CONTRIBUTION TO THE KNOWLEDGE OF THE BUTTERFLY FAUNA (LEPIDOPTERA: PAPILIONOIDEA) OF HRVATSKO ZAGORJE, CROATIA

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During a nine-year survey of the Hrvatsko zagorje region carried out from 2008 until 2016 we recorded 112 butterfly species. Records were supplemented with seven species known only from literature data, which amounted to 119 species representing 60% of the Croatian butterfly fauna. The highest butterfly diversity was registered on the mountains Ivanščica and Strahinjščica and along the Sutla River valley. Several rare and endangered species were recorded in the region, mostly grassland specialists such as *Phengaris teleius*, *Ph. alcon rebeli*, *Polyommatus thersites*, *Euphydryas aurinia* and *Zerynthia polyxena* whose habitats are declining due to changes in the use of grasslands like abandonment or, less frequently, intensification. The population of *Lycaena dispar* is still locally numerous, but its habitats are now rapidly overgrown with invasive alien plants. The butterfly diversity of Hrvatsko zagorje is high in comparison with the neighbouring region of Haloze in Slovenia. In order to maintain the high butterfly diversity in the region, grasslands and forest edges in the region are in a need of conservation actions and revitalization.

Key words: Lepidoptera, butterfly diversity, Croatia, Hrvatsko zagorje
INTRODUCTION

Croatia is located at the junction of four large biogeographic zones, which is reflected in great biodiversity on a regional scale, which is also true for butterflies, compared to other European countries. At the same time, the butterfly fauna of the country is relatively under-surveyed (Jakšić, 1988; Šašić & Mihoci, 2011). Recent studies targeted mostly the Croatian islands and karstic areas that generally have greater diversity than continental areas (e.g. Habeler, 2008, Kučinić et al., 2010, 2014; Koren et al., 2012, Tvrtković et al., 2011, 2012). Thus there are areas where the only knowledge is based on literature or collection data sometimes older than 100 years. One of such regions is Hrvatsko zagorje.

Hrvatsko zagorje is a cultural, historical and geographical region in the north-western part of Croatia, situated between Mt. Macelj, Varaždinsko Topličko hills, Mt. Kalnik, Mt. Medvednica and bounded by the Sutla River in the western side. Climatically, the region has a moderately warm and humid climate with warm summers and cold winters (Šegota & Filipčić, 2003). Steep slopes and higher hills are mainly covered by forests, whereas in the lowland these have been transformed into a mosaic of anthropogenic habitats like pastures, meadows, orchards, arable fields, vineyards, hedges and villages, a process that started in the Middle Ages (Vučetić, 2007). On the southern slopes and shallow soils, dry calcareous grasslands are still present but due to recent agricultural transformations, with no livestock on the small farms, most of these meadows became abandoned and are now in succession and overgrown by shrubs and invasive alien plants. These are now some of the most endangered habitats in this area. In the lowland, humid grasslands or wetlands are present along the alluvial plains of rivers such as the Krapina, Krapinčica, Horvatska, Bednja, Sutla and their tributaries. Wet meadows in broad valleys are better preserved but even these are slowly being overgrown by invasive plant species and shrubs or intensively exploited, some being turned into fields or urbanized by road infrastructure. The best-preserved natural habitats in the region are wet and continental forests. Part of the Hrvatsko zagorje is covered by the Natura 2000 network, which consists of 14 areas important for species and habitat conservation. Among them six areas (upper part of Ivanščica, three areas along the Bednja, the Sutla valley at Razvor and Medvednica) are selected to protect moth and butterfly species like Lycaena dispar, Euplagia quadripunctaria and Phengaris teleius.

The low number of published records is surprising due to the vicinity of Zagreb, where many lepidopterists were active during the last hundred years. The only published data on butterfly species were published more than a century ago by Abafi-Aigner (1910). These data refer to the surroundings of Krapina. Additional, more dispersed records were published by Steiner (1916), Gušić (1917), Mladinov (1973, 1975), Marčec (2008), Šašić & Mihoci (2007), Lorković (2009), Koren & Jugovic (2012) and Koren & Štih (2013).

The paper presents the results of nine year-long survey of butterflies, which we carried out during different occasions by different authors with the addition of previously published records from the region of Hrvatsko zagorje. This contribution does not consider additional collection material represented in museum and other private collections, except for the authors’ collections.

MATERIALS AND METHODS

Field surveys were carried out during the last 9 years, from 2008 to 2016 with more than 100 field days. Topography and habitat types were used to select the most suitable localities in the region. A total of 292 localities were visited during this survey, while favourable and best-preserved localities were visited several times (Fig. 1, Appendix I). Between 2008 and 2015 field data were obtained more or less at random, while in 2016 targeted surveys were carried out in the least visited areas in order to collect additional data about the butterflies of the region. Field data were entered into an Excel table and basic statistics were calculated. The spatial processing and visualisation of data were done in the program ARC GIS desktop. The EEA 10x10 km reference grid was used in order to present species diversity. Butterflies were identified using a standard field guide (Tolman & Lewington, 2008). Additionally, specimens of the genera Leptidea, Colias, Melitaea and Plebejus were collected and their genitalia were examined for correct identifications. The nomenclature of the butterflies is given according to de Jong et al. (2014) and of the genus Leptidea according to Dinca et al. (2011).
Fig. 1. Surveyed area of Hrvatsko zagorje, Croatia. Black dots represent localities surveyed.

RESULTS

More than 3300 records across the region were collected during this survey, representing 112 butterfly species. In the overview of the published data for the region, records of 99 butterfly species were found (Abafi-Aigner, 1910; Steiner, 1916; Gušić, 1917; Mladinov, 1973, 1975; Marčec, 2008; Šašić & Mihoci, 2007; Lorković, 2009; Koren & Jugovic, 2012, Koren & Štih, 2013) including seven additional species, which were not found during this study. This represents a total of 119 butterfly species found in Hrvatsko zagorje or 60% of known butterfly fauna of Croatia. Six species were not recorded during the surveys: Aporia crataegi (Linnaeus, 1758), Colias myrmidone (Esper, 1781), Lysandra coridon (Poda, 1761), Argynnis niobe (Linnaeus, 1758), Euphydryas maturna (Linnaeus, 1758) and Hipparchia semele (Linnaeus, 1758). On the other hand, 19 species were recorded for the first time in the region (Tab. 1).

Although the number of registered species is relatively high, it is important to emphasize that many species are represented by only one record or a few records for the region (e.g. Abafi-Aigner 1910, Marčec 2008). Additionally, the recent publications of Marčec (2008) and Lorković (2009) mostly represent data collected more than 50 years ago.

The region is covered by 33 EEA 10x10 km reference grid squares, 8 of which are border squares with smaller areas of Hrvatsko zagorje and without any butterfly records (Fig. 2). Overview of the number of species by squares shows that most of the squares are occupied by 21-40 species. In only one square more than 80 species were recorded, in three 61-80 species, in five 41-60 species, in 12 21-40 species, and in four 12-20 species.

The five squares with the highest butterfly diversity include mountainous areas on Strahinjčica (845,9 m a.s.l.) and Ivanščica (1,060,0 m a.s.l.) mountains, with diverse hillside and lowland parts along rivers, and the diverse Risvica and Cesar hill (509,0 m a.s.l.) also with lower parts along the Sutla River. The area of these five squares is characterized by diverse habitats; deciduous, coniferous and mixed forests, hedges, thermophilic, mesophilic and wet grasslands and meadows, and agricultural areas with settlements.
The square with the highest recorded diversity, 83 species, includes Strahinjšćica mountain and parts of Macelj mountain. The richest locality within this square was Gorjani Sutinski settlement, with 43 recorded butterfly species. This locality is characterised by thermophilic meadows with hedges and scattered shrubs on the southern slopes of Strahinjšćica mountain, in the vicinity of mixed oak and beech forest. The next two squares by species richness have 77 recorded species. One includes the Sutla River and the important landscape “Zelenjak – Risvica and Cesar Hill” with surroundings. This square also includes the locality with the highest recorded butterfly diversity in the whole research area. Mihanovićev Dol settlement, along the Sutla River towards Zelenjak restaurant, with 60 recorded species. There is a mixture of diverse habitats on a small surface area, like the Sutla River with surrounding vegetation with willow trees, wet meadows at river banks and dry meadows on the edges of thermophilic oak, beach and conifer forest on the south-western slopes of Cesar Hill. The other square with 77 species includes eastern parts of Strahinjšćica and western parts of Ivanščica mountain. The highest species diversity was recorded again close to Gorjani Sutinski settlement, Smrečki hamlet surroundings 2, with 40 species. Habitats here are wet meadows along a small creek and a fishpond, surrounded by oak and beech forest. Two more squares include the central (66 species) and eastern parts (55 species) of Ivanščica mountain with lowlands along the Bednja River.

Several species have been found at only one locality or a few localities and can be considered as rare or locally distributed in the region (Tab. 1). Species found at only 1-3 localities are: Carcharodus alceae (Esper, 1780), Spialia sertorius (Hoffmannsegg, 1804), Leptidea juvernica Williams, 1946, Pieris balauna (Lorković, 1970), Pontia edusa (Fabricius 1777), Cupido decolorata (Staudinger 1886), Phengaris alcon (Denis & Schiffermüller, 1775), Phengaris teleius (Bergsträsser, 1779), Polyommatus daphnis (Denis & Schiffermüller, 1775), Satyrium acaciae (Fabricius, 1787), Satyrium ilicis (Esper, 1779), Satyrium pruni (Linnaeus, 1758), Satyrium spinii (Denis & Schiffermüller, 1775), Thecla betulae (Linnaeus, 1758), Boloria selene (Denis & Schiffermüller, 1775), Brenthis ino (Rottemburg, 1775), Hipparchia fagi (Scopoli, 1763), Lasiommata maera (Linnaeus, 1758), Melitaea diamina (Lang, 1789), Melitaea ornata Christoph, 1893 and Pyronia tithonus (Linnaeus, 1767).

Tab. 1. List of recorded species with locality numbers and species data from literature. Locality numbers correspond to the ones given in the Appendix 1.

| No | List of species                                      | Locality number | Literature                  |
|----|-------------------------------------------------------|-----------------|-----------------------------|
| 1. | Carcharodus alceae (Esper, 1780)                      | 72              | Abafi-Aigner 1910           |
| 2. | Carcharodus floccifera (Zeller, 1847)                 | 153, 227, 275, 291 | Abafi-Aigner 1910           |
| 3. | Carterocephalus palaemon (Pallas, 1771)               | 108, 142, 143, 151, 190 | Abafi-Aigner 1910           |
| 4. | Erynnis tages (Linnaeus, 1758)                        | 4, 5, 7, 9, 16, 19, 27, 28, 29, 33, 34, 41, 42, 45, 49, 76, 78, 81, 97, 101, 103, 105, 119, 125, 129, 134, 143, 147, 156, 173, 177, 195, 239, 243, 244, 272, 281, 287, 289, 292 | Abafi-Aigner 1910 |
| 5. | Hesperia comma (Linnaeus, 1758)                       | 34, 120, 128, 129 | Abafi-Aigner 1910           |
| 6. | Heteropterus morpheus (Pallas, 1771)                  | 4, 9, 29, 34, 120, 126, 135, 148, 162, 168, 173, 179, 206, 243, 259, 271, 274 | Abafi-Aigner 1910 |
| No | List of species | Locality number | Literature |
|----|----------------|-----------------|------------|
| 7. | *Ochlodes sylvanus* (Esper, 1777) | 7, 8, 9, 10, 11, 12, 15, 18, 19, 23, 24, 29, 30, 33, 34, 36, 39, 40, 44, 45, 48, 49, 50, 57, 60, 76, 78, 82, 83, 85, 93, 97, 103, 104, 106, 108, 120, 121, 129, 142, 147, 148, 160, 169, 173, 179, 192, 198, 209, 211, 223, 224, 225, 227, 231, 239, 243, 244, 247, 258, 262, 263, 270, 275, 277, 278, 287, 290, 291 | Abafi-Aigner 1910, Marčec 2008, Mladinov 1975 |
| 8. | *Pyrgus armoricanus* (Oberthür, 1910) | 15, 28, 50, 239 | Marčec 2008 |
| 9. | *Pyrgus malvae* (Linnaeus, 1758) | 3, 7, 8, 26, 28, 34, 45, 49, 76, 78, 83, 90, 103, 105, 106, 115, 119, 121, 129, 134, 143, 148, 153, 156, 157, 160, 169, 173, 176, 177, 198, 227, 241, 243, 247, 249, 250, 259, 275, 277, 291 | Abafi-Aigner 1910, Mladinov 1975 |
| 10. | *Spialia sertorius* (Hoffmannsegg, 1804) | 78, 129 | |
| 11. | *Thymelicus lineola* (Ochsenheimer, 1808) | 20, 23, 27, 28, 57, 59, 72, 91, 98, 103, 104, 108, 116, 118, 119, 120, 129, 136, 144, 148, 149, 150, 151, 155, 164, 166, 173, 177, 179, 199, 205, 207, 213, 243, 251, 264, 274, 275, 277, 278, 290 | Marčec 2008 |
| 12. | *Thymelicus sylvestris* (Poda, 1761) | 11, 20, 23, 27, 34, 39, 42, 81, 94, 99, 100, 112, 113, 117, 136, 143, 144, 146, 149, 150, 155, 158, 164, 165, 173, 175, 178, 179, 186, 189, 196, 199, 205, 239, 243, 244, 269, 274, 276, 277, 278, 281, 287 | Marčec 2008 |

