

The distribution of butterflies (Lepidoptera: Rhopalocera) in Haloze, East Slovenia

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Abstract. Almost nothing has been known about the butterfly fauna of Haloze prior to our survey. During our field trips, including an extensive survey carried within the framework of the Student Research Camp Videm 2002, surprisingly high butterfly diversity was established. Altogether, 96 butterfly species were recorded at 67 studied sites. The highest butterfly diversity was registered in dry grasslands in the western part of the studied area. Due to the presence of rare and endangered species, such as *Maculinea arion* (Linne, 1758), *Meleageria daphnis* (Denis & Schiffermüller, 1775), and *Polyommatus thersites* (Cantener, 1825), these habitats would require more conservation efforts and a suitable management. The few remaining humid grasslands in the eastern part of the region still host the majority of specialized hygrophilous butterflies, including *Maculinea nausithous* (Bergsträsser, 1779), *Maculinea teleius* (Bergsträsser, 1779), and *Lycaena dispar* (Haworth, 1802). Some of these sites are proposed to be included into the Natura 2000 network, which could enable their suitable protection and management.

Keywords: distribution, Rhopalocera, endangerment, conservation, dry grasslands

Izvleček. RAZŠIRJENOST DNEVNIH METULJEV (LEPIDOPTERA: RHOPALOCERA) V HALOZAH, VZHODNA SLOVENIJA - Do teh raziskav ni bilo o dnevnih metuljih Haloz znanega skoraj nič. Med terenskim delom, vključno z obsežnimi raziskavami med Študentskim raziskovalnim taborom Videm 2002, je bila ugotovljena presenetljivo visoka pestrost metuljev. Skupaj je bilo opaženih 96 vrst na 67 raziskanih lokalitetah. Največja pestrost je bila zabeležena na suhih travnikih v zahodnem delu regije. Ker tu živijo nekatere redke in ogrožene vrste, kot na primer *Maculinea arion* (Linne, 1758), *Meleageria daphnis* (Denis & Schiffermüller, 1775) in *Polyommatus thersites* (Cantener, 1825), ti habitati terjajo več naravovarstvenih naporov in pravilno upravljanje. Majhno število ohranjenih vlažnih travnikov v vzhodnem delu regije še vedno omogoča preživetje večini specializiranih higrofilnih metuljev, vključno z *Maculinea nausithous* (Bergsträsser, 1779), *Maculinea teleius* (Bergsträsser, 1779) in *Lycaena dispar* (Haworth, 1802). Nekatera izmed teh območij so predlagana za vključitev v območje Natura 2000, s čimer bi omogočili njihovo trajno zaščito in pravilno upravljanje.

Ključne besede: razširjenost, Rhopalocera, ogroženost, varovanje, suha travnišča

Introduction

The area of Haloze is one of the least faunistically explored parts of Slovenia. Although it belongs to the Styria (Štajerska) region, there are no references to its butterfly fauna in the so far most comprehensive overview of the Styrian Lepidoptera by Hoffmann and Klos (1914). In his characterization of the butterfly fauna of the Podravje region, Jež (1983) gives mostly generalized remarks (e.g. "common throughout the region") about the species distribution, with few exceptions for Haloze. The most noteworthy is his observation of *Everse decoloratus* (Staudniger 1886) at Šega, south of Makole in the westernmost part of Haloze. The only available list of species has been given for a single locality in the western part of Haloze by Verovnik (1996). During the single visit at the end of July 1995, a total of 24 species were encountered near the village of Sitež (loc. no. 44).

The next visit made by the author to Haloze at the beginning of June 1999 was dedicated mostly to the search of *Colias myrmidone* (Esper 1780), whose presence was expected. Despite an unsuccessful search, the region proved to hold many promising sites with rich butterfly fauna. The greater part of our fieldwork was carried out during the Student Research Camp Videm 2002, where special attention was given to the diverse types of grasslands. The objective of the two subsequent visits in August 2002 and beginning of May 2003 was to discover further large satyrids and to supplement the list with early spring species. Altogether, 67 sites were visited enabling a good overview of the butterfly distribution in this region.

Geographical definition and description of the region

Haloze is a remote area in the eastern part of Slovenia situated south of the Dravinja and Drava Rivers. In the south it reaches the foothills of Boč and Macelj and continues along the Croatian border to the east. Its western border is less evident and usually generalised as "south of Makole", a town in the Dravinja valley. Haloze is approximately 30 km long and six to ten kilometres wide hilly country. Geologically, the area is entirely of Miocene deposits of sandy clay and marl (Gams & Vrišer 1998). The only small karst area near Žetale is covered entirely by woods.

The western part is characterised by higher hills (400 to 600 m) with steep slopes that are predominantly covered with mixed and deciduous forests. Most of the open land is situated either in deep shadowy valleys or on top of the ridges, where the majority of the steeper

cultivated grasslands have been abandoned. In some areas, the slopes are so steep that the open grasslands are maintained by occasional natural erosion. These habitats hold the highest number of butterfly species in the area. The only flatter part with humid grasslands is situated around the town of Žetale. Due to the intensive farming, these meadows are faunistically impoverished.

The central part around the Rogatnica stream valley is the flattest part of Haloze. Due to easier access, the flatlands and the nearby hills are intensively cultivated; they are mostly covered by vineyards or turned into arable land. Some small remnants of once humid grasslands are scattered along the Rogatnica stream.

The eastern part of the region is a gently undulating hilly country with hills reaching from 280 to 400 meters. The valleys are wider as in the western part, and in some of them small humid grasslands have been preserved. In certain areas, the humid grasslands are succeeded by dry grasslands on the southern exposed slopes. The intensification in the northern part and abandonment in the less accessible southern part of the area pose the major threat to the currently still abundant open grasslands.

Results

List of localities

The alphabetical list of localities contains a short description of the habitat, coordinates (Gauss-Krüger), UTM square and date of the observations. The observations were made by the author if not otherwise stated.

