons why the Register does not include speleological objects mentioned in the scientific papers.

First reason is that the Register was founded in 2015., after the publishing results of biospeleological investigations in the scientific papers. Second reason is that the Register is fullfiled by speleologists mostly (not by biospeleologists). The filling of the Register is not obligate. Most biospeleologists would like to make access difficult out of fear from "predatory biospeleologists" who collect every possible specimen without any limit, or like to make it secret until they finish investigation.

We found that the Polish expedition was discovered deepest cave in Prokletije, in 2017. The newly discovered passages in the Mining cave (Rudarska pećina) are 696 m deep. However, the Register does not contents this speleological object.

DOLINA LIMA: There are several tenth speleological objects inside or near the ASCI Dolina Lima. Shallow calcareous layer conditions size and shape of speleological objects. Most of them are small and not ramous. Nevertheless, there are some exceptions. The longest cave in Montenegro is just in the valley of Lim River – Pećina nad Vražjim firovima (Đalovića pećina). Đalovića cave, 27 km long, decorated with various speleothems and with several lakes and various halls, has not yet been fully investigated. But, the project to open this cave to the public started and we exclude this object from further deliberation.

Register of speleological objects (environmental Protection Agency of Montenegro) contents the most of the known speleological objects, including data about their coordinates. We investigated three speleological objects that are inside or near the ASCI Dolina Lima.

Župan cave is 1160.6 m long and 22.5 m deep. It has two entrance openings, upper and lower, which are at 50 m distance. Both are about 3 m wide and 2 m high. The cave is without speleothemes inside the channels. The cave was inventoried at 21th June 2017.

Bracanovića cave is 218 m long. This cave has beautiful speleothemes – stalagmites, stalactites, fossil channels, one channel with water and one small lake. The cave was inventoried at 20th June 2017.

Đato is 85 m long cave. It is a spring cave with one main large chamber and spring inside the cave. The cave was inventoried at 21th June 2017.

During our investigation, we collected some cave dwelling invertebrate species. Definitive scientific results will be known after the determination, which is in the process.

Below are lists of caves mentioned in scientific papers as localities where cave dwelling species were collected, separately for KBA Prokletije and for ASCI Dolina Lima.

KBA PROKLETIJE

Speleological object	Collected species
Komad pećina (Komad cave)	*Anthroherpon* sp.
Duboka jama (Duboka pit)	**loc.typ.** for *Anthroherpon albanicum boschi;*
Gorniča jama	**loc.typ.** for *Macrochaetosoma bertiscea;*
Kriva jama, (other name is Špela Koruns)	**loc.typ.** for *Anthroherpon albanicum divergens;*
Kuna pećina (Kuna cave)	**loc.typ.** for *Anthroherpon albanicum muelleri*
Poda jama (Poda pit)	**loc.typ.** for *Anthroherpon albanicum winkleri*
Snijeg jama (Snow pit)	*Anthroherpon albanicum winkleri*
Stražne jama	*Anthroherpon albanicum winkleri*
Trzy Kopce pit	*Macrochaetosoma bertiscea*

ASCI DOLINA LIMA (investigated objects, only)

Speleological object	Collected species
Bracanovića pećina	**loc.typ.** for: *Blattochaeta remyi* (Jeannel, 1931)
Župan pećina	**loc.typ.** for: *Blattochaeta remyi* (Jeannel, 1931) *Neobisium remyi* Beier, 1939
Đato	**loc.typ.** for: *Rozajella deelemani* Perreau & Pavićević, 2008 *Porrhomma pygmaeum convexum* (Westring)

EVALUATION OF OBJECTS ACCORDING TO THE CRITERIA

PROKLETIJE: According to the criteria, there are no speleological objects that are habitats for species from the Annex list of Habitat Directive.

Five objects are type localities for new described species. Each of them is type locality for one species, only.

Other four speleological objects are habitats for one of cave dwelling invertebrate species. We expect that the most speleological objects have great genetically diversity, but scientists usually investigate and publish results about one invertebrate group, only. These speleological objects are habitats for rare and endemic species, also.

There are no descriptions of inside morphology of speleological objects, neither in the scientific papers, nor in the Register of speleological objects. Descriptions in the Register include depth and length, mostly.

DOLINA LIMA: No one species from the Annex list of Habitat Directive were not registered in speleological objects inside the ASCI Dolina Lima. Three objects are type localities for new

described species (Bracanovića cave, Župan cave and Đato cave). Bracanovića and Župan are type localities for the same new species for science. Author had collected the species in both objects and then he described the species for the first time. Župan and Đato caves are habitats for one more cave dwelling invertebrate species. As we described previously for Prokletije, we suppose that these speleological objects have richer biodiversity.

Biodiversity of most speleological-investigated objects is not known. We suppose that most of them are habitats for various caves dwelling species, and that future investigation will give many new data, probably about some endemic species. However, without fieldwork we cannot give the conclusion about their biodiversity.

DATA FOR THE STANDARD DATA FORM - SDF

KBA Prokletije and ASCI Dolina Lima

The tables is given at the end of this document. Criteria are scoring regard to both KBA Prokletije and ASCI Dolina Lima.

Excellent representativity (A) – speleological objects are very divers in morphology (pits, caves, syphon caves); inside structure (stalagmites, stalactites and other speleothems), in humidity from very dry to very wet or with subterranean groundwater flows. This results in different habitats inside the objects and richer biodiversity.

Conservation status – excellent (A) – most objects are without any threat or anthropological influence.

Representativity – Global (A) – richness in morphological and biological diversity give global importance to these speleological objects. There are numerous type localities and we expect that future investigations will establish more type localities that are new.