| Papilionidae |

| 13. | *Iphiclides podalirius* (Linnaeus, 1758) | 8, 13, 16, 19, 30, 34, 41, 45, 49, 50, 51, 55, 66, 77, 83, 86, 90, 91, 97, 98, 101, 103, 105, 109, 120, 129, 131, 135, 136, 149, 150, 164, 166, 168, 170, 174, 179, 180, 185, 186, 188, 189, 195, 197, 213, 231, 232, 239, 244, 256, 259, 262, 271, 274, 280, 283, 287, 289 | Abafi-Aigner 1910, Marčec 2008 |
| 14. | *Papilio machaon* Linnaeus, 1758 | 8, 14, 34, 49, 55, 60, 77, 83, 86, 90, 105, 108, 109, 113, 120, 125, 128, 129, 135, 142, 188, 219, 239, 258 | Abafi-Aigner 1910, Marčec 2008 |
| 15. | *Parnassius mnemosyne* (Linnaeus, 1758) | 19, 41, 66, 134, 142, 143, 181, 183, 192, 210, 211, 212, 219, 221, 222, 225, 234, 238, 265 | Abafi-Aigner 1910, Marčec 2008, Mladinov 1973 |
| 16. | *Zerynthia polyxena* (Denis & Schiffermüller, 1775) | 12, 19, 63, 76, 97, 103 | Abafi-Aigner 1910, Marčec, 2008 |
| No | List of species                          | Locality number                                                                 | Literature               |
|----|----------------------------------------|---------------------------------------------------------------------------------|--------------------------|
|    | **Pieridae**                           |                                                                                 |                          |
| 17 | *Anthocharis cardamines* (Linnaeus, 1758) | 29, 30, 34, 52, 55, 56, 66, 83, 86, 101, 103, 105, 108, 109, 125, 129, 143, 148, 172, 177, 193, 201, 203, 230, 232, 239, 240, 261, 267, 285, 289, 292 | Abafi-Aigner 1910, Marčec 2008 |
| 18 | *Aporia crataegi* (Linnaeus, 1758)     |                                                                                 | Abafi-Aigner 1910, Marčec 2008, Mladinov 1973 |
| 19 | *Colias alfacariensis* Ribbe, 1905     | 3, 8, 16, 19, 27, 42, 89, 121, 126, 129, 134, 143, 147, 173, 196, 280, 281, 283 |                          |
| 20 | *Colias croceus* (Fourcroy, 1785)      | 5, 8, 15, 30, 34, 40, 44, 45, 51, 60, 78, 84, 88, 93, 96, 106, 113, 124, 126, 129, 140, 160, 163, 169, 170, 175, 186, 189, 190, 208, 225, 231, 233, 235, 237, 243, 244, 247, 259, 262, 272, 278 | Abafi-Aigner 1910, Marčec 2008 |
| 21 | *Colias hyale* (Linnaeus, 1758)        | 60, 120, 129, 132, 136, 170, 283                                               | Marčec 2008              |
| 22 | *Colias myrmidone* (Esper, 1781)       |                                                                                 | Abafi-Aigner 1910, Marčec 2008 |
|    | **Gonepteryx rhamni** (Linnaeus, 1758) | 4, 7, 8, 11, 19, 20, 23, 29, 30, 31, 33, 34, 40, 41, 45, 49, 50, 54, 55, 57, 65, 66, 77, 78, 81, 85, 89, 90, 91, 97, 98, 99, 100, 101, 103, 104, 105, 106, 107, 108, 115, 125, 126, 129, 138, 139, 142, 143, 144, 145, 146, 148, 149, 150, 151, 155, 170, 172, 173, 177, 178, 180, 182, 185, 188, 189, 190, 191, 192, 194, 196, 197, 201, 217, 219, 225, 227, 240, 243, 244, 247, 261, 262, 267, 274, 278, 280, 282, 283, 287, 289, 292 | Abafi-Aigner 1910, Marčec 2008 |
| 24 | *Leptidea juvernica* Williams, 1946    | 173, 198                                                                        | Marčec 2008              |
| 25 | *Leptidea morsei* (Fenton, 1882)       |                                                                                 | Lorković 1993            |
| 26 | *Leptidea sinapis* (Linnaeus, 1758)    | 2, 6, 7, 8, 10, 11, 14, 15, 19, 21, 23, 27, 28, 29, 30, 33, 34, 35, 36, 39, 41, 45, 49, 50, 51, 54, 58, 84, 85, 88, 90, 97, 98, 99, 103, 104, 105, 106, 108, 116, 119, 120, 123, 125, 128, 129, 134, 136, 142, 143, 144, 145, 148, 150, 151, 157, 160, 167, 173, 177, 178, 186, 190, 194, 196, 198, 201, 205, 209, 230, 231, 232, 233, 237, 238, 240, 243, 244, 247, 249, 252, 261, 262, 264, 278, 279, 287 | Abafi-Aigner 1910, Marčec 2008 |
| 27 | *Pieris balcana* (Lorković, 1970)      | 288                                                                             | Lorković 1989            |
| 28 | *Pieris brassicae* (Linnaeus, 1758)    | 3, 15, 24, 29, 33, 34, 40, 41, 43, 45, 49, 50, 51, 68, 73, 90, 98, 101, 103, 104, 105, 108, 110, 115, 120, 126, 128, 135, 139, 141, 148, 172, 180, 185, 192, 194, 197, 198, 210, 211, 217, 219, 222, 225, 234, 258, 269, 273, 278, 279, 287 | Abafi-Aigner 1910, Marčec 2008 |
| No | List of species | Locality number | Literature |
|----|----------------|----------------|------------|
| 29. | *Pieris mannii* (Mayer, 1851) | 28, 29, 34, 45, 77, 95, 99, 120, 151, 197, 202, 215, 222, 223, 225, 235, 243, 244, 262, 278 | Marčec 2008 |
| 30. | *Pieris napi* (Linnaeus, 1758) | 2, 6, 8, 18, 25, 29, 31, 33, 34, 40, 41, 43, 45, 49, 50, 51, 61, 68, 73, 75, 76, 78, 79, 81, 83, 89, 90, 92, 95, 98, 99, 103, 106, 107, 108, 113, 115, 119, 128, 129, 133, 135, 139, 142, 144, 147, 148, 149, 154, 155, 156, 160, 161, 164, 169, 170, 172, 173, 182, 188, 190, 191, 192, 194, 196, 197, 206, 209, 210, 211, 213, 215, 216, 217, 219, 222, 225, 231, 233, 234, 238, 242, 243, 244, 248, 249, 254, 258, 260, 262, 264, 266, 268, 269, 278, 279, 282, 284, 287, 289, 292 | Abafi-Aigner 1910, Marčec 2008 |
| 31. | *Pieris rapae* (Linnaeus, 1758) | 1, 3, 6, 8, 15, 19, 25, 27, 28, 29, 30, 32, 33, 34, 35, 40, 41, 42, 44, 45, 49, 50, 51, 60, 64, 72, 78, 88, 95, 98, 99, 103, 104, 106, 107, 116, 120, 123, 127, 129, 134, 136, 139, 140, 144, 146, 149, 155, 156, 157, 159, 163, 164, 165, 170, 173, 180, 184, 186, 188, 189, 192, 195, 199, 213, 217, 225, 229, 231, 235, 239, 240, 242, 249, 259, 268, 269, 271, 273, 274, 278, 281, 283, 287, 289, 292 | Abafi-Aigner 1910, Marčec 2008 |
| 32. | *Pontia edusa* (Fabricius, 1777) | 113 | Marčec 2008 |

**Riodinidae**

| 33. | *Hamearis lucina* (Linnaeus, 1758) | 29, 33, 34, 45, 78, 81, 86, 103, 108, 109, 149, 220, 271, 274 | Marčec 2008 |