1. Belavšek at Videm, humid meadow S of the village Repišče, along the road Dolnji Leskovec-Cirkulane, coordinates - X: 573985, Y: 132644, UTM square: WM73, 224 m, 06.06.1999
2. Belavšek at Videm, humid meadows below the village, SE of Zgornji Leskovec, coordinates - X: 573491, Y: 131424, UTM square: M73, 235 m, 06.06.1999
3. Belski Vrh at Zavrč, cultivated grasslands on top of the Vrbanjšak hill, coordinates - X: 578863, Y: 136837, UTM square: WM73, 397 m, 14.07.2002 and 02.05.2003
4. Borl at Gorišnica, cultivated meadows SE of Borl Castle, coordinates - X: 577859, Y: 137194, UTM square: WM73, 249 m, 13.07.2002
5. Brezovec at Cirkulane, dry grassy slope E of the Ošnik farm, coordinates - X: 577809, Y: 134606, UTM square: WM73, 237 m, 06.06.1999, 13.07.2002, 09.08.2002 and 02.05.2003
6. Dobrina near Žetale, dry grassy slope 500 m E of the village of Globočec, coordinates - X: 563353, Y: 128007, UTM square: WM62, 275 m, 10.07.2002, 09.08.2002 and 02.05.2003

7. Dolence at Podlehnik, cultivated grassland and forest verge at the Ornik farm, 500 NW of the village, coordinates - X: 569226, Y: 132445, UTM square: WM63, 327 m, 12.07.2002
8. Dravinjski Vrh near Videm, cultivated grasslands on the Zdolčušak ridge, S of the farm Hegediš, coordinates - X: 569843, Y: 134524, UTM square: WM63, 305 m, 12.07.2002
9. Dravinjski Vrh near Videm, humid meadows along the stream N of the Kranjc farm, coordinates - X: 570619, Y: 134751, UTM square: WM73, 240 m, 12.07.2002
10. Duga at Cirkulane, humid meadow and forest edge in the valley of the Duga stream, E of the village, coordinates - X: 578286, Y: 133866, UTM square: WM73, 224 m, 15.06.2002 and 14.07.2002, observations on 15.06.2002 by Rebeušek Franc
11. Gorca at Podlehnik, cultivated grassland and forest verge N of the road to Gorca, coordinates - X: 565312, Y: 133503, UTM square: WM63, 390 m, 11.07.2002 and 02.05.2003
12. Gorenjski Vrh at Zavrč, dry grasslands in the Kojuhovski stream valley, N of the Repičak farm, coordinates - X: 580886, Y: 135693, UTM square: WM83, 226 m, 14.07.2002
13. Goričak at Zavrč, dry and cultivated meadows on the slopes S of the Masten farm, coordinates - X: 582327, Y: 135557, UTM square: WM83, 230 m, 14.07.2002
14. Grdina at Majšperk, dry grasslands on the slope NW of the village of Vrhe, coordinates - X: 557515, Y: 128488, UTM square: WM52, 438 m, 10.07.2002 and 09.08.2002
15. Gruškovec at Cirkulane, cultivated grasslands and fields on S slope of the Zgornji Hun hill, coordinates - X: 578970, Y: 131858, UTM square: WM73, 305 m, 13.07.2002
16. Jablovec at Podlehnik, forest verge in the valley E of the Krušič farm, coordinates - X: 565769, Y: 131144, UTM square: WM63, 254 m, 11.07.2002
17. Janški vrh near Majšperk, cultivated grasslands and forest edge on the ridge S of the village of Zgornje Lipno, coordinates - X: 559886, Y: 132028, UTM square: WM53, 415 m, 11.07.2002
18. Janški vrh near Majšperk, dry and cultivated meadows near the road NW of the Peskov breg hill, coordinates - X: 560028, Y: 131519, UTM square: WM63, 413 m, 11.07.2002
19. Jelovice at Majšperk, dry and cultivated grasslands around the Church of St. Bolfenk, coordinates - X: 558228, Y: 130324, UTM square: WM53, 531 m, 10.07.2002
20. Jelovice at Majšperk, dry grasslands N of the Church of St. Bolfenk, coordinates - X: 558296, Y: 130477, UTM square: WM53, 495, 10.07.2002
21. Jelovice at Majšperk, forest road W of the Lah farm, coordinates - X: 557642, Y: 129398, UTM square: WM52, 499 m, 10.07.2002
22. Jelovice at Majšperk, Rocky scree along the road 300 m N of the village of Plate, coordinates - X: 558281, Y: 129994, UTM square: WM52, 498 m, 10.07.2002
23. Kočice at Žetale, bushes and cultivated meadows on a steep slopes on the ridge N of the Frajmežna farm, coordinates - X: 560347, Y: 128853, UTM square: WM62, 385 m, 11.07.2002
24. Kočice near Žetale, forest verge in the Peklača stream valley, SW of the village of Krošnji Vrh, coordinates - X: 560887, Y: 129078, UTM square: WM62, 307 m, 11.07.2002
25. Korenjak at Cirkulane, cultivated meadows on the ridge 400 m S of the farm Koren, coordinates - X: 579547, Y: 133241, UTM square: WM73, 311 m, 14.07.2002
26. Kozminci at Podlehnik, cultivated meadow near small stream SE of the Hronek farm, coordinates - X: 566244, Y: 128040, UTM square: WM62, 251 m, 11.07.2002
27. Kupčinji vrh at Majšperk, dry grassland and bushes along a small stream S of the village, coordinates - X: 557075, Y: 126582, UTM square: WM52, 344 m, 10.07.2002

