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Diversity of Butterflies in the Zeta-Skadar Plain, Montenegro

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Abstract: The Balkan Peninsula is amongst the most important biodiversity hot-spots in Europe. Nevertheless, the diversity of butterflies in many areas in this region is still scarcely studied. The aim of our study was to assess the diversity of butterfly fauna in the Zeta-Skadar Plain, Montenegro. This is the first comprehensive study on the subject from this area. The study was conducted in 2012-2014 and covered the valleys of the Zeta and Morača Rivers. Seventy-six species of butterflies were recorded at 37 sampling sites. One species, *Pontia chloridice*, was recorded from Montenegro for the first time.

Key words: butterflies, diversity, Montenegro, Balkan Peninsula

Introduction

Butterfly fauna of European countries is rather comprehensively studied. Information about species richness is needed for detailed zoogeographical analysis and is a component of good management plans for the protection of the most endangered species. Nevertheless, there are still locations in Europe where species richness and distribution of these insects is scarcely studied (Van Swaay *et al.* 2010). Some of these regions are especially important in the zoogeographic context. The Balkan Peninsula is among the most important biodiversity hot-spots in Europe, but our knowledge about species composition and diversity of fauna in some of the Balkan countries is still insufficient and uneven. The fauna of some countries, especially those which recently have joined the EU, are well studied, while others, like Montenegro or Albania (Sijarić 1984, Płóciennik *et al.* 2009) need more thorough examinations to pinpoint the most critical diversity hot-spots. Such places may function as small scale (e.g. mountain ridges, river valleys) or large scale (e.g. the Balkan Peninsula in general) species repositories and can play an important role for preserving biodiversity of the whole continent (Urlich, Buszko 2005, Cuttelod *et al.* 2008, Koren, Lauš 2013). Unfortunately, the increasing anthropogenic pressure may result in degradation of many of these areas, as it has already happened in many Western European countries (Maes, van Dyck 2001, van Swaay *et al.* 2010). This situation might be influenced also by the economic situation of the regions and countries, where environmental protection system is still poorly developed (Cuttelod *et al.* 2008, Kędziora, Karg 2010). Thus, the comprehensive recognition of biodiversity in these countries should be considered as one of the priorities of the European environmental policy.

Despite the small surface area of Montenegro (13 812 km^2), its butterfly fauna is still insufficiently studied. The first studies date back to the beginning of the XX-th century (Rebel 1913). The detailed studies increased in the early 80^{-ies} of the XX-th century (Sijarić 1984), while recently only a few short notes concerning diversity of Lepidoptera in regions such as Biogradska Gora National Park (Beshkov 2004, Pabis 2007) or certain, mainly mountainous regions, were published (Koren, Lauš 2013, Varga 2014). Furthermore, some studies focused on a few targeted species only (Radović *et al*. 2008).

In contrast to most of the previous studies, our research focused on the valleys of Zeta and Morača Rivers, which are characterised by large variety of vegetation and, therefore, high diversity of habitats

(Stešević 2014). The aim of this study was to assess the diversity of butterflies along the rivers, down to the estuary at Skadar Lake. It is the first comprehensive evaluation of butterfly diversity in this part of Montenegro.

Materials and Methods

Study area

Montenegro is situated on the coast of the Adriatic Sea, east from Croatia and Bosnia and Herzegovina, south-west and north-west from Serbia, Albania and Kosovo (Cuttelod *et al.* 2008). Mountains and uplands cover more than 90% of the country. The Zeta-Skadar Plain is the only large lowland in Montenegro (with surface area of over 3000 km²). It is characterised by the presence of two river valleys. Zeta River crosses most of Montenegro and, just before Podgorica, flows into the bigger Morača River (Karaman, Beeton 1981). This watercourse forms the largest river valley in Montenegro and it is substantial for the development of agriculture and animal breeding. It is also characterised by high habitat heterogeneity (e.g. meadows, urban areas, oxbow lakes) with many areas barely influenced by human activities. This area also has rich floristic diversity and a variety of vegetation types (Stešević 2014).