**Lycaenidae**

| 34. | *Aricia agestis* (Denis & Schiffermüller, 1775) | 29, 34, 45, 49, 97, 103, 128, 129, 143, 243, 278 | Marčec 2008 |
| 35. | *Callophrys rubi* (Linnaeus, 1758) | 7, 19, 29, 30, 49, 77, 103, 105, 129, 146, 172, 180, 243, 279, 289, 292 | Abafi-Aigner 1910 |
| 36. | *Celastrina argiolus* (Linnaeus, 1758) | 25, 27, 29, 33, 34, 41, 45, 49, 58, 77, 90, 98, 103, 105, 108, 109, 110, 111, 113, 116, 123, 125, 129, 135, 139, 141, 142, 143, 148, 149, 155, 165, 166, 167, 184, 188, 192, 194, 197, 201, 215, 217, 219, 223, 225, 226, 227, 232, 258, 261, 267, 274, 282, 288, 289 | Abafi-Aigner 1910, Marčec 2008 |
| 37. | *Cupido minimus* (Fuessly, 1775) | 26, 28, 75, 87, 103, 114, 124, 129, 143, 178, 186, 205, 270 | Lorković 2009, Marčec 2008 |
| 38. | *Cupido alcetas* (Hoffmannsegg, 1804) | 90, 93, 143, 153, 159 | Lorković 2009, Marčec 2008 |
| No | List of species | Locality number | Literature |
|----|----------------|----------------|------------|
| 39. | *Cupido argiades* (Pallas, 1771) | 1, 6, 7, 15, 16, 19, 28, 29, 30, 34, 40, 45, 50, 69, 78, 81, 83, 95, 99, 103, 105, 107, 111, 112, 113, 116, 120, 124, 126, 129, 142, 143, 144, 148, 155, 157, 167, 173, 178, 196, 198, 202, 205, 233, 235, 236, 237, 241, 243, 244, 249, 260, 262, 278, 283, 287 | Abafi-Aigner 1910, Marčec 2008 |
| 40. | *Cupido decolorata* (Staudinger, 1886) | 88, 281, 287 | Lorković 2009 |
| 41. | *Cyaniris semiargus* (Rottemburg, 1775) | 7, 8, 16, 19, 134, 143, 153, 171, 173, 179, 206, 213, 224, 243, 272, 277, 281, 283, 287 | Abafi-Aigner 1910, Marčec 2008 |
| 42. | *Favonius quercus* (Linnaeus, 1758) | 34, 49, 96, 102 | Abafi-Aigner 1910, Marčec 2008 |
| 43. | *Glaucopsyche alexis* (Poda, 1761) | 103, 108, 143, 190 | Lorković 2009 |
| 44. | *Lycaena alciphron* (Rottemburg, 1775) | 70, 93, 120, 137, 153 | |
| 45. | *Lycaena dispar* (Haworth, 1802) | 3, 10, 11, 16, 19, 22, 26, 34, 44, 48, 50, 53, 59, 67, 69, 70, 78, 84, 90, 107, 121, 126, 132, 137, 142, 143, 151, 155, 156, 160, 169, 170, 198, 204, 206, 231, 233, 236, 237, 243, 244, 250, 260, 262, 271, 275, 277 | Abafi-Aigner 1910, Marčec 2008 |
| 46. | *Lycaena hippothoe* (Linnaeus, 1761) | 23, 26, 36, 47, 78, 157, 169, 171, 206, 241, 243, 247, 262, 275 | |
| 47. | *Lycaena phlaeas* (Linnaeus, 1761) | 15, 28, 34, 45, 60, 76, 97, 103, 109, 134, 136, 143, 160, 170, 179, 199, 247, 262, 291 | Abafi-Aigner 1910, Marčec 2008, Steiner 1916 |
| 48. | *Lycaena tityrus* (Poda, 1761) | 10, 11, 12, 29, 34, 36, 40, 45, 49, 76, 78, 83, 97, 103, 107, 143, 146, 151, 156, 163, 167, 168, 169, 177, 196, 206, 219, 220, 224, 233, 235, 241, 243, 262, 263, 270, 278 | Abafi-Aigner 1910, Marčec 2008 |
| 49. | *Lycaena virgaureae* (Linnaeus, 1758) | 29, 98, 116, 146, 148, 151, 279 | |
| 50. | *Phengaris alcon* (Denis & Schiffermüller, 1775) | 116, 247 | Marčec 2008 |
| 51. | *Phengaris arion* (Linnaeus, 1758) | 9, 29, 30, 34, 49, 98, 262 | Abafi-Aigner 1910, Marčec 2008 |
| 52. | *Phengaris teleius* (Bergsträsser, 1779) | 247, 260 | |
| 53. | *Plebejus argus* (Linnaeus, 1758) | 3, 4, 5, 9, 12, 15, 16, 19, 20, 25, 27, 35, 38, 39, 40, 42, 44, 50, 59, 62, 67, 84, 90, 93, 112, 120, 124, 126, 129, 132, 148, 160, 168, 170, 176, 179, 243, 258, 270, 278, 282, 287 | Abafi-Aigner 1910, Marčec 2008 |
| No | List of species | Locality number | Literature |
|----|----------------|-----------------|------------|
| 54. | *Plebejus argyrognomon* (Bergsträsser, 1779) | 5, 15, 280, 287 | Abafi-Aigner 1910, Lorković 2009, Marčec 2008 |
| 55. | *Plebejus idas* (Linnaeus, 1761) | 28, 142, 188 | Marčec 2008 |
| 56. | *Polyommatus bellargus* (Rottemburg, 1775) | 76, 77, 78, 85, 120, 129, 151, 233 | Abafi-Aigner 1910 |
| 57. | *Lysandra coridon* (Poda, 1761) |  | Abafi-Aigner 1910, Lorković 2009, Marčec 2008 |
| 58. | *Lysandra icarus* (Rottemburg, 1775) | 1, 4, 5, 6, 7, 8, 9, 10, 11, 12, 15, 16, 19, 20, 23, 24, 25, 26, 27, 28, 29, 30, 32, 33, 34, 35, 36, 40, 42, 44, 45, 47, 49, 50, 51, 57, 59, 60, 67, 69, 70, 73, 77, 78, 79, 81, 85, 87, 88, 89, 90, 93, 95, 97, 99, 100, 103, 106, 107, 112, 113, 117, 120, 124, 126, 128, 129, 130, 132, 134, 136, 137, 140, 143, 144, 146, 151, 153, 156, 157, 160, 161, 164, 169, 170, 171, 173, 175, 176, 179, 182, 188, 189, 195, 196, 197, 198, 199, 200, 215, 219, 220, 231, 235, 238, 239, 243, 244, 245, 250, 254, 257, 258, 259, 263, 270, 271, 272, 273, 274, 275, 276, 278, 280, 281, 283, 284, 286, 287, 290, 291 | Abafi-Aigner 1910, Marčec 2008 |
| 59. | *Polyommatus thersites* (Cantener, 1835) | 7, 19, 28, 49, 89, 90, 103, 113, 120, 124, 134, 143, 144, 278 |  |
| 60. | *Polyommatus daphnis* (Denis & Schiffermüller, 1775) | 103 | Abafi-Aigner 1910, Marčec 2008 |
| 61. | *Satyrium acaciae* (Fabricius, 1787) | 29, 34 | Abafi-Aigner 1910 |
| 62. | *Satyrium ilicis* (Esper, 1779) | 57 | Abafi-Aigner 1910, Marčec 2008 |
| 63. | *Satyrium pruni* (Linnaeus, 1758) | 57, 189, 243 | Abafi-Aigner 1910 |
| 64. | *Satyrium spini* (Denis & Schiffermüller, 1775) | 129, 134, 243 | Abafi-Aigner 1910, Marčec 2008 |
| 65. | *Satyrium w-album* (Knoch, 1782) | 23, 29, 34, 45, 49 | Marčec 2008 |
| 66. | *Scolitantides orion* (Pallas, 1771) | 29, 33, 108, 194 | Abafi-Aigner 1910, Lorković 2009, Marčec 2008 |
| 67. | *Thecla betulae* (Linnaeus, 1758) | 34 | Abafi-Aigner 1910, Marčec 2008 |
| No  | List of species                          | Locality number                                                                 | Literature         |
|-----|-----------------------------------------|----------------------------------------------------------------------------------|--------------------|
| 68. | Aglais io (Linnaeus, 1758)              | 3, 4, 5, 6, 8, 9, 16, 19, 29, 30, 31, 33, 34, 35, 40, 50, 52, 88, 90, 91, 98, 99, 103, 104, 105, 107, 108, 109, 110, 112, 113, 120, 125, 127, 128, 129, 133, 139, 141, 148, 152, 154, 155, 163, 164, 167, 170, 172, 179, 180, 182, 185, 188, 192, 194, 196, 198, 201, 204, 209, 211, 213, 217, 219, 224, 225, 231, 242, 243, 256, 259, 267, 282, 284, 289, 292 | Abafi-Aigner 1910, Marčec 2008 |
| 69. | Aglais urticae (Linnaeus, 1758)         | 12, 29, 34, 44, 47, 49, 57, 73, 77, 97, 108, 120, 134, 143, 146, 153, 171, 172, 175, 180, 181, 187, 192, 201, 219, 224, 225, 228, 252, 253, 258, 289 | Abafi-Aigner 1910, Marčec 2008 |
| 70. | Apatura ilia (Denis & Schiffermüller, 1775) | 12, 34, 50, 68, 74, 100, 137, 142, 144, 146, 148, 152, 154, 159, 163, 167, 198, 202, 204, 207, 227, 240, 243, 244, 259, 273, 279 | Marčec 2008 |
| 71. | Apatura iris (Linnaeus, 1758)           | 144, 179, 188, 217, 219, 279                                                   | Marčec 2008 |
| 72. | Aphantopus hyperantus (Linnaeus, 1758)  | 29, 33, 34, 45, 49, 50, 91, 98, 108, 127, 134, 140, 143, 149, 150, 164, 178, 179, 196, 197, 243, 271, 274, 276, 287 | Marčec 2008 |
| 73. | Araschnia levana (Linnaeus, 1758)       | 6, 7, 10, 19, 23, 28, 29, 30, 31, 32, 33, 34, 37, 38, 39, 40, 41, 45, 50, 53, 66, 67, 78, 79, 84, 88, 90, 98, 107, 108, 110, 113, 116, 123, 125, 133, 135, 141, 142, 143, 148, 150, 151, 154, 155, 159, 167, 177, 179, 184, 188, 192, 196, 197, 201, 209, 213, 215, 217, 227, 229, 234, 240, 242, 243, 248, 249, 252, 256, 259, 261, 267, 268, 271, 278, 282, 287 | Abafi-Aigner 1910, Marčec 2006 |
| 74. | Argynnis adippe (Denis & Schiffermüller, 1775) | 34, 45, 120, 146, 149, 179, 197, 211, 214, 215, 223, 224, 225, 278               | Marčec 2006 |
| 75. | Argynnis aglaja (Linnaeus, 1758)        | 134, 149, 179, 222, 225, 274                                                   | Marčec 2008 |
| 76. | Argynnis niobe (Linnaeus, 1758)         |                                                                               | Marčec 2008 |
| 77. | Argynnis pandora (Denis & Schiffermüller, 1775) | 79, 97, 197, 219                                                               | Marčec 2008 |
| 78. | Argynnis paphia (Linnaeus, 1758)        | 6, 34, 41, 45, 49, 50, 79, 107, 108, 110, 116, 120, 129, 139, 142, 148, 155, 163, 167, 188, 191, 192, 194, 197, 209, 217, 223, 224, 225, 252, 262, 274, 278, 282 | Marčec 2008 |
| 79. | Boloria dia (Linnaeus, 1767)            | 1, 6, 15, 27, 29, 30, 34, 37, 45, 81, 95, 120, 124, 126, 128, 129, 134, 177, 178, 179, 186, 189, 199, 231, 233, 252, 256, 259, 267, 272, 273, 279 | Abafi-Aigner 1910 |
| No  | List of species                        | Locality number | Literature     |
|-----|---------------------------------------|-----------------|----------------|
| 80. | *Boloria euphrosyne* (Linnaeus, 1758) | 146, 211, 223, 238, 244 | March 2008     |
| 81. | *Boloria selene* (Denis & Schiffermüller, 1775) | 275 | March 2008     |
| 82. | *Brenthis daphne* (Bergsträsser, 1780) | 11, 23, 25, 33, 34, 38, 39, 58, 88, 91, 98, 100, 103, 104, 108, 109, 110, 116, 120, 129, 137, 139, 142, 144, 146, 148, 151, 160, 169, 179, 188, 189, 192, 219, 222, 225, 229, 238, 243, 256, 258, 269, 270, 277, 278, 279, 284, 286, 287 | March 2008     |
| 83. | *Brenthis ino* (Rottemburg, 1775)   | 36, 146, 179 | March 2008     |
| 84. | *Brintesia circe* (Fabricius, 1775) | 34, 41, 99, 120, 129, 188, 209, 278 | March 2008     |
| 85. | *Coenonympha arcania* (Linnaeus, 1761) | 8, 11, 23, 29, 30, 31, 34, 36, 41, 68, 108, 110, 113, 120, 129, 134, 143, 148, 222, 224, 225, 249 | March 2008     |
| 86. | *Coenonympha glycerion* (Borkhausen, 1788) | 1, 6, 7, 8, 10, 11, 15, 19, 20, 23, 25, 26, 34, 36, 39, 40, 44, 47, 49, 50, 57, 59, 67, 70, 78, 87, 90, 93, 98, 100, 103, 107, 117, 120, 124, 126, 128, 129, 134, 137, 141, 143, 153, 157, 161, 167, 169, 198, 202, 220, 221, 224, 231, 236, 237, 238, 239, 241, 243, 244, 249, 257, 260, 264, 270, 273, 275, 277, 278, 290, 291 | March 2008     |
| 87. | *Coenonympha pamphilus* (Linnaeus, 1758) | 1, 3, 4, 6, 7, 8, 10, 11, 12, 14, 15, 17, 19, 20, 22, 23, 26, 27, 29, 30, 34, 36, 38, 39, 40, 44, 45, 47, 48, 50, 51, 53, 57, 59, 61, 67, 70, 75, 76, 77, 78, 83, 84, 85, 87, 90, 93, 97, 103, 106, 107, 111, 113, 119, 120, 121, 124, 126, 129, 130, 132, 134, 137, 141, 143, 144, 147, 148, 153, 154, 156, 160, 161, 167, 169, 170, 171, 173, 176, 177, 186, 187, 189, 190, 196, 198, 200, 202, 213, 220, 225, 233, 235, 236, 239, 240, 242, 243, 244, 246, 247, 249, 250, 252, 254, 256, 257, 258, 259, 260, 262, 270, 272, 275, 276, 277, 280, 283, 287, 290, 291 | Abafi-Aigner 1910, March 2008 |
| 88. | *Erebia aethiops* (Esper, 1777)      | 33, 34, 45, 49, 103, 184, 197, 215, 217, 223, 233, 278 | March 2008     |
| 89. | *Euphydryas aurinia* (Rottemburg, 1775) | 76, 78, 143, 144, 200 | Gussich 1917    |
| 90. | *Euphydryas maturna* (Linnaeus, 1758) |               |                |
| 91. | *Hipparchia (Hipparchia) fogi* (Scopoli, 1763) | 129, 144, 190 | March 2008     |
| No  | List of species                                      | Locality number | Literature                      |
|-----|-----------------------------------------------------|-----------------|---------------------------------|
| 92. | *Hipparchia (Hipparchia) semele* (Linnaeus, 1758)   | 24, 29, 33, 34, 37, 41, 45, 49, 128, 134, 143, 172, 179, 189, 211, 219, 222, 225, 276, 282, 289, 292 | Marčec 2008                   |
| 93. | *Issoria (Issoria) lathonia* (Linnaeus, 1758)       | 24, 29, 33, 34, 37, 41, 45, 49, 128, 134, 143, 172, 179, 189, 211, 219, 222, 225, 276, 282, 289, 292 | Marčec 2008                   |
| 94. | *Lasionnata maera* (Linnaeus, 1758)                 | 41              | Marčec 2008                     |
| 95. | *Lasionnata megera* (Linnaeus, 1767)                | 19, 41, 46, 83, 109, 111, 120, 170, 190, 210, 217, 243, 276, 281 | Abafi-Aigner 1910, Marčec 2008, Mladinov 1973 |
| 96. | *Limenitis camilla* (Linnaeus, 1764)                | 34, 215, 217, 252, 279 | Abafi-Aigner 1910, Marčec 2008 |
| 97. | *Limenitis reducta* Staudinger, 1901                | 29, 30, 33, 34, 41, 45, 49, 50, 79, 182, 192, 210, 215, 252 | Marčec 2008                   |
| 98. | *Lopinga achine* (Scopoli, 1763)                    | 211, 217, 234, 266, 278, 279 | Lorković 2009, Šašić & Mihoci 2007 |
| 99. | *Maniola jurtina* (Linnaeus, 1758)                  | 1, 3, 4, 5, 6, 9, 10, 11, 15, 18, 19, 20, 21, 22, 23, 25, 27, 28, 29, 30, 31, 32, 33, 34, 35, 37, 38, 39, 40, 41, 42, 44, 45, 49, 50, 51, 52, 53, 57, 58, 59, 60, 61, 62, 67, 68, 69, 70, 72, 77, 78, 81, 82, 84, 88, 90, 91, 94, 98, 99, 100, 102, 103, 104, 107, 108, 110, 111, 112, 113, 116, 117, 118, 120, 123, 124, 128, 129, 131, 132, 133, 135, 136, 137, 139, 140, 141, 144, 146, 148, 149, 151, 154, 155, 157, 159, 160, 161, 164, 165, 166, 167, 168, 169, 170, 173, 175, 178, 179, 182, 184, 188, 189, 190, 192, 194, 196, 197, 199, 202, 204, 205, 209, 210, 211, 213, 215, 217, 219, 222, 224, 225, 227, 233, 236, 237, 238, 239, 240, 242, 243, 244, 247, 248, 249, 252, 256, 258, 259, 260, 262, 263, 268, 269, 270, 271, 273, 274, 275, 276, 277, 278, 279, 282, 283, 287, 290, 291 | Abafi-Aigner 1910, Marčec 2008 |
| 100.| *Melanargia galathea* (Linnaeus, 1758)              | 4, 5, 9, 10, 23, 27, 28, 29, 31, 33, 34, 36, 37, 45, 49, 72, 77, 81, 84, 91, 94, 98, 99, 103, 104, 108, 112, 113, 116, 117, 120, 124, 126, 129, 131, 134, 136, 139, 141, 143, 148, 149, 150, 151, 155, 158, 164, 166, 168, 173, 175, 176, 178, 179, 186, 189, 199, 205, 211, 219, 222, 225, 229, 239, 243, 252, 256, 258, 264, 270, 271, 272, 274, 276, 278, 279, 280, 283, 287 | Abafi-Aigner 1910, Marčec 2008 |
| No  | List of species          | Locality number | Literature                                      |
|-----|--------------------------|-----------------|------------------------------------------------|
| 101.| *Melitaea athalia* (Rottemburg, 1775) | 1, 7, 8, 11, 12, 14, 15, 19, 20, 23, 26, 27, 34, 36, 37, 38, 39, 41, 44, 45, 47, 50, 57, 58, 59, 70, 78, 83, 85, 87, 90, 93, 103, 107, 111, 112, 113, 117, 120, 126, 129, 131, 134, 137, 143, 144, 146, 147, 153, 154, 161, 164, 166, 169, 171, 177, 178, 179, 181, 186, 190, 192, 198, 202, 207, 210, 211, 216, 226, 233, 235, 238, 239, 241, 243, 247, 249, 256, 257, 260, 262, 264, 265, 269, 270, 273, 275, 277, 278, 279, 283, 291 | Abafi-Aigner 1910, Marčec 2008, Koren & Jugovic 2012 |
| 102.| *Melitaea aurelia* Nickerl, 1850 | 34, 49, 83, 85, 103, 108, 129, 151, 168, 225, 275 | Marčec 2008, Koren & Jugovic 2012 |
| 103.| *Melitaea britomartis* Assmann, 1847 | 26, 78, 153, 200 | Koren & Jugovic 2012 |
| 104.| *Melitaea cinxia* (Linnaeus, 1758) | 7, 70, 78, 83, 85, 129, 142, 143, 153, 200, 220, 257 | Abafi-Aigner 1910, Marčec 2008 |
| 105.| *Melitaea diamina* (Lang, 1789) | 11, 243, 291 | Abafi-Aigner 1910, Marčec 2008 |
| 106.| *Melitaea didyma* (Esper, 1778) | 1, 7, 8, 15, 19, 25, 26, 29, 30, 34, 38, 47, 49, 50, 61, 78, 91, 99, 120, 124, 126, 129, 134, 143, 171, 178, 186, 189, 220, 238, 239, 243, 256, 287 | Marčec 2008 |
| 107.| *Melitaea ornata* Christoph, 1893 | 143 | Koren & Štih 2013 |
| 108.| *Melitaea phoebe* (Denis & Schiffermüller, 1775) | 5, 7, 14, 15, 19, 25, 26, 29, 30, 34, 45, 49, 50, 78, 83, 85, 103, 108, 129, 134, 143, 147, 190, 200, 220, 239, 243, 247, 257, 270, 275, 281, 287 | Abafi-Aigner 1910 |
| 109.| *Melitaea trivia* (Denis & Schiffermüller, 1775) | 29, 34, 49, 124, 143, 178 | Abafi-Aigner 1910 |
| 110.| *Minois dryas* (Scopoli, 1763) | 6, 15, 28, 29, 30, 34, 45, 49, 51, 103, 120, 126, 128, 143, 157, 225, 243, 262, 263, 271, 278, 287 | Marčec 2008 |
| 111.| *Neptis rivularis* (Scopoli, 1763) | 37, 49, 64, 68, 108, 192, 194, 215 | Abafi-Aigner 1910, Marčec 2008 |
| 112.| *Neptis sappho* (Pallas, 1771) | 6, 7, 9, 19, 29, 30, 31, 33, 34, 41, 45, 46, 49, 50, 55, 66, 75, 79, 80, 89, 90, 95, 97, 103, 108, 120, 127, 134, 135, 142, 143, 144, 149, 154, 163, 164, 179, 181, 182, 183, 184, 188, 192, 196, 197, 209, 213, 215, 216, 217, 229, 233, 234, 235, 242, 243, 252, 262, 263, 266, 269, 271, 279, 282, 284, 287 | Abafi-Aigner 1910, Marčec 2008 |
| 113.| *Nymphalis antiopa* (Linnaeus, 1758) | 29, 34, 105, 108, 135, 139, 174, 180, 185, 217, 218 | Abafi-Aigner 1910, Marčec 2008 |
| 114.| *Nymphalis polychloros* (Linnaeus, 1758) | 29, 34, 105, 108, 139, 142, 180, 192, 201, 214, 217 | Abafi-Aigner 1910, Marčec 2008 |
| 115.| *Pararge aegeria* (Linnaeus, 1758) | 7, 33, 34, 41, 49, 64, 71, 73, 78, 81, 103, 105, 108, 123, 174, 192, 197, 225, 234, 238 | Marčec 2008 |
| No | List of species | Locality number | Literature |
|----|----------------|-----------------|------------|
| 116. | *Polygonia c-album* (Linnaeus, 1758) | 6, 15, 23, 24, 29, 30, 31, 33, 34, 40, 41, 45, 49, 50, 52, 54, 64, 79, 90, 98, 102, 105, 108, 110, 113, 120, 123, 125, 135, 139, 142, 144, 146, 148, 159, 160, 174, 180, 184, 185, 188, 192, 194, 197, 199, 201, 204, 210, 215, 217, 219, 222, 224, 225, 226, 234, 243, 255, 259, 269, 273, 279, 282, 286, 289 | Abafi-Aigner 1910, Marčec 2008 |
| 117. | *Pyronia (Pyronia) tithonus* (Linnaeus, 1767) | 78 | Abafi-Aigner 1910, Marčec 2008 |
| 118. | *Vanessa atalanta* (Linnaeus, 1758) | 2, 8, 9, 29, 32, 33, 34, 37, 40, 41, 43, 44, 45, 49, 50, 57, 77, 78, 79, 82, 97, 103, 107, 108, 120, 122, 123, 129, 133, 135, 139, 142, 143, 144, 148, 159, 182, 184, 186, 192, 196, 202, 207, 209, 211, 214, 215, 219, 222, 223, 225, 239, 243, 244, 248, 249, 252, 263, 275, 284 | Abafi-Aigner 1910, Marčec 2008 |
| 119. | *Vanessa cardui* (Linnaeus, 1758) | 1, 10, 12, 15, 36, 38, 39, 40, 44, 67, 70, 90, 97, 98, 99, 109, 110, 112, 113, 120, 129, 143, 217, 219, 225, 249, 278 | Abafi-Aigner 1910, Marčec 2008 |