28. Kupčinji Vrh at Majšperk, dry grassland S of the Church of St. Mohor, coordinates - X: 557214, Y: 126917, UTM square: WM52, 430 m, 02.05.2003, observed by Rebeušek Franc
29. Ljubistava at Podlehnik, humid meadows E of the Topolovec farm, coordinates - X: 570705, Y: 133320, UTM square: WM73, 230 m, 12.07.2002
30. Ljubistava at Podlehnik, humid meadows in the Črna valley near the Junger farm, coordinates - X: 569777, Y: 133580, UTM square: WM63, 247 m, 12.07.2002
31. Majski Vrh at Videm, dry cultivated meadow and forest verge on the slope 200 m SE of the Zorinč farm, coordinates - X: 569252, Y: 135085, UTM square: WM63, 308 m, 16.07.2002
32. Mala Varnica at Podlehnik, humid meadow in the Psičina stream valley along the village, coordinates - X: 573714, Y: 129830, UTM square: WM72, 237 m, 12.07.2002
33. Medribnik at Cirkulane, humid meadow along the Bela stream, UTM square: W of the Church of St. Florjan, coordinates - X: 578030, Y: 131300, UTM square: WM73, 235 m, 13.07.2002
34. Nadole at Žetale, dry, partially cultivated meadow S of the village of Zlaka, coordinates - X: 559835, Y: 127059, UTM square: WM52, 366 m, 09.08.2002
35. Pestike at Zavrč, dry and cultivated meadows W of the Potočjak farm, coordinates - X: 579936, Y: 134133, UTM square: WM73, 261 m, 14.07.2002
36. Planjsko near Majšperk, dry grasslands on the ridge N of the village of Vinarje, coordinates - X: 560611, Y: 129621, UTM square: WM62, 413 m, 11.07.2002 and 09.08.2002
37. Planjsko near Majšperk, humid meadow W of the Šerbak farm, coordinates - X: 560800, Y: 130545, UTM square: WM63, 471 m, 11.07.2002
38. Podlehnik, dry cultivated grassland below the dam of Lake Dežno, coordinates - X: 567568, Y: 132234, UTM square: WM63, 233 m, 15.06.2003, observed by Rebeušek Franc
39. Podlehnik, humid meadows SW of the town, coordinates - X: 567981, Y: 132684, UTM square: WM63, 229 m, 10.07.2002
40. The village of Pohorje near Cirkulane, dry and humid meadows in the Belana stream valley near Mali Okič, coordinates - X: 575924, Y: 130836, UTM square: WM73, 255 m, 13.07.2002
41. Rodni Vrh at Podlehnik, cultivated meadow on the ridge S of the Hrvat farm along the road to the village of Rovce, coordinates - X: 564168, Y: 130827, UTM square: WM63, 370 m, 11.07.2002
42. Rodni Vrh at Podlehnik, dry grassland 100 m N of the Vindiš farm, coordinates - X: 564746, Y: 132356, UTM square: WM63, 373 m, 02.05.2003
43. Sedlašek at Videm, dry grasslands on the ridge E of the Kamen farm, Zgornje Gruškovje, coordinates - X: 568997, Y: 128946, UTM square: WM62, 448 m, 06.06.1999
44. Sitež at Majšperk, steep dry grassy slope W of the Dolič farm, coordinates - X: 559419, Y: 129237, UTM square: WM52, 294 m, 06.06.1999 and Verovnik (1996)
45. Skorišnjak at Cirkulane, cultivated meadow SW of Pristava, coordinates - X: 575854, Y: 132892, UTM square: WM73, 225 m, 13.07.2002
46. Skorišnjak at Cirkulane, pastures below the village on the slopes to Mali Okič, coordinates - X: 574644, Y: 130053, UTM square: WM73, 323 m, 06.06.1999
47. Skorišnjak at Cirkulane, ridge with dry grasslands E of the Frajgláč farm, coordinates - X: 574588, Y: 130835, UTM square: WM73, 301 m, 13.07.2002
48. Soviče at Videm, cultivated meadow along a small tributary of the Psičina stream N of the village, coordinates - X: 572592, Y: 135350, UTM square: WM73, 226 m, 13.07.2002

49. Spodnje Gruškovje at Podlehnik, dry grassy slope between the Lipnica stream and the Cigler farm, coordinates - X: 569554, Y: 130514, UTM square: WM63, 352 m, 12.07.2002
50. Stanošina at Podlehnik, dry meadow along a path S of the village of Vranušek, coordinates - X: 567013, Y: 128876, UTM square: WM62, 341 m, 11.07.2002
51. Strajna at Videm, dry meadow and forest verge 200 m W of the Mlakar farm, coordinates - X: 565960, Y: 129894, UTM square: WM62, 295 m, 02.05.2003
52. Trdobjci near Videm, dry grasslands around the Oteno farm, coordinates - X: 570450, Y: 131306, UTM square: WM73, 370 m, 06.06.1999
53. Turški Vrh at Zavrč, Dry and cultivated meadows on the slope SE of the Habjanek farm, coordinates - X: 581575, Y: 134102, UTM square: WM83, 252 m, 14.07.2002 and 02.05.2003
54. Vareja at Videm, humid meadow along the Dravinja river N of Jaševar hill, coordinates - X: 571546, Y: 136372, UTM square: WM73, 211 m, 13.07.2002 and 09.08.2002
55. Velika Varnica at Podlehnik, humid meadows in the Psična stream valley SW of the Koštrunč farm, coordinates - X: 571286, Y: 127672, UTM square: WM72, 290 m, 12.07.2002
56. Veliki Okič at Cirkulane, humid meadow along the stream near the road to Veliki Okič, coordinates - X: 574094, Y: 132532, UTM square: WM73, 226 m, 13.07.2002
57. Veliki Okič at Cirkulane, humid meadow at the confluence of two small streams, on the road to Belavšek, coordinates - X: 573639, Y: 132499, UTM square: WM73, 225 m, 13.07.2002
58. Zakl at Podlehnik, cultivated meadow 100 m SW of the Vevečnik farm, coordinates - X: 566738, Y: 130538, UTM square: WM63, 263 m, 02.05.2003
59. Zakl at Podlehnik, humid and cultivated meadow on the E side of the road to Stanošina, coordinates - X: 566980, Y: 130283, UTM square: WM63, 240 m, 10.07.2002
60. Zavrč, sandbanks of the Drava River with willow forests NW of the town, coordinates - X: 580741, Y: 139217, UTM square: WM83, 199 m, 14.07.2002 and 09.08.2002
61. Zgornje Gruškovje at Podlehnik, dry grassland on the ridge 700 m NE of a small chapel, coordinates - X: 569284, Y: 129382, UTM square: WM62, 428 m, 12.07.2002
62. Zgornji Leskovec at Podlehnik, pastures and cultivated grasslands W of the town, near the Lipnica stream, coordinates - X: 571855, Y: 131841, UTM square: WM73, 229 m, 12.07.2002 and 02.05.2003
63. Zgornji Leskovec at Podlehnik, pastures and forest verge on the slopes 300 m E of the town, coordinates - X: 572770, Y: 132095, UTM square: WM73, 248 m, 15.6.2002, observed by Rebeušek Franc
64. Žetale, bushes and dry grassy slopes near the road 400 m W of the Church of St. Marija, coordinates - X: 560470, Y: 125649, UTM square: WM62, 356 m, 09.08.2002 and 02.05.2003, observed by Rebeušek Franc
65. Žetale, dry grasslands and bushes on the S slope to the Church of St. Marija W of the town, coordinates - X: 560957, Y: 125443, UTM square: WM62, 306 m, 17.07.2003
66. Žetale, dry meadow and forest verge E of the village of Podpeč, coordinates - X: 562676, Y: 126374, UTM square: WM62, 308 m, 17.07.2003
67. Žetale, humid cultivated meadow NW of the village of Čret, coordinates - X: 562520, Y: 125754, UTM square: WM62, 284 m, 10.07.2003

List of localities

Table 1: Distribution of butterflies in the Haloze area. The localities are numbered as in the List of localities chapter. The threat status in Slovenia (SLO) according to the new Red Data Book (Ur.l. RS, MP82/02: 8893-8975) and the inclusion in the FFH directive (FFH) annexes are indicated (*Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora*). The taxonomy and nomenclature are according to Karsholt & Razowski (1996).