Morača River flows into Lake Skadar: a huge reservoir of fresh water located in the southern part of the country (Radović *et al.* 2008). Morača and Zeta Rivers are the most important sources of water for the lake (about 62%). The geology of the area is relatively well known. Most of the area consists of Quaternary formations but in some areas Mesozoic rocks can be identified (Karaman, Beeton 1981).

Data collection and analyses

Data were collected between the summer of 2012 to the end of May 2014 at 37 sites located along the valleys of the Zeta and Morača Rivers as well as close to the Skadar Lake (Table 1). Each site was visited one – three times per year. Material was gathered with standard entomological net. The collected specimens were identified in the field or in the laboratory. We included also the information about the position of species in the IUCN Red List Category for Europe (IUCN) and species endemic to Europe, which are on the Targeted Species Lists (TSL).

Results

In total, 76 species of butterflies were found in the studied area. Five species were of the family Hesperiidae, three of Papilionidae, 15 of Pieridae,

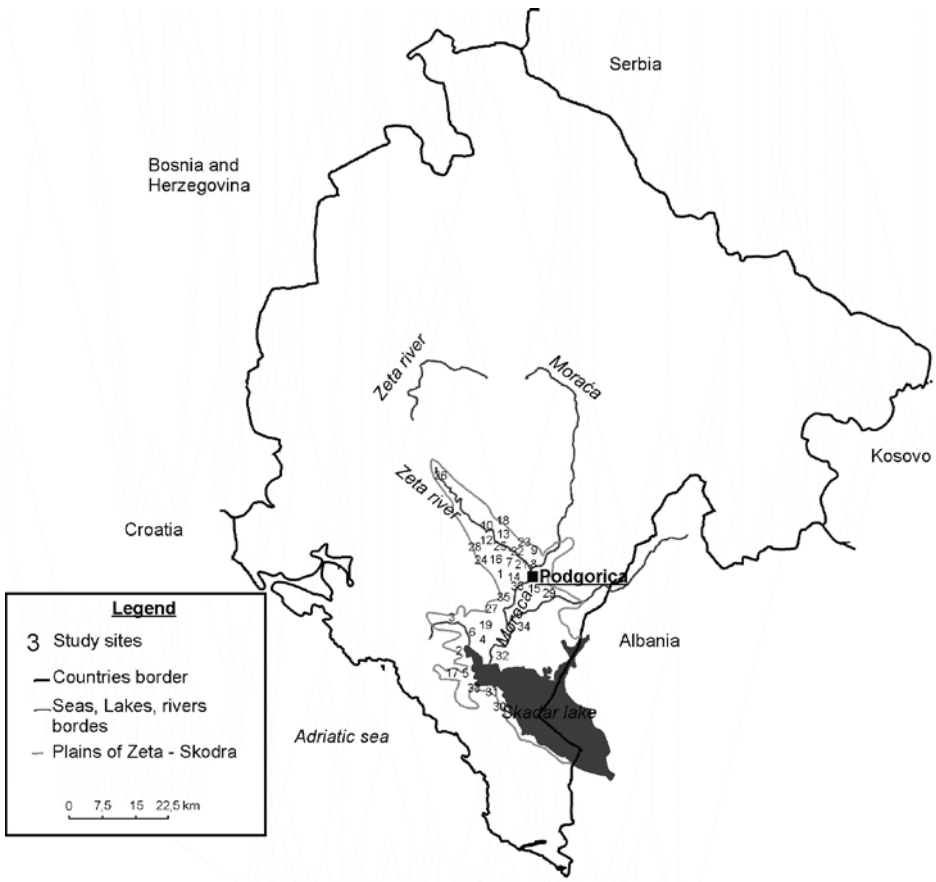

Fig. 1. Skadar Zeta plain with the indicated sampling sites

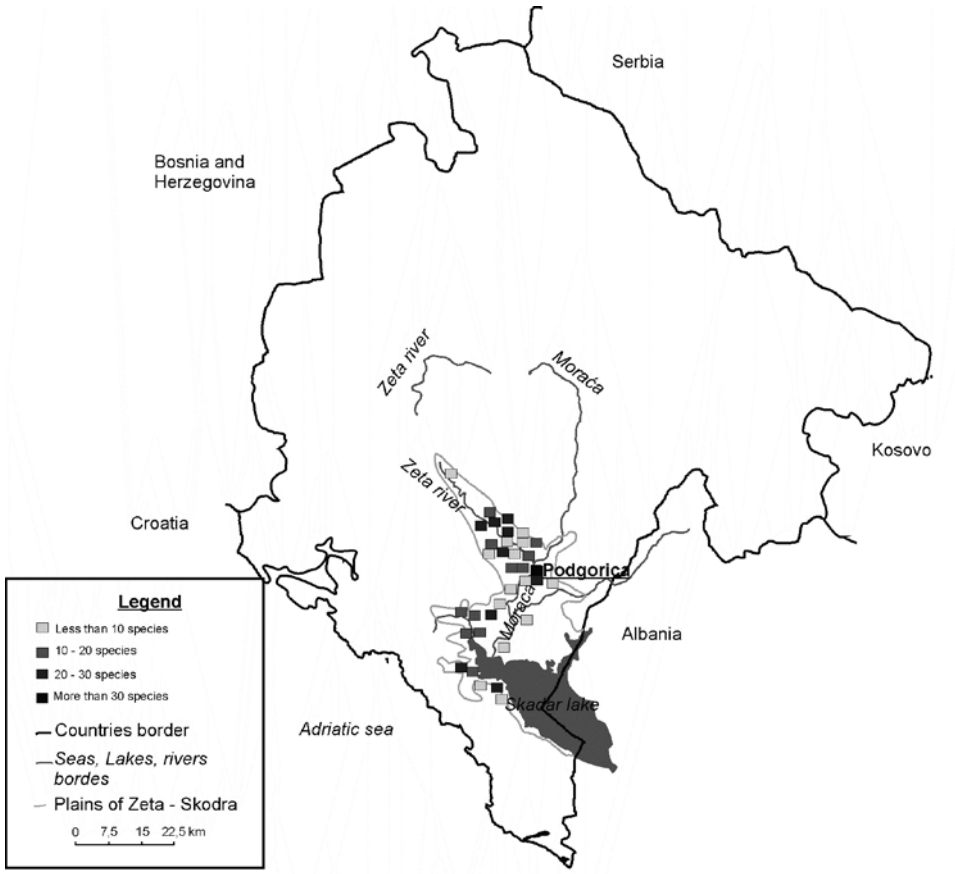

Fig. 2. Species richness of butterflies at each study sites

