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ZNANSTVENA ČLANKA / SCIENTIFIC PAPERS

Gorazd URBANIČ: Ecological status assessment of the rivers in Slovenia – an overview. /
VREDNOTENJE EKOLOŠKEGA STANJA REK V SLOVENIJI – PREGLED.5

Rudi VEROVNIK, Marko KOSMAČ, Peter VALIČ: Mlake – a hotspot of butterfly diversity in Slovenia. /
MLAKE – VROČA TOČKA VRSTNE PESTROSTI DNEVNIH METULJEV V SLOVENIJI.17

KRATKE ZNANSTVENE VESTI / SHORT COMMUNICATIONS

Matjaž BEDJANIČ: *Coenagrion hastulatum* (Charpentier, 1825), new for the dragonfly fauna of
Bosnia and Herzegovina (Odonata: Coenagrionidae). / *COENAGRION HASTULATUM*
(CHARPENTIER, 1825), NOVA VRSTA ZA FAVNO KAČJIH PASTIRJEV BOSNE IN HERCEGOVINE
(ODONATA: COENAGRIONIDAE).31

Dušan ŠÁCHA & Matjaž BEDJANIČ: Ponovno odkritje ogroženega rumenega porečnika *Gomphus*
flavipes (Charpentier, 1825) v Sloveniji po pol stoletja (Odonata: Gomphidae). / REDISCOVERY
OF THE ENDANGERED RIVER CLUBTAIL *GOMPHUS FLAVIPES* (CHARPENTIER, 1825) IN
SLOVENIA AFTER HALF A CENTURY (ODONATA: GOMPHIDAE).37

Rudi VEROVNIK: *Cupido osiris* (Lepidoptera, Rhopalocera): an overlooked species of the Slovenian
butterfly fauna. / *CUPIDO OSIRIS* (LEPIDOPTERA, RHOPALOCERA): PREZRTA VRSTA DNEVNEGA
METULJA V SLOVENIJI.45

Tomaž JAGAR & Erika OSTANEK: Occurrences of the brown colour form of Western Whip (*Hierophis*
viridiflavus carbonarius (Bonaparte, 1833)) in Slovenia. / POJAVLJANJE RJAVE BARVNE OBLIKE
ČRNICE (*HIEROPHIS VIRIDIFLAVUS CARBONARIUS* (BONAPARTE, 1833)) V SLOVENIJI.51

TERENSKI NOTICI / FIELD NOTES

Toni KOREN & Domen TRKOV: *Proterebia afra damlata* (Godart, 1824) (Lepidoptera, Satyrinae)
recorded for the first time in Bosnia and Herzegovina. / *PROTEREBIA AFRA DAMLATA* (GODART,
1824) (LEPIDOPTERA, SATYRINAE) PRVIČ ZABELEŽENA V BOSNI IN HERCEGOVINI.57

Teo DELIČ & Anamarija ŽAGAR: First record of partial melanism in Horvath's rock lizard
(*Iberolacerta horvathi*) from Slovenia. / PRVA NAJDBA DELNO MELANISTIČNE HORVATOVE
KUŠČARICE (*IBEROLACERTA HORVATHI*) V SLOVENIJI.59

Ecological status assessment of the rivers in Slovenia – an overview

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Abstract. Adoption of the Water Framework Directive (Directive 2000/60/EC) includes ecological assessment of water bodies with biological communities. A WFD compliant ecological assessment includes ecological typology of water bodies, definition of reference conditions and classification system with five ecological classes. In this paper, an overview is given on the development of the ecological assessment system for Slovenian rivers. A special emphasis is laid on ecological river typology. 74 ecological river types were defined using bioregions or large rivers, and nine natural environmental descriptors recognised in literature as being important for river community composition in Slovenia. The rivers' ecological status is assessed based on two biological elements, phytoplankton and macrophytes, and on benthic invertebrates, whereas an assessment system for fish is still under development. Phytoplankton rarely occurs in Slovenian rivers; therefore phytoplankton-based assessment systems were not developed. The Slovenian river classification system consists of three modules with pressure-specific assessment methods. The impact of three groups of pressures is assessed: organic pollution (saprobity), nutrient load (eutrophication) and hydromorphological alterations/general degradation. Phytoplankton and macrophytes are used to assess river saprobic and trophic status, whereas benthic invertebrates are used to assess saprobity and impact of hydromorphological alteration/general degradation. In our study, the impact of hydromorphological alterations of the Drava River was assessed using benthic invertebrates. A Slovenian multimetric index SMEIH was calculated at fifteen sampling sites. Good to bad ecological status was assessed. Moreover, at most sites within the Heavily Modified Water Bodies of the Drava River, good ecological potential was not achieved. In conclusion, mitigation measures are needed on the Drava River in order to achieve objectives of the Water Framework Directive.