Tabela 1: Razširjenost vrst dnevnih metuljev v Halozah. Lokalitete so oštevilčene kot v seznamu lokalitet. Prikazana sta še varstveni status v Sloveniji (SLO) na podlagi novega Rdečega seznama (Ur.l. RS, MP82/02: 8893-8975) in vključitve v sezname *Direktive o habitatih* (FFH) (*Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora*). Taksonomija in nomenklatura sta povzeti po Karsholt & Razowski (1996).

Species	Localities	SLO	FFH
PAPILIONIDAE			
<i>Papilio machaon</i>	3, 5, 6, 28, 30, 34, 36, 38, 41, 51, 61, 63, 63, 65		
<i>Iphiclides podalirius</i>	3, 4, 5, 6, 7, 10, 11, 13, 14, 15, 17, 18, 19, 20, 21, 23, 26, 27, 28, 29, 30, 31, 32, 33, 35, 36, 37, 39, 44, 45, 47, 49, 50, 53, 55, 61, 63, 65, 66, 67		
<i>Parnassius mnemosyne</i>	3	V	◆
PIERIDAE			
<i>Pieris brassicae</i>	14, 17, 27, 36, 46, 50, 65		
<i>Pieris rapae</i>	3, 4, 5, 6, 6, 7, 10, 13, 14, 17, 20, 28, 29, 30, 31, 32, 33, 36, 37, 38, 41, 42, 44, 48, 49, 53, 54, 55, 57, 60, 61, 65, 66, 67		
<i>Pieris mannii</i>	5, 6, 11, 15, 18, 21, 25, 27, 40	V	
<i>Pieris napi</i>	2, 3, 10, 11, 22, 24, 27, 42, 54, 58, 60, 63, 65		
<i>Antocharis cardamines</i>	3, 5, 6, 11, 28, 42, 51, 53, 58, 63, 65		
<i>Pontia daplidice</i>	5, 17, 18, 49, 50, 61		
<i>Colias croceus</i>	5, 6, 13, 14, 30, 33, 34, 44, 45, 53, 60, 63, 64, 65, 66, 67, 68		
<i>Colias hyale</i>	4, 62		
<i>Colias alfaciariensis</i>	5, 6, 13, 14, 15, 18, 19, 20, 21, 23, 29, 30, 36, 37, 44, 47, 49, 50, 53, 57, 61, 68		
<i>Gonepteryx rhamni</i>	6, 10, 11, 12, 14, 16, 18, 19, 21, 22, 23, 24, 26, 27, 28, 29, 33, 50, 53, 54, 57, 65		
<i>Leptidea sinapis/reali</i>	2, 3, 5, 6, 7, 8, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 24, 25, 26, 27, 28, 29, 31, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 44, 45, 47, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 60, 61, 63, 64, 65, 66, 67, 68		
LYCAENIDAE			
<i>Callophrys rubi</i>	5, 53		
<i>Thecla betulae</i>	15		
<i>Satyrium acaciae</i>	11, 14, 21, 23, 36		
<i>Satyrium spini</i>	17, 23, 36, 37		
<i>Satyrium pruni</i>	65		
<i>Satyrium w-album</i>	11, 21, 40		
<i>Lycaena phlaeas</i>	5, 14, 36, 54, 63, 64, 65, 66		
<i>Lycaena dispar</i>	1, 2, 5, 10, 33, 38	V	◆
<i>Lycaena virgaureae</i>	2, 6, 19, 21, 27, 32, 62		
<i>Lycaena tityrus</i>	5, 12, 13, 18, 20, 21, 22, 27, 29, 32, 33, 34, 35, 37, 40, 44, 47, 48, 53, 54, 55, 56, 59, 65, 66		
<i>Lycaena alciphron</i>	2	V	
<i>Lycaena hippothoe</i>	10, 29, 57	V	
<i>Leptotes pirithous</i>	54		
<i>Everes decoloratus</i>	3	R	

Species	Localities	SLO	FFH
<i>Everes argiades</i>	3, 4, 5, 6, 9, 10, 12, 13, 14, 15, 16, 20, 23, 25, 28, 30, 31, 35, 36, 38, 42, 44, 45, 47, 48, 50, 51, 53, 54, 56, 57, 58, 60, 63, 64, 65, 66, 67, 68		
<i>Cupido minimus</i>	31, 66		
<i>Celastrina argiolus</i>	3, 7, 10, 11, 13, 16, 21, 29, 31, 32, 38, 51, 53, 54, 57, 60, 65		
<i>Glaucoopsyche alexis</i>	52		
<i>Maculinea teleius</i>	10, 26, 29, 30, 32, 39, 45, 54, 59	V	◆
<i>Maculinea nausithous</i>	10, 29, 30, 32, 54	V	◆
<i>Maculinea arion</i>	5, 6, 14, 18, 19, 20, 21, 23, 31, 36, 37, 40, 44, 50, 53, 65, 66, 67	V	◆
<i>Plebeius argyrognomon</i>	6, 13, 15, 23, 35, 36, 40, 53	V	
<i>Plebeius argus</i>	6, 44, 66		
<i>Plebeius idas</i>	3, 4, 5, 6, 7, 8, 9, 14, 23, 25, 32, 34, 35, 36, 44, 46, 49, 50, 52, 53, 55, 57	V	
<i>Aricia agestis</i>	14, 18, 20, 21, 22, 23, 37, 49, 66		
<i>Cyaniris semiargus</i>	2, 3, 13, 29, 33, 47, 56, 57, 67		
<i>Polyommatus thersites</i>	5, 6, 11, 14, 18, 19, 23, 27, 34, 36, 37, 47, 50, 53, 61, 66	E	
<i>Polyommatus dorylas</i>	14, 40, 43, 52, 54, 67		
<i>Polyommatus icarus</i>	2, 3, 4, 5, 6, 8, 9, 10, 11, 12, 13, 14, 15, 16, 18, 19, 20, 24, 25, 26, 27, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 43, 44, 44, 45, 46, 47, 48, 49, 50, 52, 53, 54, 55, 56, 57, 59, 60, 61, 63, 64, 65, 66, 67, 68	V	
<i>Meleageria bellargus</i>	5, 14, 36		
<i>Meleageria daphnis</i>	5, 6, 12, 14, 20, 21, 22, 23, 36, 44, 47, 49, 53, 61		
RIODINIDAE			
<i>Hamearis lucina</i>	3, 5, 6, 7, 8, 9, 10, 12, 14, 16, 18, 24, 25, 27, 28, 29, 31, 32, 35, 40, 47, 48, 50, 53, 54, 55, 56, 58, 65, 67		
NYMPHALIDAE			
<i>Apatura iris</i>	16, 32		
<i>Apatura illia</i>	27, 54, 60	V	
<i>Limenitis reducta</i>	4, 31, 54		
<i>Limenitis camilla</i>	60		
<i>Neptis sappho</i>	11, 16, 24, 27, 48, 54, 56, 60, 62		
<i>Neptis rivularis</i>	16, 55		
<i>Nymphalis antiopa</i>	33		
<i>Inachis io</i>	9, 14, 21, 22, 24, 27, 28, 30, 32, 39, 50, 53, 54, 57, 58, 60, 65		
<i>Vanessa atalanta</i>	5, 6, 9, 16, 21, 23, 24, 31, 36, 38, 40, 53, 54, 60, 65		
<i>Vanessa cardui</i>	3, 5, 7, 14, 15, 19, 28, 30, 33, 36, 42, 51, 53, 58, 63, 65, 66, 68		
<i>Aglais urticae</i>	5, 21, 27, 52, 62		
<i>Polygonia c-album</i>	2, 3, 6, 13, 16, 21, 24, 29, 50, 52, 54, 55, 60, 62		
<i>Araschnia levana</i>	1, 3, 4, 5, 6, 9, 10, 10, 11, 14, 16, 18, 20, 21, 23, 24, 27, 29, 31, 32, 33, 35, 36, 38, 40, 48, 50, 52, 53, 54, 55, 58, 60, 64, 65, 68		
<i>Argynnis paphia</i>	21, 44, 62		
<i>Argynnis aglaja</i>	29		
<i>Argynnis adippe</i>	21		
<i>Argynnis niobe</i>	2		
<i>Issoria lathonia</i>	4, 6, 11, 12, 13, 15, 18, 27, 29, 30, 35, 47, 63, 65, 68		
<i>Brenthis daphne</i>	5, 6, 7, 10, 11, 14, 16, 18, 20, 21, 26, 27, 29, 32, 35, 36, 37, 38, 41, 44, 49, 52, 56, 64, 68		
<i>Clossiana selene</i>	2, 29	V	