25 of Lycaenidae, 27 of Nymphalidae and one of Libytheidae. Among the most frequently reported species were *Aricia agestis* (21 locations), *Pieris napi* (22 locations), *Iphiclides podalirus* (22 locations), *Colias croceus* (22 locations), *Gonepteryx rhamni* (22 locations) and *Nymphalis antiopa* (25 locations). Most species of butterflies occurred at ten to 15 locations (Fig. 2). Some taxa were found from only one or a few areas. These represented mainly two families, i.e. Hesperiidae and Lycaenidae, but also a few species of the family Nymphalidae. Most of the collected species were included in the IUCN Red List Category for Europe: 72 species have the status of Least Concern (LC), three species have the status of Near Threatened (NT: *Iolana iolas*, *Pseudophilotes vicrama, Hipparchia fagi*), one species was classified as Vulnerable (VU: *Euphydryas maturna*), and one as Endangered (EN: *Phengaris arion*; Table 2).

Lycaena ottomanus and *Scolitantides orion* can be found also on the European List in the category LC and on the Targeted Species List. *Lyceana dispar* is on the Montenegrin Red List (LC/NT) and on the European Red List (LC). Furthermore, three important species represent the family Nymphalidae. *Euphydryas maturna* and *Euphydryas aurinia* are on the Targeted Species List and the European Red List. The first taxon is classified as VU and the second falls in the category LC. Another species of the same family, *Hipparchia fagi*, is on the European Red List and on the Montenegrin Red List in the category NT.