THREATS AND PRESSURES

PROKLETIJE: Speleological objects in Prokletije KBA are mainly above 1500 m altitude. That is the main reason why anthropogenic influence is minimal. Only objects that are near the summer residences (katuni) might be under the human pressure. It is usual to use shifts and pits as landfills. But, most of speleological objects are not used for that purpose. Potential negative impact might be a development of tourist infrastructure. Punching the roads, clearing trails for winter sports might open some of underground habitats. There are still no detailed plans for these activities, and we cannot suppose which of underground habitats might be endangered.

DOLINA LIMA: The waste disposal in rural areas might have impact on speleological objects directly or through the underground waters. There are no organized collection of waste in villages above the river valley. Illegal forestry and intentional fires of meadows for mushroom harvest might have great influence for underground waters.

COMPARISON WITH OTHER KBAS.

Speleological objects in KBA Prokletije, according to published data, has well importance for biodiversity of cave dwelling species. In the line with knowledge and experience, our and others, future investigations of biodiversity will increase value of this

KBA. Expectation is that speleological objects hide numerous new species for science, probably endemic. Large number of objects and their morohological diversity give same great importance of this KBA as have KBA Durmitor and Tara Canyon and KBA Maglić, ASCI rest of Piva Canyon and ASCI Bioc, Maglić i Volujak. We are sure that future investigations will prove it.

CONCLUSIONS

The most of speleological objects in the Prokletije KBA are at high altitudes and outside of the common footpaths. Pits dominate in number in compare with caves. For the most of the speleological objects physical characteristics are known – depth, length, inside temperature. Biospeleological investigations, although they are poor, gave very significant results. New species for science of Invertebrate were discovered. The common opinion among the biospeleologists is that the huge number of new invertebrate species for science can be expected in the future investigation.

The most of objects are outside of the anthropogenic influence in the meaning of pollution risk. The biggest risks for these speleological objects are irresponsible collectors of rare cave dwelling animals. The populations of animals in caves are small in number. In addition, when some collect most of the specimens from the one cave, the sustainability of that species is in danger. Especially, if that species are endemics and live in one or two speleological objects only.

There is the law about the protection of speleological objects, but it is implemented very poorly. The guard service is not adequate, the awareness of the local people about protection of rare animals in the caves is not high, does not even exist. The custom service is not trained to recognize rare biological material etc.

The main conclusion about speleological objects in KBA Prokletije and ASCI Dolina Lina is that they have global representativity regard the cave dwelling biodiversity, mostly. But, the diversity in geomorphology of speleological objects is important, also.

List of annexes

Annex I: SDF – chart 3.1

Annex II: List of caves from the Register of speleological objects, Environmental protection Agency, Montenegro

Annex II: Map with overview of the caves in the area with separate KMZ file.

REFERENCES:

Bešić, Z. 1969: Geologija Crne Gore, knjiga II. Karst Crne Gore. – Zavod za geološka istraživanja Crne Gore, 304pp.

Bešić, Z. 1980: Geologija Crne Gore. Stratigrafija i facijalni sastav Crne Gore. – Crnogorska akademija nauka i umjetnosti. Posebna izdanja, knjiga IX. Odjeljenje prirodnih nauka, knjiga 8, 379pp.

Bešić, Z. 1983: Geologija Crne Gore. Geotektonika i paleogeografija Crne Gore. – Crnogorska akademija nauka i umjetnosti. Posebna izdanja, knjiga XVI. Odjeljenje prirodnih nauka, knjiga 10, 212pp.

Cvijić, J. 1994: Glacijacija na balkanskim planinama. – Sabrana dela Jovana Cvijića, knjiga 10. Srpska akademija nauka i umjetnosti, Zavod za udžbenike i nastavna sredstva, Beograd, 231pp.

Culver D.C. and White W.B. (Eds.) 2005: Encyclopedia of Caves. - Elsevier Academic Press, 662pp.

Opština Berane: Izveštaj o strateškoj proceni uticaja na životnu sredinu prostorno-urbanističkog plana opštine Berane

Karaman M. 2018: Establishment of criteria for cave selection as a part of the future network of Natura2000 habitats. - Part of the IPA Project “Establishment of NATURA 2000 network” in Montenegro.

Natura 2000, Standard Data Form. Explanatory Notes, 32 pp.

Petrović, D. (Ed.) 2009: Važna biljna staništa u Crnoj Gori. – NU Zelena Gora, Podgorica, 79pp.

RZUP i CAU (Eds.) 2015: Prostorni plan posebne namjene. Nacionalni park Prokletije. – Ministarstvo održivog razvoja i turizma Crne Gore.

Republički zavod za zaštitu prirode, 2007: Studija opravdanosti proglašenja Prokletija nacionalnim parkom, 46pp.

Strateški plan razvoja opštine Berane za period 2012-2017. Godine. – Opština Berane, 2012. 150pp.

Strateški plan razvoja opštine Plav 2013-2017. – Opština Plav, USAID, 100pp.

Annex I

3. ECOLOGICAL INFORMATION - KBA Prokletije and ASCI Lim valley

3.1 Habitat types present on the site and site evaluation for them:

Annex I Habitata types						Site assessment			
Code	PF	NP	Cover (ha)	Caves (number)	Data quality	AIBICID	AIBIC		
						Representativity	Relative Surface	Conservation	Global
8310				> 70	M	A		A	A

PF: for the habitat types that can have a non-priority as well as a priority form (6210, 7130, 9430) enter „x“ in the column PF to indicate the priority form.
NP: in case that a habitat type no longer exists in the site enter X (optional);
Cover: decimal values can be entered;
Caves: for habitat types 8310, 8330 (caves) enter the number of caves if estimated surface is not available;
Data quality: G – good (based on surveys); M-moderate (based on partial data with some extraplation); P – poor (rough estimation.