Key words: WFD, ecological status, benthic invertebrates, hydromorphology, heavily modified water bodies, ecological potential, Drava River

Izvleček. VREDNOTENJE EKOLOŠKEGA STANJA REK V SLOVENIJI – PREGLED – Sprejetje Vodne direktive (Direktiva 2000/60/ES) vključuje tudi ekološko vrednotenje stanja vodnih teles z združbami vodnih organizmov. Vrednotenje v skladu z vodno direktivo vključuje ekološko tipologijo vodnih teles, določitev referenčnih razmer in razvrščanje v pet razredov ekološkega stanja. V tem članku je podan pregled razvoja metodologij vrednotenja ekološkega stanja za reke v Sloveniji. Poseben poudarek je dan ekološki tipologiji rek. 74 ekoloških tipov rek je bilo določenih z uporabo bioregij oz. velikih rek in devet naravnih deskriptorjev, ki so bili v literaturi prepoznani kot pomembni za združbe vodnih organizmov v Sloveniji. Ekološko stanje voda vrednotimo z uporabo dveh bioloških elementov fitobentosa in makrofitov ter bentoških nevretenčarjev, medtem ko sistem na podlagi rib še razvijamo. Fitoplankton se v rekah v Sloveniji redko pojavlja, zato sistemi vrednotenja na podlagi fitoplanktona niso bili razviti. Slovenski sistem razvrščanja sestavljajo trije moduli sistemi vrednotenja, občutljivimi za stres. Vrednotimo vpliv treh skupin obremenitev: obremenitve z organskimi snovmi (saprobnost), obremenitve s hranili (trofičnost) in vpliv hidromorfološke spremenjenosti/splošne degradiranosti. Vpliv hidromorfološke spremenjenosti reke Drave smo ovrednotili z bentoškimi nevretenčarji. Slovenski multimetrijski indeks SMEIH je bil izračunan na 15 mestih vzorčenja. Ugotovili smo dobro do zelo slabo stanje. Za večino mest vzorčenja močno preoblikovanih vodnih teles reke Drave smo ugotovili, da ne dosegajo dobrega ekološkega potenciala. Na reki Dravi je treba izpeljati omilitvene ukrepe, če želimo doseči okoljske cilje vodne direktive.

Ključne besede: Vodna direktiva, ekološko stanje, bentoški nevretenčarji, hidromorfologija, močno preoblikovana vodna telesa, ekološki potencial, reka Drava

Introduction

Adoption of the European Water Framework Directive (WFD) (Directive 2000/60/EC) changed water management in EU member countries. Changes are reflected in the assessment of the ecological status of water bodies. Ecological quality (status) of surface waters is measured using a range of biological communities rather than the more limited aspects of the chemical quality (Moss 2007). Actually, biological communities are showing a response to all major aquatic components water quality, water quantity and habitat quality. Most biological assessment systems are based on the concept of comparing the current biological community to the »reference conditions« - a status of community observed in the absence of human disturbance or alteration (Bailey et al. 2004). Although reference conditions approach is widely used in ecological assessment, no general consensus exists regarding how pristine a reference condition should characterise (see Hawkins et al. 2000 for a review). In the WFD implementation process, guidance was prepared in order to use conditions with comparable degree of changes across Europe (Wallin et al. 2003). According to the WFD, ecological status assessment has to be type-specific. Biological communities and reference conditions differ across streams due to physical and morphological attributes, such as stream size, altitude, catchment geology. A stream typology classifies streams or stream reaches into entities with a limited variability of both community composition and abiotic factors (Lorenz et al. 2004). In the WFD typology, a top-down approach is defined by using geomorphological characteristics of river landscapes and individual streams. As a framework for national stream typologies, WFD includes 25 European ecoregions defined by Illies (1978), which should be upgraded by several descriptors of the system A or system B. Some water bodies were altered in the past to suit a specific purpose (e.g. hydroelectric power plants, flood protection, navigation). When their original appearance is significantly changed, water bodies can be defined as heavily modified water bodies (HMWBs). Instead of reference conditions, maximum ecological potential is defined and ecological potential is assessed.