Pontia chloridice was recorded in Montenegro for the first time.

Discussion

The whole Mediterranean region is one of the most important biodiversity hot-spots in Europe. In this area, a number of smaller regions of high biodiversity are identified. The Balkan Peninsula is one of them (Cuttelod *et al.* 2008, Hewitt 2011, Koren, Lauš 2013, Apostolova 2014).

There is a lot of data on the occurrence and the distribution of butterflies from countries neighbouring to Montenegro. Seventy-six species reported during this study represent 47.5% from the total number of 160 species of butterflies previously reported from the whole Montenegro, including the mountainous habitats (Sijarić 1984, Sijarić *et al.* 1984, Jakšić 1988). Therefore, we could speculate that the Zeta-Skadar Plain is an area of high biodiversity.

Table 1. Names and coordinates of the study sites

Site	Sampling site	Co-ordinates	Alt. (m)
1	Podgorica area, village Bandići	42°48’36,06” N 19°15’41,03” E	35
2	Poseljani	42°30’66,44” N 19°05’15,83” E	29
3	Rijeka Crnojvića	42°35’53,59” N 19°02’03,21” E	12
4	Žabljak Crnojevića	42°31’98,26” N 19°15’75,22” E	14
5	Virpazar	42°25’03,68” N 19°06’27,06” E	20
6	Crmničko polje	42°21’92,42” N 19°06’84,86” E	11
7	Podgorica, village Daljam,	42°48’59,24” N 19°17’36,37” E	35
8	Podgorica	42°43’72,61” N 19°29’72,70” E	49
9	Podgorica, Piperi, near river Zete	42°48’30,93” N 19°24’31,84” E	43
10	Viš, near river Zeta Danilovgrad	42°62’24,02” N 19°04’23,32” E	46
11	Dobro polje Danilovgrad	42°63’04,91” N 19°03’26,92” E	48
12	Danilovgrad, Bjelopavlići, area„Glava Zete“	42°67’47,37” N 18°99’69,38”E	78
13	Danilovgrad, Bjelopavlići, Tunjevo	42°63’84,20” N 19°00’73,64” E	55
14	Podgorica, area Mareza	42°47’98,55” N 19°18’20,43” E	35
15	Podgorica region, Kuči, village Mosor	42°46’29,89” N 19°30’89,70” E	115
16	Village Zajčina	42°26’25,4”N 19°09’52”E	203
17	Village Dupilo near Virpazar	42°26’43,60” N 18°98’80,14” E	179
18	Danilovgrad, village Gornji Martinići,	42°55’53,74” N 19°19’32,41” E	189
19	Village Podostrog, area Bjelopavlići Danilovgrad,	42°22’50.15” N 19°07’65,03” E	263
20	Vransjskie Njive	42°28’12.30”N 19°15’9.42”E	49
21	Mareza	42°28’18.42”N 19°11’12.93”E	38
22	Spuž	42°30’51.87”N 19°12’10.86”E	48
23	Stream near Spuž	42°31’39.38”N 19°13’10.60”E	98
24	Well near Mokanje	42°27’59.79”N 19° 4’30.72”E	530
25	Ćurilac	42°32’3.01”N 19° 7’9.85”E	50
26	Ostrog	42°40’2.23”N 18°59’37.19”E	64
27	Lekići	42°23’17.01”N 19°11’39.08”E	17
28	Susica River	42°31’57.87”N 19° 5’27.22”E	57
29	Steppe, Tahiraj	42°24’23.24”N 19°19’39.05”E	75
30	Donij Murići	42° 9’31.49”N 19°12’49.16”E	20
31	Krnjice – Godinje - Virpazar		1 - 250
32	Vranjina	42°16’50.08”N 19° 8’26.04”E	3
33	Limljani	42°11’41.20”N 19° 6’15.28”E	407
34	Mahala	42°20’55.21”N 19°13’19.51”E	16
35	Goričani	42°20’11.45”N 19°12’45.65”E	10
36	Cypress forest, Podgorica	42°23’51.36”N 19°14’30.64”E	39
37	Bogićevići, river Zeta`s waterside	42°34’22.19”N 19° 4’59.59”E	42

Although Montenegro has relatively small surface area, the diversity of butterflies is high in comparison with Serbia (88 361 km^2 with 198 species) as well as Bosnia and Herzegovina (51 195 km^{2}with 189 species; Sijarić 1984, Lelo 2000, Jakšić 2008), or Albania (28 718 km^{2}with 196 species; Jakšić 2008, Płóciennik *et al.* 2009, Verovnik, Popović 2013).