Species	Localities	SLO	FFH
<i>Clossiana dia</i>	3, 5, 6, 9, 10, 13, 14, 20, 28, 33, 34, 36, 40, 42, 50, 51, 53, 54, 57, 64, 65, 67		
<i>Melitaea phoebe</i>	3, 4, 5, 6, 7, 9, 10, 12, 13, 14, 18, 19, 29, 30, 32, 33, 35, 40, 44, 46, 47, 52, 53, 63, 66, 67, 68		
<i>Melitaea didyma</i>	4, 6, 12, 13, 14, 29, 30, 34, 36, 43, 44, 47, 48, 53, 61, 63, 64, 65, 66		
<i>Melitaea diamina</i>	57	V	
<i>Melitaea britomartis</i>	43, 44	V	
<i>Melitaea athalia</i>	2, 5, 6, 9, 10, 13, 26, 28, 29, 30, 31, 32, 33, 34, 38, 44, 45, 46, 47, 48, 48, 52, 53, 54, 55, 63, 64, 65, 66, 67, 68		
<i>Melanargia galathea</i>	2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 14, 16, 17, 18, 19, 20, 23, 24, 27, 29, 31, 32, 33, 35, 36, 37, 38, 40, 41, 43, 44, 45, 46, 47, 48, 49, 52, 54, 55, 56, 57, 59, 61, 63, 64, 66, 67, 68		
<i>Hipparchia fagi</i>	5, 6, 14, 17, 21, 34, 46, 49, 61, 62		
<i>Minois dryas</i>	3, 4, 5, 6, 8, 12, 14, 15, 23, 24, 29, 31, 32, 34, 35, 36, 40, 44, 47, 49, 54, 61, 66		
<i>Brintesia circe</i>	14, 18, 20, 32, 47, 52, 64		
<i>Erebia aethiops</i>	16, 24, 27, 62		
<i>Maniola jurtina</i>	2, 3, 4, 5, 6, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 23, 24, 25, 26, 27, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 43, 44, 45, 46, 47, 48, 49, 50, 52, 53, 54, 55, 56, 57, 59, 63, 64, 65, 66, 67, 68		
<i>Aphantopus hyperantus</i>	3, 5, 6, 7, 9, 10, 12, 16, 18, 19, 20, 21, 23, 27, 29, 31, 32, 33, 35, 36, 40, 41, 47, 50, 55, 60, 66, 67		
<i>Coenonympha pamphilus</i>	2, 3, 4, 5, 5, 6, 9, 10, 11, 12, 13, 14, 15, 18, 19, 25, 28, 31, 33, 34, 35, 36, 37, 38, 39, 44, 45, 47, 48, 49, 53, 54, 56, 57, 59, 60, 63, 63, 64, 65, 66, 67, 68		
<i>Coenonympha arcania</i>	42, 43, 44, 52		
<i>Coenonympha glycerion</i>	2, 4, 5, 6, 13, 14, 34, 36, 38, 44, 46, 52, 54, 64, 65, 66		
<i>Pararge aegeria</i>	3, 24, 54		
<i>Lasiommata maera</i>	52		
<i>Lasiommata megera</i>	5, 11, 14, 17, 19, 28, 35, 36, 37, 42, 49, 50, 54, 58, 59, 64, 65, 66		
HESPERIIDAE			
<i>Pyrgus malvae</i>	6, 13, 32, 35, 44, 53, 54, 55, 57, 58, 63, 65, 66, 67		
<i>Pyrgus armoricanus</i>	6, 9, 14, 33, 57, 65	V	
<i>Spialia sertorius</i>	5, 6, 18, 28, 36, 49, 53		
<i>Carcharodus alceae</i>	6, 11, 14, 17, 18, 22, 27, 40, 44, 49, 53, 57	V	
<i>Erynnis tages</i>	3, 4, 5, 6, 6, 9, 10, 12, 13, 14, 15, 18, 20, 21, 23, 28, 29, 30, 32, 33, 35, 36, 37, 40, 41, 42, 44, 45, 48, 49, 50, 51, 53, 54, 55, 56, 57, 58, 61, 63, 65, 66, 67, 68		
<i>Carterocephalus palaemon</i>	28, 51, 53		
<i>Heteropterus morpheus</i>	6, 8, 14, 16, 17, 18, 20, 23, 24, 27, 29, 32, 35, 40, 41, 44, 49, 50, 55, 61, 67		
<i>Thymelicus lineola</i>	3, 6, 8, 9, 13, 20, 29, 30, 33, 40, 44, 46, 47, 52, 56, 61, 63		
<i>Thymelicus sylvestris</i>	6, 7, 8, 9, 10, 12, 18, 19, 20, 21, 23, 29, 36, 38, 40, 45, 49, 64, 65, 66, 68		
<i>Hesperia comma</i>	5, 65		
<i>Ochlodes venata</i>	2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 14, 16, 17, 19, 20, 21, 23, 24, 26, 27, 29, 31, 32, 35, 36, 38, 40, 41, 47, 48, 50, 53, 54, 55, 56, 57, 60, 61, 67		