The objective of this paper is to give an overview of the ecological assessment system development for rivers in Slovenia. A special attention is given to the ecological typology of our rivers and ecological assessment of the Drava River.

Ecological typology of Slovenian rivers

The ecological river typology in Slovenia was developed according to the System B of the WFD Annex II, which allows any natural environmental parameter influencing communities to be included. In the first step, a re-delineation of European ecoregions defined by Illies (1978) was performed (Urbanič 2008a). In total, Slovenia shares four European ecoregions: Italy, Corsica, Malta (Ecoregion 3), The Alps (Ecoregion 4), Dinaric western Balkans (Ecoregion 5) and Hungarian Plains (Pannonian Lowland) (Ecoregion 11). However, Urbanič (2008a) changed the criteria for delineation of the Ecoregion 3 in the north-east and named it Po Lowland. In the second step, ecoregions were further subdivided into bioregions and special »large river« units (Urbanič 2008b, 2009). Bioregions were defined using a synthesis of abiotic

top-down approach (altitude of the catchment area, geology and division between the Danube and Adriatic river basins) and community based bottom-up approach. Sixteen bioregions were defined, but one bioregion has no rivers with a catchment area $>10 \text{ km}^2$. Large rivers were defined as rivers with a catchment area $>2,500 \text{ km}^2$ and/or mean discharge in a period (sQs) $>50 \text{ m}^3/\text{s}$ and were further divided. Based on ecoregion, maximum water temperature and geomorphologic type, ten large river types were defined. Additional 64 river types were defined using bioregion and nine environmental parameters as river type descriptors. Selection of descriptors was based on literature data with information on the influence of environmental variables on aquatic communities, with special emphasis on information from Slovenia (Urbanič 2004, Urbanič & Toman 2007). Size class, karst spring influence, intermittent karst spring influence, limnocrene spring influence, lake outflow influence, intermittency, periodical flooding, meandering and altitude class were selected. Some parameters (e.g. size class) were used as descriptors of all river types, whereas others were used in just certain bioregions. Besides large rivers, three river size classes were defined using catchment size classes or combination of catchment size class and mean discharge in a period (sQs):

- Small rivers ($10\text{-}100 \text{ km}^2$)
- Medium-sized rivers ($>100\text{-}1000 \text{ km}^2$)
- Medium-sized to large rivers ($>1000\text{-}2500 \text{ km}^2$ and $\text{sQs} < 50 \text{ m}^3/\text{s}$)

Most other descriptors were used based on presence/absence of information, whereas in the Alps the altitudinal class $>700 \text{ m a.s.l.}$ was used where no karst spring influence was detected. Altogether, 74 river types were defined with a length of at least 5 km (App. 1). Relatively high number of ecological river types is a result of the ecological variety of the area. In the territory of Slovenia, four different geographic regions meet the Pannonian lowland, Alps, Dinarides and Mediterranean (Perko and Orožen-Adamič 1998), four ecoregions (Urbanič 2008a), two main river basins that influence fish communities (Urbanič 2008b), big karst area with karst phenomena (Gams 2004), variety of geologies and rivers of varied sizes. Hering et al. (2010) wrote that typology is always a trade-off between having all environmental factors included and having a manageable typology. Therefore broadly or strictly defined river types might be developed across Europe, but no compilation was made. It was also found that parameters relevant for typology are among the major sources of uncertainty in ecological assessment (Hering et al. 2010). In our opinion, this is very much true with broad types where broad reference conditions are defined (see Hawkins et al. 2000). Therefore, it is probably better to strictly define river types and merge them when necessary to get relevant community specific units for development of the assessment system than to define broad types with high variability in reference conditions of some biological elements. Biological community specific typologies are used for ecological assessment system development; e.g. in Slovenia benthic invertebrate based ecological river types were merged to define type specific reference values using macrophytes (Kuhar et al. 2011).