Approximately 16% of all butterfly species living in Europe (Van Swaay *et al.* 2010) occur in the small area of Zeta-Skadar Plain. The diversity of this restricted lowland is comparable with the one of other confined areas, such as mountainous regions in the Balkan Peninsula, e.g. the Durmitor Mountains (Sijarić 1984, Koren, Lauš 2013), Biogradska Gora National Park (Tomic *et al.* 1990, Markovic 1991, Beshkov 2004, Pabis 2007) or Skadar Lake (Radović 2008, Verovnik 2013). Moreover, this region is connected with the area of Skadar Lake that is included in the list of the 431 European Prime Butterfly Fugitive Areas as an essential place for species conservation (van Swaay, Warren 2006). The high biodiversity of flora and vegetation types (Stešević 2014) presumably support a high diversity of butterflies in the Zeta-Skadar Plain. Not only it constitutes a perfect food base for caterpillars, but also creates a heterogeneous mosaic of habitats. Moreover, this area offers a variety of sheltered and isolated sites, which are particularly important for preserving of the butterfly fauna.

Montenegro, a candidate country for accession to the European Union, will bring a great natural wealth to the Union. Beforehand the authorities of the Montenegrin government have to introduce law regulations related to nature conservation (Ozinga, Schaminée 2005, Cuttelod *et al.* 2008, Van Swaay *et al.* 2010). The total population of European en-

Table 2. List of species with their distribution in the study area. (position of each species on the IUCN Species List and Targeted List is also given)