Diversity distribution and coverage of the region

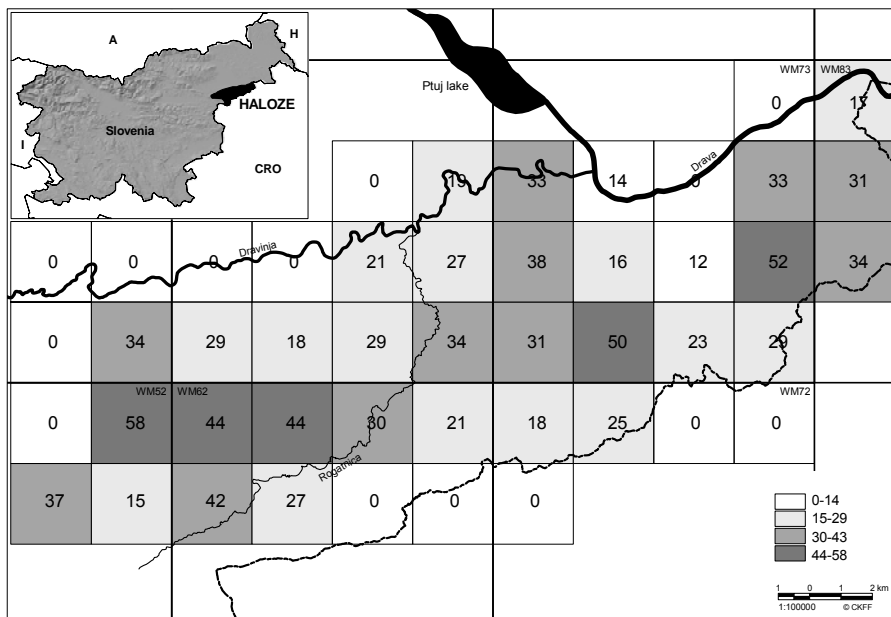


Figure 1: Pattern of the butterfly diversity in Haloze. The grid size is 2.5 km² and is based on UTM squares (1/16). The absolute numbers of species observed are given in the centre of each grid. The shading intensity increases with the number of observed species. The position of Haloze in Slovenia is given.

Slika 1: Vzorec razporeditve pestrosti dnevnih metuljev v Halozah. Stranica kvadratov je dolžine 2.5 km² in temelji na UTM mreži (1/16). Številke v sredini vsakega kvadrata ponazarjajo skupno število opaženih vrst metuljev. Intenziteta senčenja narašča s povečevanjem pestrosti. Podana je lega Haloz v Sloveniji.

To achieve a higher resolution, the UTM squares covering the Haloze area were divided into 16 squares measuring 2,5 km x 2,5 km. Except for the few bordering squares, all were visited at least once. Those on the northern border were superficially surveyed from the car, but no promising sites were observed. The only area deserving further attention is the forested hilly region E of Žetale on the border with Croatia. As the Haloze area is relatively well covered with the visited localities, some basic inferences on the diversity distribution are possible. The highest numbers of species were observed in the extreme western part of Haloze. This could be explained with high habitat diversity ranging from humid forested valleys to extreme thermophilous grasslands on steep slopes. Similar butterfly diversity was observed in two squares in the eastern part of Haloze, where humid grasslands still host some of the rare and threatened hygrophilous butterfly species. In general, the butterfly diversity is

lower around the Rogatnica River and in the northern part of Haloze, where farming is more intensive owing to a better accessibility.

Discussion

General observations

If the geography and geology of the Haloze area are taken into consideration, one could conclude that the region hosts low butterfly diversity due to lack of calcareous areas and vertical span. The present research proved, quite on the contrary, that the region has one of the highest species counts in inland Slovenia with nearly 100 species recorded. The reason for such unexpected high butterfly diversity is the presence of extensively used grasslands and their heterogeneity. The hilly relief provides different inclinations and expositions of the thermophilous grasslands, which are additionally diversified by natural erosion, different levels of shrub encroachment and grazing. The remains of humid grasslands in the valleys of the eastern part of Haloze still provide shelter for many specialised and endangered butterfly species. Further surveys in May and June could bring discoveries of further species and new records of some underrecorded species. Among these, we could mention *Apatura ilia* (Denis & Schiffermüller, 1775), *Limenitis camilla* (Linne, 1758) and *Neptis rivularis* (Scopoli, 1763), whose suitable habitats occur commonly throughout the region.

The most surprising was the high diversity of butterflies in dry grasslands and the wide distribution of some otherwise rare thermophilous species. *Pieris mannii* (Mayr, 1851) was recorded for the first time in NE Slovenia. Its occurrence in inland Slovenia is very sporadic except for the SE part, where the species is locally common (Verovnik & Škvarč 2002). Among rare lycaenid thermophilous species, *Maculinea arion* (Linne, 1758), *Meleageria daphnis* (Denis & Schiffermüller, 1775), *Plebeius idas* (Linne, 1758) and *Polyommatus thersites* (Cantener, 1825) were commonly observed. The latter has been so far considered extremely rare in central Slovenia with only few scattered records around Ljubljana, Zasavje and Slovenske Gorice. The thermophilous character of the entire Haloze area is best illustrated by wide distribution of *Iphiclides podalirius* (Linne, 1758), *Melitaea phoebe* (Denis & Schiffermüller, 1775), *Melitaea didyma* (Esper, 1778) and *Erynnis tages* (Linne, 1758). These species were commonly observed also in the degraded and intensively farmed meadows. Despite higher expectations, only two species of large satyrids were present in the region. *Brintesia circe* (Fabricius, 1775) is widespread in Slovenia and was relatively rare in Haloze, while the more

thermophilous *Hipparchia fagi* (Scopoli, 17863) was more common here as in the other parts of inland Slovenia.