**Fig. 2.** EEA 10 x 10 km reference grid with the number of recorded species within each square.
DISCUSSION

In the historically extensively managed agricultural landscape of Hrvatsko zagorje with small parcels of mosaic and diverse land use and heterogeneous habitats, changes in agricultural policy and globalisation led to the decline and abandonment of pastures and meadows, with the consequence of declining butterfly diversity. Today, suitable habitats in lowland and hilly areas are dotted between arable land and forest fragments on the hills. Big areas of wet meadows are urbanised or overgrown by invasive alien plant species.

Habitat generalists like *Pieris rapae* (Linnaeus, 1758), *Pieris napi* (Linnaeus, 1758), *Leptidea sinapis* (Linnaeus, 1758), *Melitaea athalia* (Rottemburg, 1775), *Gonepteryx rhamni* (Linnaeus, 1758), *Coenonympha pamphilus* (Linnaeus, 1758), *Lyassandra icarus* (Rottemburg, 1775) and *Maniola jurtina* (Linnaeus, 1758) are still common and widespread throughout the region. On the other hand, habitat specialists are usually very local and present only on suitable habitat types, which are also usually scarce and small.

Dry grasslands are one of the most endangered habitats in the region, as the only preserved patches of grasslands in the area remained in mountainous areas. They are usually located on steep or not easily accessible localities and are now abandoned and overgrown with shrubs and small trees. The best-preserved dry grasslands in the area are at the locality Plat on the southern slope of Mt. Strahinjščica. They were revitalized several years ago, and are now regularly mowed late in the season once a year, to stop the succession, which is the main cause of degradation of dry grasslands. There are several areas in the region that urgently need actions for preventing loss of grasslands, like Mt. Ivanščica, Zelenjak and on other preserved meadows in the western part of the region, near the Sutla River. Due to lack of suitable habitats dry grassland specialists like *Plebejus* spp., *Polyommatus daphnis* (Denis & Schiffermüller, 1775), *Pyrgus armoricanus* (Oberthür, 1910), *Spialia sertorius* (Hoffmannseggg, 1804), *Carcharodus alceae* (Esper, 1780) are generally very rare in the region.

*Polyommatus thersites* (Cantener, 1834) is another rare and a local species in Hrvatsko zagorje but also generally in Croatia, categorized as Near Threatened (Šašić et al., 2015). This species inhabits dry grasslands on which its host plant, *Onobrychis vicifolia* Scop., grows. In Hrvatsko zagorje we recorded this species on small grassland patches on Mt. Strahinjščica, Mt. Ivanščica and Risvica and Cesar hill. On similar habitats *Phengaris alcon rebeli* (Dennis & Schiffermüller, 1775) and *Polyommatus daphnis* were found, also in very small numbers. All three species are endangered due to lack of management on grasslands being overgrown with shrubs.

Wet grasslands are found along watercourses and in areas with limited drainage in valleys. Several interesting species have been found there including a wet grassland specialist, *Boloria selene* (Dennis & Schiffermüller, 1775), which was recorded only once with a single specimen. While several historical records exist for this species in northern Croatia, it seems that it is becoming rare in Hrvatsko zagorje as the majority of wet grasslands are abandoned and declining. Similarly, in the neighbouring Slovenian region, Haloze, the species was recorded at only two of 67 surveyed localities (Verovnik, 2003). This species is not included in the Red Book of butterflies of Croatia (Šašić et al., 2015) but with the start of monitoring activities, we will be able to determine changes in population trends. Additionally, wet grassland species included in the Habitats Directive Annexes, *Euphydryas aurinia* (Rottemburg, 1775) and *Lycaena dispar* (Haworth, 1802) are present in these habitats and are included in the Natura 2000 network of nature protection areas of the European Union.

An additional Habitats Directive species, *Phengaris teleius*, has been observed on grasslands along the Bednja River. Its habitats are slowly overgrowing by shrubs and invasive plant species and urgent conservation actions are needed to prevent the disappearance of the species from Hrvatsko zagorje.

Species inhabiting forest clearings, forest edges and light woodlands are rarely observed. The same is true for *Hipparchia* species, with only three records of *H. fagi*, and none of *H. semele*, which is more common on karstic areas. Only a single specimen of *H. fagi* was observed in the region. We were expecting to find populations in woodlands on Mt. Ivanščica and Mt. Strahinjščica, but without success, despite many field observations. Lorković (2009) had already stated that the species was rare in lowland hill forests. Similarly, *L. achine* (Scopoli, 1763) has been observed only on Mt. Ivanščica with only a dozen observed specimens. The consecutive visits to the same locality during the last couple of years have yielded no further observation of this species, which may indicate it has become extinct or that the numbers have dropped to levels below the detectability threshold.
In contrast with the past, forests are becoming increasingly dense and not used or maintained in the same way as 40 years ago, when the edges were regularly cleaned, leaf litter was partly used in livestock keeping, and the clearings and forest edges were full of flowers. Today there is a lot less undergrowth and the forest edges are not maintained, being overgrown by shrubs, Rubus species and invasive plants or they are cleaned with heavy machinery, which destroys remaining plants and insects in the middle of the season. Therefore, many forest species are also declining.