L.P	Species:	Study sites:	IUCN (Europe):	Targeted Species List:
Family Hesperiidae				
1.	*Carcharodus alceae* (Esper, 1780)	8, 21	LC	
2.	*Erynnis tages* (Linnaeus, 1758)	25, 28, 33	LC	
3.	*Gegenes pumilio* (Hoffmannsegg, 1804)	19	LC	
4.	*Pyrgus serratule* (Rambur, 1839)	34	LC	
5.	*Pyrgus sidae* (Esper, 1784)	19	LC	
6.	*Spialia orbifer* (Hübner, 1823)	34	LC	
Family Papilionidae				
7.	*Iphiclides podalirius* (Linnaeus, 1758)	**1**, **2**, **3**, **4**, **5**, **6**, **7**, **8**, **9**, **10**, **11**, **12**, **13**, **14**, **15**, **16**, **17**, **18**, **19**, **28**, **31**, **33**	LC	
8.	*Papilio machaon* (Linnaeus, 1758)	**1, 2, 3, 4, 7, 8, 9, 10, 13, 15, 16, 17, 21, 26, 28, 33, 34**	LC	
9.	*Zerynthia polyxena* (Denis & Schiffermüller, 1775)	**5**, **7**, **28**, **31**	LC	
Family Pieridae				
10.	*Anthocharis cardamines* (Linnaeus, 1758)	**4**, **5**, **6**, **7**, **8**, **9**, **10**, **11**, **12**, **13**, **14**, **15**, **16**, **17**, **18**, **31**, **32**, **33**	LC	
11.	*Aporia crataegi* (Linnaeus, 1758)	**16**, **17**, **18**, **19**, **31**	LC	
12.	*Colias crocea* (Fourcroy, 1785)	**1**, **2**, **3**, **4**, **5**, **6**, **7**, **8**, **9**, **10**, **11**, **12**, **13**, **14**, **15**, **16**, **17**, **18**, **19**, **21**, **30**, **37**	LC	
13.	*Colias erate* (Esper, 1805)	**8**, **27**	LC	
14.	*Euchloe ausonia* (Hübner, 1804)	**8**, **10**, **11**, **12**, **13**, **21**, **25**, **31**	LC	
15.	*Gonepteryx farinosa* (Zeller, 1847)	31	LC	
16.	*Gonepteryx rhamni* (Linnaeus, 1758)	**3**, **4**, **5**, **6**, **7**, **8**, **9**, **10**, **11**, **12**, **13, 14, 15**, **16**, **17**, **18**, **19**, **21**, **26**, **27**, **31**, **33**	LC	
17.	*Leptidea duponcheli* (Staudinger, 1871)	**5**, **6**, **7**, **31**	LC	
18.	*Leptidea sinapis* (Linnaeus, 1758)	**15**, **16**, **17**, **18**, **19**	LC	
19.	*Pieris brassicae* (Linnaeus, 1758)	**1**, **2**, **3, 4**, **5**, **6**, **7**, **8**, **9**, **11**, **15**, **16**, **17**, **18**, **19**, **31**	LC	
20.	*Pieris mannii* (Mayer, 1851)	**7**, **8**	LC	
21.	*Pieris napi* (Linnaeus, 1758)	**4**, **5**, **6**, **7**, **8**, **9**, **10**, **11**, **12**, **13**, **14**, **15**, **16**, **17**, **18**, **20**, **21**, **23**, **26**, **27**, **28**, **31**	LC	
22.	*Pieris rapae* (Linnaeus, 1758)	**5**, **7**, **8**, **9**, **10**, **22**, **24**, **25**, **26**, **27**, **28**, **30**, **37**	LC	
23.	*Pontia chloridice* (Hübner, 1813)	**6**, **7**, **8**, **9**, **10**, **11**, **12**, **15**	LC	
Family Lycaenidae				
24.	*Aricia agestis* (Denis & Schiffermüller, 1775)	**1**, **2**, **3**, **4**, **5**, **6**, **7**, **8, 9**, **10**, **16**, **17**, **18**, **19**, **29**, **31**, **33**, **34**, **35**, **36**, **37**	LC	
25.	*Callophrys rubi* (Linnaeus, 1758)	31	LC	
26.	*Celastrina argiolus* (Linnaeus, 1758)	8	LC	
27.	*Cupido argiades* (Pallas, 1771)	11	LC	
28.	*Glaucopsyche alexis* (Poda, 1775)	**8**, **31**, **35**	LC	x
29.	*Iolana iolas* (Ochsenheimer, 1816)	37	NT	
30.	*Lycaena dispar* (Haworth, 1802)	**18**, **19**	LC, LC/ NT (MN)	
31.	*Lycaena ottomanus* (Linnaeus, 1758)	28	LC	x
32.	*Lycaena phlaeas* (Linnaeus, 1761)	**8**, **18**, **19**, **21**, **25**, **27**, **28**, **30**, **33**, **37**	LC	
33.	*Phengaris arion* (Linnaeus, 1758)	**10**, **11**, **12**, **13**, **14**	EN	x
34.	*Plebejus argus* (Linnaeus, 1758)	**8**, **10**, **11**, **17**, **37**	LC	
35.	*Plebejus argyrognomon* (Bergsträsser, 1779)	10	LC	
36.	*Plebejus idas* (Linnaeus, 1761)	**16**, **17**, **18**, **19**, **37**	LC	