The humid grassland species have a much more limited distribution in Haloze and should be considered much more vulnerable to extinction. The *Maculinea teleius* (Bergsträsser, 1779) and *M. nausithous* (Bergsträsser, 1779) occurred syntopically at few sites in the eastern part of the area. The first species was found in more degraded habitats of the Rogatnica valley as well. Other hygrophilous species were even less common. *Lycaena alciphron* (Rottemburg, 1775), *L. hippothoe* (Linne, 1761), *Clossiana selene* (Denis & Schiffermüller, 1775) and *Melitaea diamina* (Lang, 1789) were found only at a single or up to three sites. Although they are not considered threatened in Slovenia in general, they show a similar limited distribution in Haloze as in the Goričko area (Verovnik 2000).

Along with some of the previously mentioned thermophilous species, the ecological generalists, such as *Pieris rapae* (Linne, 1758), *Polyommatus icarus* (Rottemburg, 1775), *Araschnia levana* (Linne, 1758), *Melanargia galathea* (Linne, 1758), *Maniola jurtina* (Linne, 1758), *Coenonympha pamphilus* (Linne, 1758) and *Ochlodes venata* (Bremer & Gray, 1853) were among the most commonly observed species. Some of the forest or forest verge species, like *Apaturia iris* (Linne, 1758), *Argynnis paphia* (Linne, 1758), *Argynnis aglaja* (Linne, 1758) and *Pararge aegeria* (Linne, 1758), had much more limited distribution than in other parts of central Slovenia. *Argynnis aglaja* along with other two large fritillaries (*A. adippe* (Denis & Schiffermüller, 1775) and *A. niobe* (Linne, 1758)) are still common in the southwestern part of Slovenia, but have become increasingly rare in the other parts of the country (personal observations). Similar declines have been observed in other parts of Central and northern Europe (Settele et al. 2000, Asher et al. 2001, Beneš & Konvička 2002).

The conservation value of Haloze

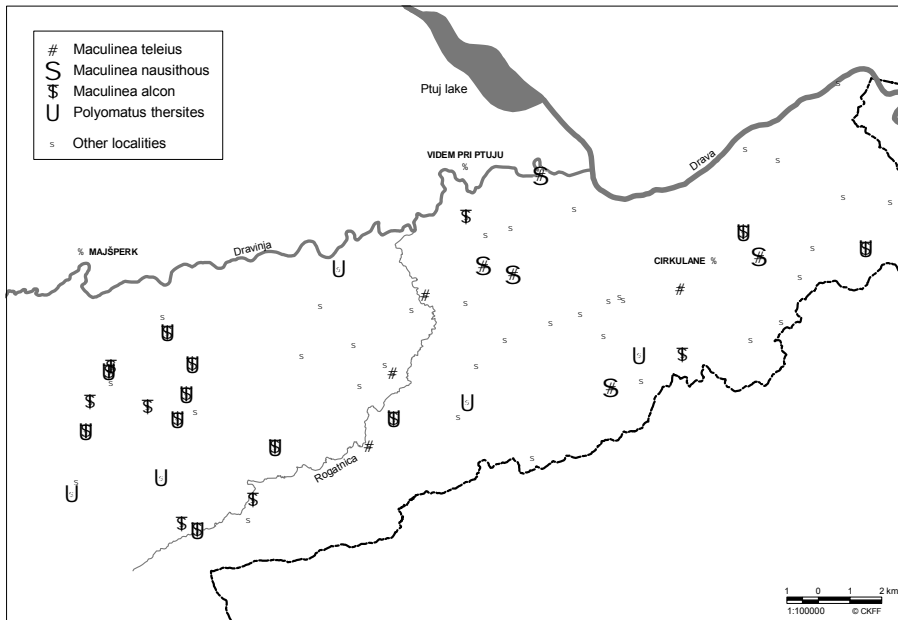


Figure 2: The distribution of threatened and *FFH directive* butterfly species considered endangered in Slovenia in the area of Haloze. Overlapping of the presence of two species in the same locality is indicated by combined symbols.

Slika 2: Razširjenost ogroženih vrst dnevnih metuljev v Halozah ter tistih vrst iz *Direktive o habitatih*, ki so v Sloveniji ogrožene. Pojavljanje dveh vrst na isti lokaliteti je prikazano s prekrivajočimi se simboli.

Twenty of the 96-recorded species are included in the *Red Data Book of Slovenia* (Ur.l. RS, MP82/02: 8893-8975). Only a single species *Polyommatus thersites* is considered threatened (IUCN old category: E) in Slovenia. It has one of its distribution centres in the western part of Haloze. As its presence mostly coincides with the distribution of *Maculinea arion* (Fig. 2), a vulnerable species also listed in the *Annex IV* of the *FFH directive*, their habitats should be given a high conservation priority in Haloze. These dry grasslands also host the highest diversity of butterflies in the area (Fig. 1) and are present in sufficient numbers to support a potential metapopulation structure of most lycaenid species. Much more research would have to be carried out as certain specific ecological requirements of each species and to recommend exact conservation measures. Nevertheless, a continued current use of the grasslands with the same intensity should preserve the rare and endangered butterfly species.

Revitalisation of the abandoned dry grasslands and extensive grazing would certainly have a further positive effect on the distribution of these species.

Although the humid grasslands are much more limited in their size and number, they still host the majority of the hygrophilous species present in Slovenia. Despite isolation, the high density of both *Maculinea teleius* and *M. nausithous* at some of the sites gives us new hope for their long-term survival. As these two lycaenids and *Lycaena dispar* (Haworth, 1802) are the priority species for conservation in Europe, Slovenia is liable to protect a sufficient part of its populations with inclusion in the Natura 2000 network. The designation of some of the sites in Haloze as Natura 2000 areas could enable proper management and restoration of the nearby more intensively farmed humid grasslands. According to the present survey, the following sites could be included:

- (10) Duga at Cirkulane - all three species are present. The bordering grasslands would require minimum alterations in their use, especially mowing, to enable expansion of these species.
- (29, 30) The upper part of the Črna stream valley - the potentially largest site with both *Maculinea* species. Currently, two large density sites are connected by approximately a kilometre of intensively cultivated humid grasslands, where *Sanguisorba officinalis* L. is present in low numbers. Only minimum management and limitations of the mowing period would enable expansion of both species.
- (32) Mala Varnica in the Psičina stream valley - both *Maculinea* species are present in great numbers. The site is threatened due to its abandonment and encroachment by tall herbs. The neighbouring grasslands are already unsuitable due to the prevailing tall herb vegetation. Only regular mowing, which would suppress and remove the tall herbs after the first larval stages of both species are completed (late September), would enable their survival.