Erebia aethiops (Esper, 1777) is the only member of the genus Erebia in northern Croatia. The presence of this species on Mt. Ivanšćica was already published (Lorković, 2009) but the species was additionally discovered on Mt. Strahinjičica, Mt. Ivanšćica and Rsvica and Cesar hill. On the neighbouring Mt. Medvednica near Zagreb, this species was not recorded during the recent intensive survey (Koren, unpublished), indicating possible changes in the butterfly diversity. Further studies of the population of this species in northern Croatia are needed in order to access its status.

An interesting species that was observed only twice in the region is Pyronia tithonus (Linnaeus, 1767). Historically it was known from many regions in mainland Croatia, but with limited number of records (Jaksić, 1988). The species is common in the Mediterranean region (e.g. Istria), but in the continental part of the country it is very localized. It usually inhabits forest edge habitats like shrubs, field edges and hedgerows. Additional surveys of this species are needed, in order to access its distribution and status in the region.

Six species have not been found during our nine years of study. One is the most endangered European species Colias myrmidone (Esper, 1781), which is already extinct from several countries (Marhoul & Dolek, 2012). In the past it was present in the surroundings of Krapina (Abafi-Aigner 1910). During recent surveys in nearby Slovenia it was not found as either (Verovnik, 2003). The last record of the species from Croatia is from the 1990s (Krčmar et al., 1996), which is similar to the situation in Slovenia, where it is presumed to be extinct (Predovnik & Verovnik, 2004).

Another formerly common species which we have not found is Aporia crataegi (Linnaeus, 1758). In the past, it was a widely distributed species in Croatia (Lorković, 2009), also in the WE part. Brusina (1889) reports an interesting observation from his train ride from Zagreb to Varazdin: “in the places where the land was wet, or at dunghills, hundreds of butterflies could be seen, one close to another drinking from the surface, which from the distance looked like a big white sheet”. He also mentions that in a nearby region, Kutinsko-Moslavačka County, money was offered for 100 caught butterflies, and during the first day, 7000 adults were caught. Nowadays, such large populations are a rarity especially in the northern part of the country. Despite natural fluctuations in numbers, it seems that the species is slowly disappearing from the northern part of Croatia. However, the statement should be confirmed with long-term monitoring. At present, its IUCN Red List status at the European scale is Least Concern, but it has been reported as regionally extinct in the Czech Republic, the Netherlands and the United Kingdom (van Swaay et al., 2010).

Also, we could not confirm the Natura 2000 woodland species, Euphydryas maturna (Linnaeus, 1758). This species is very localized and present only in the northern part of the country (Lorković, 2009). We visited several potential habitats for this species, and several of them like Lobor valley or the northern part of Mt. Ivanšćica seemed very suitable as habitat is similar to the species’ habitat in other parts of the country. E. maturna will be one of the target species for future surveys as it is present in Slovenia close to the state border (Verovnik et al., 2012). Additional field surveys should be carried out in order to confirm historical finding (Lorković, 1993) of another Natura 2000 species Leptidea morsei (Fenton, 1882) in deciduous woodland at the base of Mt. Ivanšćica

In addition, Argynnis niobe, a species observed to be in strong decline in Europe, was not found during recent surveys. Recent studies show species dependence on very large areas of potential larval habitats with Viola spp. and Plantago (Salz & Fartmann, 2009), which might be a problem in the mosaic landscape of Hrvatsko zagorje because most of the meadows and forest edges are becoming abandoned.

Whereas the majority of butterfly species in the region are declining in abundance due to habitat loss and habitat changes, Pieris manni (Mayer, 1851) seems to be expanding its range towards the north. Lorković (2009) stated that the species is rare but present on rocky areas in continental Croatia. Verovnik (2003) reports the first findings of the species in Haloze across the border and we found this species more often in Hrvatsko zagorje in recent years as well as across the border in Kozjanski Park in Slovenia. In addition, Argynnis pandora (Denis & Schiffermüller, 1775) is more often seen in the region, most probably due to climate change and global warming. In Slovenia, there are no known records of this species more northerly than Hrvatsko zagorje (Verovnik, 2003).
In a wider context, Hrvatsko zagorje preserves a more diverse butterfly fauna than the neighbouring region of Haloze in Slovenia, with a reported 96 species from 67 localities (Verovnik, 2003). However, looking at the situation of the remaining preserved flowering grassland and other valuable butterfly habitats, the future is not very optimistic. Small-scale farming is already disappearing as farms cannot survive and compete with globalisation. Therefore, more and more meadows are abandoned, turned into fields or too intensively managed. Forest edges, hedges and wet meadows are overgrowing with invasive alien plants. Therefore, suitable habitats for butterflies that are habitat specialists are increasingly difficult to find, and the distances between them are increasing with the disappearance of habitat patches in between. In the near future this will probably lead to local extinctions of some species, especially dry grassland specialists like *P. thersites* or *P. daphnis*. To preserve this valuable diversity in the region, renaturation of remaining grassland would be necessary and urgent. In the long term, this can work only in cooperation with local farmers, to enable them economic survival using extensive agriculture. With increasing globalisation and pressure on production processes from the global market the future does not look very optimistic even with more focused subsidies. To preserve valuable habitats in the region a joint cross-border approach with Kozjanski park and Haloze region is proposed to connect refugial habitats with potential dispersal corridors to enable sufficient gene flow between neighbouring populations of endangered species.

**CONCLUSIONS**

This contribution to the butterfly fauna is one of only a few extensive surveys of larger areas of Croatia, with the exception of Podravina region (Kranjičev, 1985) and the island of Krk (Habeler, 2008). With the combination of random surveys and targeted visits to the EEA 10x10 km grids, we were able to map the general butterfly biodiversity of the region. Prior to our survey the butterfly fauna of Hrvatsko Zagorje region was one of the least studied regions in Croatia, with a very limited number of literature records. During our survey, we could not record any significant expansions in the known species ranges; however, our data fill an existing gap in the known distribution of butterflies of Croatia. We still expect to reconfirm some species in the future which are known from the literature; however, no major increase in species richness is expected. The region Hrvatsko Zagorje may now be considered as one of the best studied regions in Croatia.

The largest butterfly biodiversity in the region can be found on the hills or in the mountains with preserved and diverse natural habitats. Some species historically inhabiting the region became very rare in the last century, or have possibly disappeared from the region. The most endangered habitats are grasslands and consequently, the most endangered butterflies are grassland specialists. Most of the remaining grasslands are abandoned and overgrown with shrubs and even trees. Wet grasslands are mostly covered with invasive plant species as they are not mowed, or at least, not regularly. For the long-term preservation of remaining grasslands, appropriate conservation actions and correct habitat management are needed.

As the Slovenian side of the border is also well surveyed (Verovnik, 2003), this result could be important in order to start joint conservation efforts to preserve the butterfly diversity on a broader scale. We would also encourage additional surveys and publications from the neighbouring region to gain a more comprehensive picture about the butterfly diversity of Croatia.

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SAŽETAK

Prilog poznavanju faune danjih leptira (Lepidoptera: Papilionoidea) Hrvatskog zagorja, Hrvatska

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Područje Hrvatskog zagorja jedno je od najneistraženijih područja u Hrvatskoj u pogledu raznolikosti danjih leptira, s tek ograničenim brojem literaturnih nalaza, većinom starijih od 100 godina. Naše istraživanje ove regije trajalo je devet godina, od 2008. pa do 2016. godine, prilikom čega smo posjetili 292 lokacije. Kao podlogu za kartiranje koristili smo EEA 10x10 kilometarsku mrežu, koju smo prvih godina popunjavali nesustavno, a 2016. godine ciljano smo kartirali i posjećivali slabije istražene ili neistražene lokacije. Ukupno smo zabilježili 112 vrste danjih leptira, a pregledom literature zabilježili smo dodatnih šest vrsta, što zajedno čini 118 vrsta ili 60% faune danjih leptira Hrvatske. Najveća raznolikost leptira zabilježena je na planinama Ivanjščici i Strahinjščici te u dolini rijeke Šutle. Tijekom istraživanja primijećeno je da se vrste koje su stanišni generalisti mogu susresti gotovo na svim lokacijama, dok su vrste vezane uz točno određene stanišne tipove, odnosno stanišni specijalisti, vrlo lokalne i uglavnom malobrojne. Zabilježili smo i nekoliko rijetkih i ugroženih vrsta, ponajviše travnjakčkih specijalista poput *Phengaris teleius*, *Ph. alcon*, *Polyommatus thersites*, *Euphydryas aurinia* i *Zerynthia polyxena* čija su staništa u opadanju zbog promjene u korištenju travnjaka poput zapuštanja ili rjeđe, pojačanog korištenja. Populacija vrste *Lycaena dispar* je još uvijek lokalno mnogobrojna, no i njena se staništa ubrzano zarastaju od strane invazivnih biljaka. Regija Hrvatskog zagorja bogatija je vrstama nego susjedna regija Haloze u Sloveniji (Verovnik, 2003), no primijećeni su negativni trendovi u nestanku staništa. Promjene u načinu gospodarenja zemljištem, prvenstveno napuštanje tradicionalnog stočarstva kao i poljoprivrede na malim parcelama, dovelo je do zarastanja i nestanka malih fragmenta staništa. Najpovoljnija staništa poput suhih travnjaka opstaju uglavnom na termofilnim strmim obroncima brežuljaka i planina, dok su drugdje gotovo izumjerene. Zahvaljujući tome su i brojnosti vrsta vezana uz takva staništa, poput *P. thersites* ili *P. daphnis*, iznimno male. Isto tako, vlažni travnjaci uglavnom su degradirani ili prekriveni invazivnim biljkama, onemogućujući dugoročni opstanak močvarnih vrsta na području Hrvatskog zagorja. Opstanak rijetkih i ugroženih vrsta leptira na području Hrvatskog zagorja u potpunosti ovisi o usmjerenim manjim i većim akcijama revitalizacije staništa.
| Locality number | Locality name | Locality number | Locality name | Locality number | Locality name | Locality number | Locality name |
|-----------------|---------------|-----------------|---------------|-----------------|---------------|-----------------|---------------|
| 1               | Zagorska Sela municipality, between Luke Poljanske and Hum na Sutli settlements | E               | Hum na Sutli municipality, between Luke Poljanske and Hum na Sutli settlements | N               | Zagorska Sela municipality, between Luke Poljanske and Hum na Sutli settlements | Date          | 187 |
| 2               | Zagorska Sela municipality, Poljanska Sutlanska settlement | E               | Zagorska Sela municipality, Poljanska Sutlanska settlement | N               | Zagorska Sela municipality, Poljanska Sutlanska settlement | Date          | 187 |
| 3               | Zagorska Sela municipality, surrounds of Pokšće settlement | E               | Zagorska Sela municipality, surrounds of Pokšće settlement | N               | Zagorska Sela municipality, surrounds of Pokšće settlement | Date          | 187 |
| 4               | Zagorska Sela municipality, Plavić settlement | E               | Zagorska Sela municipality, Plavić settlement | N               | Zagorska Sela municipality, Plavić settlement | Date          | 187 |
| 5               | Zagorska Sela municipality, Zagorska Sela settlement, 500 m NE from settlement | E               | Zagorska Sela municipality, Zagorska Sela settlement, 500 m NE from settlement | N               | Zagorska Sela municipality, Zagorska Sela settlement, 500 m NE from settlement | Date          | 187 |
| 6               | Hum na Sutli municipality, Donje Brezno settlement | E               | Hum na Sutli municipality, Donje Brezno settlement | N               | Hum na Sutli municipality, Donje Brezno settlement | Date          | 187 |
| 7               | Kumrovec municipality, Razvor settlement, close to border with Slovenia | E               | Kumrovec municipality, Razvor settlement, close to border with Slovenia | N               | Kumrovec municipality, Razvor settlement, close to border with Slovenia | Date          | 187 |
| 8               | Kumrovec municipality, Razvor settlement, close to border with Slovenia | E               | Kumrovec municipality, Razvor settlement, close to border with Slovenia | N               | Kumrovec municipality, Razvor settlement, close to border with Slovenia | Date          | 187 |
| 9               | Kumrovec municipality, Kumrovec settlement, SW of the railway station | E               | Kumrovec municipality, Kumrovec settlement, SW of the railway station | N               | Kumrovec municipality, Kumrovec settlement, SW of the railway station | Date          | 187 |
| 10              | Kumrovec municipality, Razvor settlement, close to border with Slovenia | E               | Kumrovec municipality, Razvor settlement, close to border with Slovenia | N               | Kumrovec municipality, Razvor settlement, close to border with Slovenia | Date          | 187 |
| 11              | Kumrovec municipality, Razvor settlement, close to border with Slovenia | E               | Kumrovec municipality, Razvor settlement, close to border with Slovenia | N               | Kumrovec municipality, Razvor settlement, close to border with Slovenia | Date          | 187 |
| 12              | Kumrovec municipality, Kumrovec settlement, SW of the railway station | E               | Kumrovec municipality, Kumrovec settlement, SW of the railway station | N               | Kumrovec municipality, Kumrovec settlement, SW of the railway station | Date          | 187 |
| 13              | Kumrovec municipality, Osuška Desinski settlement | E               | Kumrovec municipality, Osuška Desinski settlement | N               | Kumrovec municipality, Osuška Desinski settlement | Date          | 187 |
| 14              | Kumrovec municipality, Mali Tabor settlement | E               | Kumrovec municipality, Mali Tabor settlement | N               | Kumrovec municipality, Mali Tabor settlement | Date          | 187 |
| 15              | Kumrovec municipality, surrounding of St. Mary Risvica church | E               | Kumrovec municipality, surrounding of St. Mary Risvica church | N               | Kumrovec municipality, surrounding of St. Mary Risvica church | Date          | 187 |
| 16              | Kumrovec municipality, surrounding of St. Mary Risvica church | E               | Kumrovec municipality, surrounding of St. Mary Risvica church | N               | Kumrovec municipality, surrounding of St. Mary Risvica church | Date          | 187 |
| 17              | Kumrovec municipality, surrounding of St. Mary Risvica church | E               | Kumrovec municipality, surrounding of St. Mary Risvica church | N               | Kumrovec municipality, surrounding of St. Mary Risvica church | Date          | 187 |
| 18              | Kumrovec municipality, surrounding of St. Mary Risvica church | E               | Kumrovec municipality, surrounding of St. Mary Risvica church | N               | Kumrovec municipality, surrounding of St. Mary Risvica church | Date          | 187 |