Table 2. Continued

L.P	Species:	Study sites:	IUCN (Europe):	Targeted Species List:
37.	*Polyommatus amandus* (Schneider, 1792)	**6**, **10**, **35**	LC	
38.	*Polyommatus coridon* (Poda, 1761)	3	LC	
39.	*Polyommatus escheri* (Hübner, 1823)	5	LC	
40.	*Polyommatus icarus* (Rottemburg, 1775)	**5**, **8**, **12**, **30**, **31**, **33**, **34**, **35**, **36**	LC	
41.	*Polyommatus thersites* (Cantener, 1835)	**11**, **37**	LC	
42.	*Pseudophilotes vicrama* (Moore, 1865)	**3**, **4**, **5**, **7**, **8**, **10**, **11, 12**, **13**, **35**, **37**	NT	x
43.	*Satyrium acaciae* (Fabricius, 1787)	**6**, **7**, **8**, **9**	LC	
44.	*Satyrium ilicis* (Esper, 1779)	**10**, **11**, **12**, **13**, **14**, **15**, **16**, **17**, **18**, **19**	LC	
45.	*Satyrium pruni* (Linnaeus, 1758)	**18**, **19**	LC	
46.	*Satyrium spini* (Denis & Schiffermüller, 1775)	16	LC	
47.	*Scolitantides orion* (Pallas ,1771)	**5**, **31**	LC	x
48.	*Tarucus balkanicus* (Freyer, 1844)	15	LC	
Family Nymphalidae				
49.	*Aglais io* (Linnaeus, 1758)	**7**, **10**, **11**, **12**, **13**, **14**, **15**, **16**, **17**, **18**, **19**, **21**, **22**, **25**	LC	
50.	*Aglais urticae* (Linnaeus, 1758)	**16**, **17**, **18**, **19**	LC	
51.	*Argynnis adippe* (Denis & Schiffermüller, 1775)	**13**, **14**, **15**, **16**, **17**	LC	
52.	*Argynnis paphia* (Linnaeus, 1758)	**4**, **8**	LC	
53.	*Brenthis hecate* (Denis & Schiffermüller, 1775)	14	LC	
54.	*Brintesia circe* (Fabricius, 1775)	**15**, **16**, **17**, **18**, **19**	LC	
55.	*Coenonympha pamphilus* (Linnaeus, 1758)	**8**, **28**, **29**, **31**, **34**, **35**, **36**, **37**	LC	
56.	*Erebia ligea* (Linnaeus, 1758)	**11**, **12**, **15**, **16**, **17**	LC	
57.	*Euphydryas aurinia* (Rottemburg, 1775)	**1**, **2**, **3**, **4**, **8**, **9**, **10**, **11**, **12**, **13**, **14**, **15**, **16**, **17**, **19**, **37**	LC	x
58.	*Euphydryas maturna* (Linnaeus, 1758)	**18**, **19**	VU, VU (MN)	x
59.	*Hipparchia fagi* (Scopoli, 1763)	**5**, **6**, **7**, **8**, **9**, **10**, **11**, **12**, **13**, **14**, **15**, **16**, **17**, **18**, **19**	NT, NT(MN)	
60.	*Issoria lathonia* (Linnaeus, 1758)	**1**, **8**, **21**, **28**	LC	
61.	*Lasiommata megera* (Linnaeus, 1764)	**3**, **20**, **30**, **31**	LC	
62.	*Limenitis reducta* (Staudinger, 1901)	**6**, **7**, **8**, **9**, **10**, **11**, **12**, **13**, **14**, **15**, **16**, **17**, **18**, **19**, **31**	LC	
63.	*Maniola jurtina* (Linnaeus, 1758)	**12**, **16**, **17, 18**, **19**, **35**, **37**	LC	
64.	*Melanargia galathea* (Linnaeus, 1758)	**1**, **2**, **3**, **4**, **5**, **11**, **12**, **13**, **14**, **15**, **16**, **17**	LC	
65.	*Melitaea cinxia* (Linnaeus, 1758)	**8**, **9**, **10**, **11**, **12**, **13**, **14**, **15**, **16**, **17**, **18**, **31**	LC	
66.	*Melitaea didyma* (Esper, 1779)	**10**, **15**, **16**	**LC**	
67.	*Melitaea phoebe* (Denis & Schiffermüller, 1775)	37	LC	
68.	*Melitaea trivia* (Denis & Schiffermüller, 1775)	31	LC	
69.	*Nymphalis antiopa* (Linnaeus, 1758)	**1**, **2**, **3**, **4**, **5**, **6**, **7**, **8**, **9**, **10**, **11**, **12**, **13**, **14**, **15**, **16**, **17**, **18**, **19**, **21**, **24**, **26**, **28**, **31**, **32**	LC	
70.	*Nymphalis polychloros* (Linnaeus, 1758)	**4**, **5**, **6**, **7**, **8**, **10**, **11**, **12**, **13**, **15**, **16**, **17**, **18**, **19**, **20**, **21**, **22**, **24**, **25**, **26**	LC	
71.	*Pararge aegeria* (Linnaeus, 1758)	**7**, **8**, **32**	LC	
72.	*Polygonia c-album* (Linnaeus, 1758)	**19**, **25**	LC	
73.	*Polygonia egea* (Cramer, 1775)	**2**, **3**, **4**	LC	
74.	*Vanessa atalanta* (Linnaeus, 1758)	**1**, **2**, **3**, **4**, **8**, **9**, **10**, **11**, **12**, **13**, **14**, **15, 16**, **17**, **19**, **28**, **32**, **33**, **37**	LC	
75.	*Vanessa cardui* (Linnaeus, 1758)	**1**, **2**, **3**, **4**, **8**, **9**, **10**, **11**, **24**, **31**, **36**, **37**	LC	
Family Libytheidae				
76	*Libythea celtis* (Laicharting, 1782)	**5**, **8**, **20**, **26**, **31**	LC	