Some further sites in the eastern part of Haloze should be monitored for possible discovery of *Colias myrmidone*. These sites have a suitable habitat structure and large number of its potential larval foodplant *Chamaecytisus supinus* L. (Beneš & Konvička 2002). The Haloze area could also provide further clues about the habitat requirements and distribution of the rare lycaenid *Everes decoloratus*, whose presence in Slovenia is not well known. Haloze have surprisingly high butterfly diversity and would deserve a further faunistic research and more conservation efforts.

Povzetek

Haloze sodijo med zoološko najmanj raziskane dele Slovenije. O njihovih dnevnih metuljih je bilo doslej objavljenih le nekaj posameznih podatkov (Jež 1983, Verovnik 1996) o skupno 25 vrstah. Tako je bil glavni namen terenskih raziskav v letih 1999, 2002 in 2003 v čim večjem obsegu raziskati celotno območje. Poudarek raziskav je bil predvsem na sonaravno izkoriščanih termofilnih in higrofilnih traviščih, kjer je pestrost dnevnih metuljev potencialno največja. Geografsko lahko Haloze razdelimo na zahodni, bolj gozdat in hribovit del, ter vzhodni, bolj gričevnat del. Loči ju dolina Rogatnice, ki je eno izmed najbolj intenzivno obdelanih območij Haloz.

Zaradi majhnega vertikalnega razpona in enotne geološke podlage je bilo 96 ugotovljenih vrst dnevnih metuljev visoko nad pričakovanji. Predvsem je bila presenetljiva velika pestrost metuljev suhih travišč v zahodnem delu Haloz, kjer je bilo pogosto na isti lokaliteti opaženih več vrst v osrednji Sloveniji sicer redkih in ogroženih vrst metuljev. V prvi vrsti velja omeniti modrine *Maculinea arion* (Linne, 1758), *Meleageria daphnis* (Denis & Schiffermüller, 1775), *Plebeius idas* (Linne, 1758), *Polyommatus thersites* (Cantener, 1825) ter belina *Pieris manni* (Mayr, 1851). V vzhodnem delu Haloz je pestrost dnevnih metuljev na suhih traviščih praviloma manjša, vendar še obstajajo fragmenti vlažnih travišč, kjer še najdemo skoraj vse slovenske specializirane higrofilne vrste dnevnih metuljev. Zelo redka sta pisančka *Clossiana seline* (Denis & Schiffermüller, 1775) in *Melitaea diamina* (Lang, 1789), v večjih gostotah pa se lokalno pojavljata *Maculinea teleius* (Bergsträsser, 1779) in *M. nausithous* Bergsträsser, 1779.

Naravovarstveno so pomembna suha travišča v zahodnem delu Haloz, kjer se sintopo pojavljata dve ogroženi vrsti modrinov *Polyommatus thersites* in *Maculinea arion* (Sl. 2). Njihov obstoj najbolj ogroža zaraščanje, kot posledica opuščanja košnje. Skupaj z *Lycaena dispar* (Haworth, 1802) sodita med najpomembnejše vrste za varovanje v Evropi med metulji Haloz uvrščeni še *Maculinea nausithous* in *M. teleius*. Za te vrste je Slovenija dolžna zavarovati večji del populacij in njihov življenjski prostor v okviru mreže Natura 2000. Z vključitvijo nekaterih območij iz vzhodnega dela Haloz v to mrežo bi lahko zagotovili pravilno upravljanje in renaturacijo sosednjih intenzivneje izkoriščanih vlažnih travnikov. Glede na dosedanje terenske raziskave bi tak status lahko pripisali območjem:

- (10) Duga pri Cirkulanah - pojavljajo se vse tri vrste. Sosednja travišča bi lahko izboljšali že z omejitvami košnje v času letanja imagov in prvih larvalnih stadijev.
- (29, 30) Zgornji del doline potoka Črna - potencialno največje območje, kjer se pojavljata obe vrsti iz rodu *Maculinea*. Trenutno sta dve populaciji z veliko gostoto imagov ločeni s približno kilometrom intenzivno rabljenih vlažnih travnikov, kjer je hranilno rastlino *Sanguisorba officinalis* L. opaziti le v manjšem številu. Že z omejitvami košnje v času letanja imagov in prvih larvalnih stadijev bi lahko zagotovili razširitev areala obeh vrst.
- (32) Mala Varnica, v dolini potoka Psičina - obe vrsti iz rodu *Maculinea* z veliko gostoto imagov. Območje je ogroženo predvsem zaradi opuščanja rabe in širjenja visokih steblik. Le z redno košnjo v poznem septembru bi lahko omogočili preživetje teh populacij in razširitev ustreznega habitata na sosednje že zaraščene travnike.

V Halozah je bila ugotovljena presenetljivo visoka pestrost dnevnih metuljev. Zaradi tega si to območje zagotovo zasluži nadaljnje favnistične raziskave in več naravovarstvenih prizadevanj.

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Literature

- Asher J., Warren M., Fox R., Harding P., Jeffcoate G., Jeffcoate S. (2001): The millenium atlas of butterflies in Britain and Ireland. Oxford University Press, Oxford, 433 pp.
- Beneš J., Konvička M. (Eds.) (2002): Butterflies of Czech Republic: Distribution and conservation, part I. SOM, Prague, 478 pp.
- Gams I., Vrišer I. (Eds.) (1998): Geography of Slovenia (in Slovene). Slovenska Matica, Ljubljana, 501 pp.
- Hofmann F., Klos R. (1914): Die Schmetterlinge Steiermarks, Teil 1. Mitt. naturw. Ver. Steiermark 50: 184-323.
- Jež M. (1983): General characteristics of the day-butterflies (Lepidoptera, Diurna) in Slovenian Podravje. *Biol. Vest.* 31(1): 83-106.
- Karsholt O., Razowski J. (Eds.) (1996): The Lepidoptera of Europe. A distributional checklist. Apollo Books, Stenstrup, 380 pp.
- Settele J., Feldmann R., Reinhardt R. (Eds.) (2000): Die Tagfalter Deutschlands. Ulmer, Stuttgart.
- Verovnik R. (1995): Raka '92 - Report of the entomological group (in Slovene). In: Bedjanič, M. (Ed.), Students of biology research camp Kozje. Zveza organizacij za tehnično kulturo Slovenije, Gibanje znanost mladini, Ljubljana, pp. 75-82.
- Verovnik R. (2000): Distribution of butterflies (Lepidoptera: Rhopalocera) at Goričko (northeast Slovenia). *Natura Sloveniae* 2(1): 41-59.
- Verovnik R., Škvarč A. (2002): Contribution to the knowledge of butterfly fauna (Lepidoptera: Rhopalocera) of the Bela krajina and eastern part of Kočevska region (southeastern Slovenia). *Natura Sloveniae* 4(1): 21-32.