Appendix I. List of surveyed localities, coordinates and dates.
| Locality number | Locality name | E    | N    | Date                   |
|-----------------|---------------|------|------|------------------------|
| 34              | Klanjec municipality, Mihanovićev Dol settlement, along Sutla River towards Zelenjak restaurant | 46,05705 | 15,71641 | 14.04.2013, 08.06.2013, 31.07.2013, 02.08.2013 |
| 35              | Hum na Sutli municipality, Hum na Sutli settlement, Leskov Grm hamlet | 46,22183 | 15,7168 | 9.7.2011 |
| 36              | Klanjec municipality, Druškovec Humski settlement, Ulice hamlet | 46,188 | 15,71993 | 7.6.2016 |
| 37              | Klanjec municipality, Mihanovićev Dol settlement, old ruins on Cesar hill | 46,06031 | 15,7233 | 2.7.2013 |
| 38              | Klanjec municipality, Mihanovićev Dol settlement, along Sutla River | 46,052 | 15,72388 | 29.5.2009 |
| 39              | Desinić municipality, Velika Horvatska settlement, towards Kramarić hamlet | 46,10471 | 15,72318 | 2.6.2009 |
| 40              | Klanjec municipality, Kačkovec settlement | 46,01151 | 15,72497 | 16.8.2013 |
| 41              | Klanjec municipality, Mihanovićev Dol settlement, mountaineers house on Cesar hill | 46,03678 | 15,72462 | 10.05.2012, 08.06.2013, 01.08.2013 |
| 42              | Pregrada municipality, Kosteljsko settlement, SW part of the settlement | 46,18841 | 15,72396 | 9.7.2011 |
| 43              | Klanjec municipality, Mihanovićev Dol settlement, road to mountaineers house on Cesar hill 1 | 46,05686 | 15,7259 | 27.6.2012 |
| 44              | Desinić municipality, Donji Zbilj settlement, eastern part of the settlement | 46,11449 | 15,72519 | 7.6.2016 |
| 45              | Kumrovec municipality, Podgora settlement | 46,06541 | 15,72662 | 16.07.2013, 01.08.2013 |
| 46              | Klanjec municipality, Mihanovićev Dol settlement, road to mountaineers house on Cesar hill 2 | 46,08559 | 15,72735 | 27.6.2012 |
| 47              | Klanjec municipality, Novi Dvori Klanječki settlement | 46,02367 | 15,72911 | 19.5.2012 |
| 48              | Tuhelj municipality, Pristava settlement 1 | 46,07347 | 15,73366 | 9.7.2011 |
| 49              | Klanjec municipality, Cesarska Ves settlement, Japica top on Cesar hill | 46,05859 | 15,7362 | 08.06.2013, 01.08.2013 |