Table 3. Comparison of Zeta-Skadar plane butterfly species richness with butterfly diversity of the countries neighbouring to Montenegro

Region	Zeta Plain	Montenegro	Bosnia and Herzegovina	Serbia	Albania
Numb of species	76	160	189	198	196
Surface [km²]	Over 3000	13 812	51 197	88 361	28 748
Reference	This paper	Sijarić 1984	Lelo 2000	Van Swaay et al. 2007, Jakšić 2008	Jakšić 2008, Verovnik & Popović 2013

dangered butterfly species declines by about 31%, thus regions as the Balkan Peninsula are important centres of biodiversity for the whole continent. Even in the small area of Zeta-Skadar Plain, large number of species from the European Red List of Threatened Species (van Swaay *et al.* 2010) or from the Targeted Species List (Ozinga, Schaminée 2005) was recorded.

Several species of butterflies found in the study area deserve special attention due to the risk of their extinction in Europe. As environmental protection regulation in Montenegro is still being developed, the comprehensive database with information about the species richness and distribution of butterfly fauna in the country is decisively needed (EEA 2013, van Swaay *et al.* 2010, Kędziora, Karg 2010). Special attention should be paid to the areas inhabited by endangered species (e.g. *Phengaris arion*, *Pseudophilotes vicrama* or *Euphydryas maturna*) and especially those included in Annex II and IV of the EU Habitats Directive (Ozinga, Schaminée 2005, Maes, van Dyck 2001). Recently the Red List of Threatened Animals of Montenegro was developed. It includes five species of butterflies. Three of those species (*Lycaena dispar, Euphydrya maturna* and *Hipparchia faggi*) were found in the studied area (www.iucnredlist.org). The list of threatened taxa is likely to be extended, because the knowledge on the distribution of butterflies in Montenegro is far from being completed.

Human activity is the most ruthless threat for the biodiversity of the Zeta-Skadar Plain. The Zeta Valley is the largest agricultural area of Montenegro, so intensification of agriculture and urbanisation processes may lead to impoverishment of biodiversity. The greatest threat related to agriculture is the burning of grass (van Swaay, Warren 2006). Another threat is the pollution derived from the Podgorica Aluminum Plant or municipal waste but also electronic equipments or even old cars. Some wastes are discarded into the rivers and cause serious disturbance in these sensitive ecosystems and the neighbouring areas (Oikonomou *et al.* 2014). Drying of the wetlands may also have a serious impact on the butterfly populations, especially on the species associated with this type of habitat (van Swaay *et al*. 2010). Therefore, it is essential to protect these areas. Taking these processes into account we can conclude that further research of this region should be dedicated to the better recognition of the human pressure on butterfly fauna. It will allow protecting areas like Zeta-Skadar Plain.

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