| Locality number | Locality name | E    | N    | Date                   |
|-----------------|---------------|------|------|------------------------|
| 50              | Klanjec municipality, Ledine Klanačke settlement | 46,01662 | 15,73687 | 16.8.2013 |
| 51              | Klanjec municipality, between town of Klanjec and Lepoglavec settlement | 46,04649 | 15,73911 | 16.8.2013 |
| 52              | Tuhelj municipality, Prosenik settlement, vicinity of Horvatska river | 46,09907 | 15,73889 | 20.04.2013, 14.06.2013 |
| 53              | Tuhelj municipality, Pristava settlement 2 | 46,07493 | 15,74132 | 14.6.2013 |
| 54              | Tuhelj municipality, Tuhelj settlement, northern part along Horvatska river | 46,08719 | 15,74704 | 20.4.2013 |
| 55              | Klanjec municipality, between town of Klanjec and Cesarska Ves settlement | 46,05545 | 15,74859 | 7.5.2013 |
| 56              | Pregrada municipality, town of Pregrada, Kuna mountain slopes north of the town | 46,16854 | 15,74828 | 9.5.2012 |
| 57              | Pregrada municipality, Kostel settlement, NE slopes of Kuna mountain next to Kosteljina river | 46,18123 | 15,74899 | 7.6.2016 |
| 58              | Pregrada municipality, town of Pregrada, suburbs | 46,16083 | 15,75927 | 20.04.2013, 14.06.2013 |
| 59              | Pregrada municipality, town of Pregrada, between Dubrava hamlet and Vrh Pregradski settlement | 46,14728 | 15,7605 | 7.6.2016 |
| 60              | Klanjec na Sutli municipality, Radakovo settlement, next to Lučêlnica stream | 46,00447 | 15,77379 | 7.9.2013 |
| 61              | Pregrada municipality, Valentinovo settlement, between Pasarički and Makari hamlet | 46,15626 | 15,79191 | 14.6.2013 |
| 62              | Petrovsko municipality, Švedruža settlement, between Makari and Zivičniki hamlet | 46,15572 | 15,80038 | 9.7.2011 |
| 63              | Durmanec municipality, Jezeriše settlement, NW from the settlement | 46,20255 | 15,80035 | 9.5.2012 |
| 64              | Durmanec municipality, Hromec settlement, 3,7 km from the settlement on Macelj mountain | 46,24329 | 15,80085 | 6.6.2015 |
| 65              | Durmanec municipality, Jezeriše settlement, N from the settlement | 46,20652 | 15,80543 | 9.5.2012 |
| 66              | Durmanec municipality, Hromec settlement, southern slopes of the Macelj mountain | 46,2125 | 15,80951 | 9.5.2012 |
| 67              | Veliško Trgovišče municipality, Ravnice settlement, 800 m N-NE from Pavliš hamlet | 46,0591 | 15,81255 | 29.5.2009 |
| Locality number | Locality name | Locality number | Locality name | Date |
|----------------|--------------|----------------|--------------|------|
| 68             | Đurmanec municipality, Đurmanec town, 3.5 km S from the settlement of Završje Začretsko | 86             | Krapina municipality, Krapina town | 04.07.2015 |
| 69             | Đurmanec municipality, Đurmanec town, 4 km S from the settlement of Završje Začretsko | 87             | Krapina municipality, Zagorje settlement, Križni jarek area | 04.07.2015 |
| 70             | Đurmanec municipality, Đurmanec town, 900 m N from the settlement of Završje Začretsko | 88             | Đurmanec municipality, Đurmanec town, 900 m N from the settlement of Završje Začretsko | 04.07.2015 |
| 71             | Đurmanec municipality, Đurmanec town, 900 m N from the settlement of Završje Začretsko | 89             | Krapina municipality, Žutnica settlement, Križni jarek area | 04.07.2015 |
| 72             | Đurmanec municipality, Đurmanec town, 900 m N from the settlement of Završje Začretsko | 90             | Krapina municipality, Žutnica settlement, Križni jarek area | 04.07.2015 |
| 73             | Đurmanec municipality, Đurmanec town, 900 m N from the settlement of Završje Začretsko | 91             | Krapina municipality, Žutnica settlement, Križni jarek area | 04.07.2015 |
| 74             | Đurmanec municipality, Đurmanec town, 900 m N from the settlement of Završje Začretsko | 92             | Krapina municipality, Žutnica settlement, Križni jarek area | 04.07.2015 |
| 75             | Đurmanec municipality, Đurmanec town, 900 m N from the settlement of Završje Začretsko | 93             | Krapina municipality, Žutnica settlement, Križni jarek area | 04.07.2015 |
| 76             | Đurmanec municipality, Đurmanec town, 900 m N from the settlement of Završje Začretsko | 94             | Krapina municipality, Žutnica settlement, Križni jarek area | 04.07.2015 |
| 77             | Đurmanec municipality, Đurmanec town, 900 m N from the settlement of Završje Začretsko | 95             | Krapina municipality, Žutnica settlement, Križni jarek area | 04.07.2015 |
| 78             | Đurmanec municipality, Đurmanec town, 900 m N from the settlement of Završje Začretsko | 96             | Krapina municipality, Žutnica settlement, Križni jarek area | 04.07.2015 |
| 79             | Đurmanec municipality, Đurmanec town, 900 m N from the settlement of Završje Začretsko | 97             | Krapina municipality, Žutnica settlement, Križni jarek area | 04.07.2015 |
| 80             | Đurmanec municipality, Đurmanec town, 900 m N from the settlement of Završje Začretsko | 98             | Krapina municipality, Žutnica settlement, Križni jarek area | 04.07.2015 |
| 81             | Đurmanec municipality, Đurmanec town, 900 m N from the settlement of Završje Začretsko | 99             | Krapina municipality, Žutnica settlement, Križni jarek area | 04.07.2015 |
| Locality number | Locality name | E     | N     | Date                          |
|-----------------|---------------|-------|-------|-------------------------------|
| 100             | Radoboj municipality, Radoboj settlement, Biruši hamlet | 46,16467 | 15,89881 | 16.06.2013, 08.09.2013         |
| 101             | Radoboj municipality, Strahinje Radobojsko settlement | 46,17596 | 15,89876 | 12.4.2014                     |
| 102             | Radoboj municipality, Radoboj settlement, Zgorečki Cerovečki hamlet | 46,1704 | 15,9005 | 237.2.2015                    |
| 103             | Radoboj municipality, Strahinje Radobojsko settlement, towards Gornji Kamenečki hamlet | 46,177 | 15,90183 | 10.05.2014, 21.06.2014, 03.08.2014, 24.07.2015, 03.08.2016 |
| 104             | Jesenje municipality, Gornje Jesenje settlement, S from the Galoviči hamlet on Strahinjščica mountain slopes | 46,19708 | 15,90241 | 4.7.2015                      |
| 105             | Radoboj municipality, Radoboj settlement, between Gornji and Donji Kamenečki hamlet 1 | 46,17614 | 15,90838 | 17.4.2016                     |
| 106             | Oroslavje municipality, Oroslavje settlement, between Toplički stream and Krapina river | 46,01207 | 15,91034 | 08.06.2016, 22.05.2016         |
| 107             | Sveti Križ Začretje municipality, Sveti Križ Začretje settlement | 46,07949 | 15,91017 | 17.8.2013                     |
| 108             | Radoboj municipality, Radoboj settlement, between Gornji and Donji Kamenečki hamlet 2 | 46,17638 | 15,91049 | 10.05.2014, 21.06.2014, 24.07.2015 |
| 109             | Radoboj municipality, Radoboj settlement, Kunšteki hamlet | 46,16023 | 15,91465 | 24.06.2012, 21.07.2012, 23.07.2013 |
| 110             | Jesenje municipality, Brdo Jesenjsko settlement, Kranjčevi hamlet surroundings 1 | 46,19531 | 15,91448 | 4.7.2015                      |
| 111             | Radoboj municipality, Radoboj settlement, between Jurinjaki and Tuški hamlet | 46,15388 | 15,91511 | 24.6.2012                     |
| 112             | Zabok municipality, Zabok town, Tršinski hamlet | 46,03208 | 15,91748 | 22.6.2013                     |
| 113             | Zabok municipality, Lug Zabocki settlement, vicinity of river Krapina | 46,0181 | 15,91792 | 22.6.2013                     |
| Locality number | Locality name | E       | N       | Date                      |
|-----------------|---------------|---------|---------|---------------------------|
| 129             | Radoboj municipality, Gorjani Sutinski settlement, NE from Draganići hamlet 2 | 46,17689 | 15,93922 | 21.06.2014, 22.06.2014, 29.08.2014, 30.08.2014, 09.09.2014, 29.09.2014, 16.04.2015, 06.06.2015, 17.04.2016, 22.05.2016 |
| 130             | Bedekovčina municipality, Križanče settlement | 46,05797 | 15,94054 | 31.8.2013                 |
| 131             | Stubičke toplice municipality, Pila settlement, 1 km SE from settlement towards G.Pila hamlet | 45,94255 | 15,94179 | 29.6.2012                 |
| 132             | Radoboj municipality, Gornja Šemnica settlement, Slivnjaki hamlet | 46,1489  | 15,94122 | 9.7.2011                  |
| 133             | Stubičke toplice municipality, Stubičke toplice settlement, Jarki hamlet | 45,9862  | 15,94422 | 18.8.2013                 |
| 134             | Radoboj municipality, Gorjani Sutinski settlement, NE from Draganići hamlet 3 | 46,17746 | 15,94286 | 20.05.2012, 23.06.2012     |
| 135             | Bednja municipality, Trakoščan settlement, Trakoščan lake next to castle | 46,25829 | 15,94387 | 23.7.2013                 |
| 136             | Donja Stubica municipality, Pustodol settlement | 45,97671 | 15,9505  | 29.6.2012                 |
| 137             | Jesenje municipality, Brdo Jesenjsko settlement, Basaki hamlet surroundings next to Presečna stream | 46,19102 | 15,95132 | 16.6.2013                 |
| 138             | Radoboj municipality, Gornja Šemnica settlement, between Šlepji and Rišeki hamlet | 46,14885 | 15,95247 | 9.7.2011                  |
| 139             | Stubičke toplice municipality, Sljeme settlement, Medvednica mountain, quarry 3.5 km SE from Kraljev Vrh | 45,92331 | 15,95569 | 26.6.2014                 |
| 140             | Bednja municipality, Šinkovica Šaška settlement, next to the Bednja River | 46,2533  | 15,95426 | 7.7.2012                  |
| 141             | Mihovljani municipality, Mihovljani settlement, Dačnik hamlet surroundings | 46,12034 | 15,95848 | 9.7.2011                  |
| 142             | Radoboj municipality, Gorjani Sutinski settlement, Smrečki hamlet surroundings 1 | 46,18093 | 15,95932 | 30.08.2014, 06.06.2015     |
| Locality number | Locality name | E     | N     | Date       |
|-----------------|--------------|-------|-------|------------|
| 159             | Bedekovčina municipality, Bedekovčina settlement, lakes | 46,04081 | 16,0039 | 18.8.2013 |
| 160             | Bedekovčina municipality, Lug Poznanovečki settlement, next to Vojsek stream | 46,05463 | 16,00381 | 4.6.2016 |
| 161             | Bedekovčina municipality, Lug Poznanovečki settlement, next to Vojsek stream across Turk hamlet | 46,08582 | 16,00487 | 4.6.2016 |
| 162             | Mihovljan municipality, Sutinske toplice settlement | 46,1168 | 16,00658 | 9.7.2011 |
| 163             | Gornja Stubica municipality, Samci settlement, road between Samci and Banšćica settlements | 45,99527 | 16,01803 | 18.8.2013 |
| 164             | Lobor municipality, Stari Golubovec settlement, road between Stari and Novi Golubovec settlements 1 | 46,17604 | 16,01803 | 7.7.2012 |
| 165             | Lepoglava municipality, Lepoglava settlement, Purga Lepoglavska hamlet | 46,2106 | 16,02024 | 7.7.2012 |
| 166             | Gornja Stubica municipality, Volavec settlement | 45,96543 | 16,02362 | 29.6.2012 |
| 167             | Lobor municipality, Stari Golubovec settlement, road between Stari and Novi Golubovec settlements 2 | 46,17654 | 16,02238 | 17.8.2013 |
| 168             | Mače municipality, Veliki Komor settlement, Podolovje hamlet next to Sutinski stream | 46,10388 | 16,0246 | 9.7.2011 |
| 169             | Gornja Stubica municipality, Dubovec settlement, Krapina river surroundings close to the Golčev bridge | 46,04089 | 16,02575 | 4.6.2016 |
| 170             | Mače municipality, Peršaves settlement, Bukalj hamlet | 46,11894 | 16,02924 | 9.7.2011 |
| 171             | Gornja Stubica municipality, Hum Stubički settlement, next to Toplica stream | 45,97041 | 16,03054 | 19.5.2012 |
| 172             | Lepoglava municipality, Lepoglava settlement, Gaveznica significant geoheritage 1 | 46,20592 | 16,03487 | 25.3.2012 |
| 173             | Lepoglava municipality, Zlogorje settlement, between Soštanči and Kolenički hamlet | 46,29874 | 16,03487 | 10.7.2011 |
| 174             | Lepoglava municipality, Lepoglava settlement, Gaveznica significant geoheritage 2 | 46,20506 | 16,03667 | 25.3.2012 |
| 175             | Lepoglava municipality, Žarovnica settlement, next to Kamenica stream | 46,23793 | 16,03692 | 7.7.2012 |
| 176             | Mače municipality, Mače settlement | 46,09547 | 16,03948 | 9.7.2011 |
| 177             | Gornja Stubica municipality, Dobri Zdenci settlement, Pošteki hamlet | 46,01145 | 16,04323 | 8.5.2016 |
| 178             | Gornja Stubica municipality, Karivaroš settlement, Zenkomir hamlet | 45,96458 | 16,05005 | 29.6.2012 |
| 179             | Stari Golubovec municipality, Stari Golubovec settlement, Siterice hamlet | 46,17636 | 16,04844 | 7.7.2012 |
| 180             | Klenovnik municipality, Klenovnik settlement, from the Cari hamlet towards Goranec settlement | 46,26063 | 16,05338 | 18.3.2012 |
| 181             | Lepoglava municipality, Lepoglava settlement, Ivanščica mountain, quarry from Gornji Gečkovec hamlet towards Vlinska špica mountain top 1 | 46,19612 | 16,05764 | 4.6.2011 |
| 182             | Lobor municipality, Lobor town, beginning of road towards ruins of old Lobor castle | 46,17473 | 16,058 | 17.8.2013 |
| 183             | Lepoglava municipality, Lepoglava settlement, Ivanščica mountain, quarry from Gornji Gečkovec hamlet towards Vlinska špica mountain top 2 | 46,19735 | 16,05925 | 4.6.2011 |
| 184             | Lepoglava municipality, Lepoglava settlement, Ivanščica mountain, quarry from Gornji Gečkovec hamlet towards Vlinska špica mountain top 3 | 46,1977 | 16,06076 | 17.8.2013 |
| 185             | Ivanec municipality, Bedenec settlement, Bitoševje lakes | 46,25312 | 16,06047 | 17.3.2012 |
| 186             | Gornja Stubica municipality, Sveti Matej settlement, Jelovečki hamlet | 45,96569 | 16,06365 | 29.6.2012 |
| 187             | Lepoglava municipality, Lepoglava settlement, Gornji Gečkovec hamlet | 46,20447 | 16,06206 | 4.6.2011 |
| 188             | Lobor municipality, Lobor settlement, quarry 700 m N from the town | 46,15702 | 16,06382 | 22.06.2014, 02.08.2014, 30.08.2014, 30.08.2015, 30.08.2015 |
| 189             | Lobor municipality, Lobor settlement, 330 m N from the town | 46,15393 | 16,06536 | 7.7.2012 |
| Locality number | Locality name | E     | N     | Date               |
|-----------------|---------------|-------|-------|--------------------|
| 190             | Lobor municipality, Lobor settlement, surroundings of Majka Božja Gorska church | 46,15667 | 16,0689 | 10.05.2014, 30.08.2014 |
| 191             | Lobor municipality, Lobor town, Ivanščica mountain, old sawmill 500 m NE from ruins of old Lobor castle | 46,18126 | 16,07016 | 8.9.2013 |
| 192             | Lobor municipality, Lobor town, Ivanščica mountain, old sawmill 630 m NE from ruins of old Lobor castle | 46,18173 | 16,07149 | 22.06.2014, 06.06.2015 |
| 193             | Zlatar municipality, Zlatar town, next to the Reka stream | 46,09252 | 16,07257 | 2.4.2012 |
| 194             | Lobor municipality, Lobor settlement, 460 m NE from Majka Božja Gorska church | 46,15717 | 16,07399 | 22.6.2014 |
| 195             | Zlatar municipality, Zlatar town, road between Zlatar and Borkovec settlement | 46,10416 | 16,08023 | 9.7.2011 |
| 196             | Donja Voća municipality, Slivarško settlement, Krčeki hamlet | 46,29828 | 16,07913 | 10.7.2011 |
| 197             | Donja Voća municipality, Rijeka Voćanska settlement, road to Vindija cave | 46,30162 | 16,07914 | 24.7.2013 |
| 198             | Ivanec municipality, Kaniža settlement, Donja Kaniža hamlet | 46,22469 | 16,08208 | 30.7.2011 |
| 199             | Marija Bistrica municipality, Laz Stubički settlement, 500 m NW from the settlement | 45,97712 | 16,08746 | 29.6.2012 |
| 200             | Marija Bistrica municipality, Laz Bistrački settlement, at the KVe hamlet, road crossing between Sveti Matej - Laz Bistrički | 45,99938 | 16,08973 | 19.5.2012 |
| 201             | Zlatar municipality, Martinšćina settlement, Ivanščica mountain, Majer mountain house | 46,16482 | 16,08821 | 13.4.2014 |
| 202             | Ivanec municipality, Kaniža settlement, meadows next to the Bednja River | 46,22823 | 16,08886 | 7.8.2008 |

| Locality number | Locality name | E     | N     | Date               |
|-----------------|---------------|-------|-------|--------------------|
| 203             | Zlatar municipality, Ratkovec settlement, road towards Znož settlement | 46,11403 | 16,09174 | 2.4.2012 |
| 204             | Ivanec municipality, Jerovec settlement, Kuljevčica hamlet, meadows next to the Bednja River | 46,23296 | 16,09234 | 7.8.2008 |
| 205             | Marija Bistrica municipality, Hum Bistrički settlement, Obadi hamlet | 46,00866 | 16,09544 | 29.6.2012 |
| 206             | Donja Voća municipality, Slivarško settlement, Slivarčani hamlet | 46,29023 | 16,09502 | 24.7.2013 |
| 207             | Zlatar municipality, Gornja Batina settlement, Lončari hamlet | 46,12234 | 16,10156 | 15.6.2013 |
| 208             | Ivanec municipality, Jerovec settlement, Vidinjak lakes | 46,23157 | 16,10293 | 7.8.2008 |
| 209             | Marija Bistrica municipality, Tugonica settlement, lake north from the Mesari hamlet | 46,04092 | 16,10550 | 18.8.2013 |
| 210             | Ivanec municipality, Krapnič settlement, road towards the top of Ivanščica mountain, Vuglovečka steza area 1 | 46,19531 | 16,10593 | 15.6.2013 |
| 211             | Ivanec municipality, Krapnič settlement, road towards the top of Ivanščica mountain, Vuglovečka steza area 2 | 46,19306 | 16,10684 | 12.06.2011, 18.07.2011 |
| 212             | Ivanec municipality, Krapnič settlement, road towards the top of Ivanščica mountain, Vuglovečka steza area 3 | 46,1931 | 16,10698 | 4.6.2011 |
| 213             | Zlatar municipality, Gornja Batina settlement, between Gornja Batina and Kadoići hamlet | 46,11149 | 16,10798 | 9.7.2011 |
| 214             | Zlatar municipality, Gornja Batina settlement | 46,1167 | 16,11096 | 15.6.2013 |
| 215             | Ivanec municipality, Prigorec settlement, road towards the top of Ivanščica mountain, Žgano vino area 1 | 46,19591 | 16,12133 | 25.7.2013 |
| Locality number | Locality name | E | N | Date       |
|-----------------|--------------|---|---|------------|
| 216             | Ivanec municipality, Prigorec settlement, road towards the top of Ivanščica mountain, Žgano vino area 2 | 46,19594 | 16,12158 | 7.6.2015   |
| 217             | Ivanec municipality, Prigorec settlement, road towards the top of Ivanščica mountain, Žgano vino area 3 | 46,1963 | 16,12196 | 12.06.2011, 18.07.2011, 19.08.2011, 16.09.2011, 16.09.2011, 26.06.2012, 15.06.2013 |
| 218             | Ivanec municipality, Prigorec settlement, Ivanščica mountain top, surroundings of mountaineers house 2 | 46,1831 | 16,1239 | 5.7.2014   |
| 219             | Ivanec municipality, Prigorec settlement, Ivanščica mountain top, surroundings of mountaineers house 2 | 46,1804 | 16,12426 | 22.06.2014, 24.07.2015 |
| 220             | Marija Bistrica municipality, Marija Bistrica town, road towards Brezje hamlet | 46,01342 | 16,12630 | 26.06.2008, 19.05.2012 |
| 221             | Ivanec municipality, Prigorec settlement, Ivanščica mountain top, surroundings of mountaineers house 3 | 46,18245 | 16,12651 | 15.6.2013   |
| 222             | Ivanec municipality, Prigorec settlement, Ivanščica mountain top, surroundings of mountaineers house 4 | 46,18154 | 16,127 | 4.6.2014   |
| 223             | Ivanec municipality, Prigorec settlement, Ivanščica mountain top, surroundings of mountaineers house 5 | 46,18244 | 16,12807 | 25.7.2013   |
| 224             | Ivanec municipality, Prigorec settlement, Ivanščica mountain top, surroundings of mountaineers house 6 | 46,17894 | 16,12975 | 28.6.2014   |
| 225             | Ivanec municipality, Prigorec settlement, Ivanščica mountain top, surroundings of mountaineers house 7 | 46,17926 | 16,13 | 12.06.2011, 18.07.2011, 19.08.2011, 16.09.2011, 16.09.2011, 16.09.2011 |
| 226             | Ivanec municipality, Prigorec settlement, road towards Ivanec at Rišje area | 46,20541 | 16,13243 | 12.6.2011   |
| 227             | Marija Bistrica municipality, Poljanica Bistiška settlement, lakes north from the Habazini hamlet | 46,04169 | 16,13468 | 21.04.2013, 18.08.2013 |
| 228             | Zlatar municipality, Donja Batina settlement, Majdaki hamlet | 46,0937 | 16,13633 | 19.5.2012 |
| 229             | Zlatar municipality, Završje Belečko settlement 1 | 46,13636 | 16,1362 | 9.7.2011 |
| 230             | Zlatar municipality, Petruševac settlement, Vuki hamlet | 46,1174 | 16,13738 | 2.4.2012 |
| 231             | Marija Bistrica municipality, Poljanica Bistiška settlement, bridge over Krapina river north from the Habazini hamlet | 46,04473 | 16,13922 | 18.8.2013 |
| 232             | Zlatar municipality, Završje Belečko settlement 2 | 46,13761 | 16,14068 | 2.4.2012 |
| 233             | Ivanec municipality, Prigorec settlement, surroundings of Beli zdenci spring SE from the settlement | 46,1933 | 16,14451 | 8.8.2008 |
| 234             | Ivanec municipality, Prigorec settlement, Ivanščica mountain, Šumi area SE from the top | 46,17921 | 16,14753 | 4.6.2011 |
| 235             | Ivanec municipality, Prigorec settlement, road towards Ivančeviž Železnica | 46,20307 | 16,15166 | 8.8.2008 |
| 236             | Ivanec municipality, Prigorec settlement, Ivanščica mountain, Šumi spring surrounding 1 | 46,18867 | 16,1529 | 8.8.2008 |
| 237             | Ivanec municipality, Ivančeviž naselje settlement, meadows next to the Bednja River 1 | 46,24482 | 16,1548 | 7.8.2008 |
| 238             | Ivanec municipality, Prigorec settlement, Ivanščica mountain, Šumi spring surrounding 2 | 46,1891 | 16,15525 | 15.6.2013 |
| 239             | Konjiška municipality, Bočadir settlement, Kosovci hamlet | 46,06972 | 16,1573 | 27.04.2010, 08.07.2012, 17.08.2013 |
| 240             | Zlatar municipality, Donja Selnica settlement, surroundings of Gorja Selnica castle 1 | 46,14031 | 16,16068 | 21.04.2013, 31.08.2013 |
| 241             | Konjiška municipality, Klinjen settlement, Šuširi hamlet | 46,08585 | 16,16132 | 27.04.2010, 22.05.2010 |
| 242             | Marija Bistrica municipality, Šušobreg Bistiški settlement, fishpond east of the Jantoleki hamlet | 46,03086 | 16,16357 | 31.8.2013 |
| Locality number | Locality name | E        | N        | Date                      |
|-----------------|---------------|----------|----------|---------------------------|
| 243             | Konjščina municipality, Klimen settlement, Suvići hamlet 1 | 46,09793 | 16,1635 | 11.06.2010, 10.07.2010, 05.08.2010, 30.06.2011, 09.07.2011, 10.07.2011 |
| 244             | Ivanec municipality, Ivanček naselje settlement, meadows next to the Bednja River 2 | 46,24396 | 16,16275 | 7.8.2008 |
| 245             | Zlatar municipality, Donja Selinica settlement, surroundings of Gornja Selinica castle 2 | 46,14139 | 16,16348 | 12.6.2013 |
| 246             | Konjščina municipality, Klimen settlement, Suvići hamlet 2 | 46,09846 | 16,1638 | 27.4.2010 |
| 247             | Ivanec municipality, Ivanček naselje settlement, meadows next to the Bednja River 3 | 46,24398 | 16,16328 | 30.7.2011 |
| 248             | Konjščina municipality, Šušobreg settlement, Martinci hamlet, meadows next to the Krapina River 1 | 46,04626 | 16,17026 | 31.8.2011 |
| 249             | Ivanec municipality, Ivanček naselje settlement, meadows next to the Bednja River 4 | 46,24103 | 16,16938 | 30.05.2014, 27.07.2014, 21.10.2014 |
| 250             | Konjščina municipality, Šušobreg settlement, Martinci hamlet, meadows next to the Krapina River 2 | 46,04747 | 16,17339 | 19.5.2012 |
| 251             | Konjščina municipality, Gornji Kereši settlement, Gornji Kereši hamlet | 46,09682 | 16,17467 | 9.7.2011 |
| 252             | Ivanec municipality, Salinovec settlement, Ivanšćica mountain, Međe area | 46,21838 | 16,17598 | 19.6.2010 |
| 253             | Konjščina municipality, Gornja Konjščina settlement, Donji Kereši hamlet | 46,08821 | 16,17767 | 10.5.2012 |
| 254             | Budinšćina municipality, Sveti Križ settlement, Hruškari hamlet | 46,11391 | 16,17806 | 9.7.2011 |
| 255             | Budinšćina municipality, Sveti Križ settlement, Keliši hamlet | 46,12562 | 16,17814 | 21.4.2013 |
| 256             | Budinšćina municipality, Pažurovec settlement, farm surroundings | 46,13517 | 16,17859 | 9.7.2011 |
| 257             | Konjščina municipality, Kosovečko settlement | 46,07277 | 16,18248 | 19.5.2012 |

| Locality number | Locality name | E        | N        | Date                      |
|-----------------|---------------|----------|----------|---------------------------|
| 258             | Ivanec municipality, Salinovec settlement, meadows next to the Bednja River 1 | 46,2232 | 16,18267 | 19.6.2010 |
| 259             | Konjščina municipality, Donja Konjščina settlement, at the lake | 46,05107 | 16,18542 | 08.07.2012, 17.08.2013 |
| 260             | Ivanec municipality, Salinovec settlement, meadows next to the Bednja River 2 | 46,22145 | 16,18467 | 7.8.2008 |
| 261             | Budinšćina municipality, Pažurovec settlement, road towards Budinšćina | 46,12751 | 16,1869 | 21.4.2013 |
| 262             | Ivanec municipality, Ivančka Željeznica settlement | 46,20968 | 16,18743 | 8.8.2008 |
| 263             | Ivanec municipality, Stažjevec settlement, a fishpond NE from the settlement | 46,24608 | 16,18951 | 20.7.2014 |
| 264             | Budinšćina municipality, Zajeza settlement, Ivanšćica mountain, towards Degaći hamlet | 46,17215 | 16,19109 | 5.6.2011 |
| 265             | Budinšćina municipality, Bokojevec settlement, Ivanšćica mountain, SW from Mali Oštri top 1 | 46,18139 | 16,19533 | 5.6.2011 |
| 266             | Budinšćina municipality, Bokojevec settlement, Ivanšćica mountain, SW from Mali Oštri top 2 | 46,17949 | 16,19698 | 5.6.2011 |
| 267             | Budinšćina municipality, Zajeza settlement, Ivanšćica mountain, towards the hunting house | 46,17098 | 16,20002 | 13.4.2014 |
| 268             | Budinšćina municipality, Zajeza settlement, surroundings of the Zajeza castle | 46,15071 | 16,20035 | 31.8.2013 |
| 269             | Ivanec municipality, Željeznica settlement, road towards Civača hamlet | 46,19877 | 16,20147 | 15.6.2013 |
| 270             | Hrašćina municipality, Jarek Habekov settlement | 46,10512 | 16,20554 | 4.6.2016 |
| 271             | Konjščina municipality, Jertovec settlement, Mačkoviči hamlet | 46,03268 | 16,20673 | 8.7.2012 |
| 272             | Hrašćina municipality, Husinec settlement, Cerinski hamlet | 46,07515 | 16,20684 | 8.7.2012 |
| 273             | Ivanec municipality, Željeznica settlement, Čovrani hamlet | 46,19801 | 16,21137 | 15.6.2013 |
| 274             | Bedenica municipality, Otrčkovec settlement | 46,0219 | 16,21775 | 8.7.2012 |
| 275             | Hrašćina municipality, Vrbovo settlement, Granoši hamlet surrounding | 46,08003 | 16,22694 | 4.6.2016 |
| Locality number | Locality name                                                                 | E     | N     | Date               |
|-----------------|-------------------------------------------------------------------------------|-------|-------|--------------------|
| 276             | Hrašćina municipality, Vrbovo settlement, Markovići hamlet surrounding       | 46,0911 | 16,22714 | 8.7.2012           |
| 277             | Hrašćina municipality, Vrbovo settlement, road towards Hrašćina             | 46,08557 | 16,22892 | 4.6.2016           |
| 278             | Budinšćina municipality, Pokoječ settlement, Ivanšćica mountain, Frnčev Krč hamlet 1 | 46,17963 | 16,235 | 12.06.2011, 18.07.2011, 19.08.2011, 16.09.2011 |
| 279             | Budinšćina municipality, Pokoječ settlement, Ivanšćica mountain, Frnčev Krč hamlet 2 | 46,1819 | 16,23893 | 5.6.2011           |
| 280             | Bedenica municipality, Omamno settlement, next to Omamno stream               | 46,02257 | 16,24062 | 8.7.2012           |
| 281             | Bedenica municipality, Turkovčina settlement, Travnik meadows                | 46,0527 | 16,24612 | 8.7.2012           |
| 282             | Budinšćina municipality, Pokoječ settlement, Ivanšćica mountain, Frnčev Krč hamlet 3 | 46,18284 | 16,24583 | 17.8.2013          |
| 283             | Ivanec municipality, Lovrečan settlement                                       | 46,23508 | 16,24613 | 10.7.2011          |
| 284             | Novi Marof municipality, Bela settlement, Belki dol quarry 1                  | 46,19341 | 16,24753 | 10.7.2011          |

| Locality number | Locality name                                                                 | E     | N     | Date               |
|-----------------|-------------------------------------------------------------------------------|-------|-------|--------------------|
| 285             | Novi Marof municipality, Bela settlement, Belki dol quarry 2                  | 46,19342 | 16,24738 | 21.4.2013          |
| 286             | Novi Marof municipality, Bela settlement, Belki dol quarry 3                  | 46,19369 | 16,24787 | 5.6.2011           |
| 287             | Novi Marof municipality, Podrute settlement, Žegri hamlet                     | 46,15783 | 16,24964 | 10.7.2011          |
| 288             | Novi Marof municipality, Bela settlement                                       | 46,2058 | 16,25341 | 21.4.2013          |
| 289             | Novi Marof municipality, Topličica settlement, fishponds                      | 46,15625 | 16,28528 | 14.4.2013          |
| 290             | Novi Marof municipality, Novi Marof town                                        | 46,15807 | 16,33395 | 4.6.2016           |
| 291             | Novi Marof municipality, Moždenec settlement, meadows next to the Bednja River north from Degači hamlet | 46,15466 | 16,34532 | 4.6.2016           |
| 292             | Varaždinske Toplice municipality, Svibovec settlement                          | 46,21073 | 16,46634 | 14.4.2013          |