Ecological assessment and classification of Slovenian rivers

Only three of the four biological elements listed in the WFD are relevant for ecological assessment of Slovenian rivers. Phytoplankton is not relevant as it occurs only occasionally in some rivers. So far, assessment systems were developed based on phyto**ben**thos and macrophytes and benthic invertebrates, whereas fish-based assessment systems are still under development (UL 2009). A stressor-specific approach was used for ecological assessment system development in Slovenia. Three main stressors occur in Slovenia: eutrophication, organic pollution and hydromorphological alterations/general degradation (Fig. 1). BQE stressor-specific assessment systems were developed based on suitability to detect specific stress type (e.g. Hering et al. 2006) and biomonitoring tradition. Phyto**ben**thos and macrophyte-based assessment system consists of eutrophication and saprobity (organic pollution) modules, whereas benthic invertebrate-based assessment system is composed of hydromorphological alterations/general degradation and saprobity modules. Final ecological assessment of the water body is made with a combination of individual BQE classification results using »one-out all-out principle«; the lowest score off all assessment results determines the overall ecological quality class (see WFD, Annex V, section 1.4.2 (i)). This principle is in line with the precautionary principle, and will provide sufficient protection for the most vulnerable BQE (Hering et al. 2010).

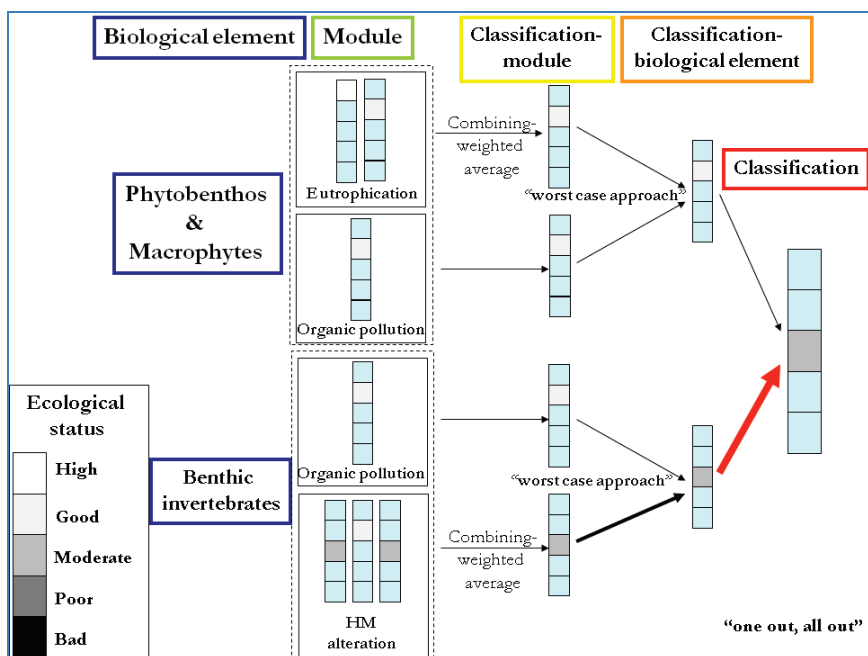


Figure 1. Biological quality element (BQE)-based classification of Slovenian rivers.

Slika 1. Razvrščanje rek v Sloveniji z biološkimi elementi kakovosti.

Heavily modified water bodies

Heavily modified water bodies (HMWBs) are a special category of altered natural surface water bodies as the result of hydromorphological pressures. The main environmental objectives are good chemical status and good ecological potential. The latter is defined as the ecological quality expected under the conditions of the implementation of all possible mitigation measures. Based on the Prague approach, which is mainly based on measures (Kampa & Kranz 2005), 22 HMWB candidates were defined in Slovenia, 20 of them on rivers (UL 2005). Urbanič et al. (2010) applied the Common Implementation Strategy guidance approach by using biological assessment and concluded that only 17 of 20 HMWBs candidates should be categorised as HMWBs. According to the Slovenian classification system, there is no difference between good ecological status (GES) and good ecological potential (GEP) values in saprobity and eutrophication modules. Main difference can be found in the hydromorphological alteration/general degradation module, where lower objectives were set for GEP. Boundary value between good and moderate ecological potential equals a boundary value between moderate and poor ecological status (Fig. 2). However, all other boundary values of ecological potential classes have not been defined yet.

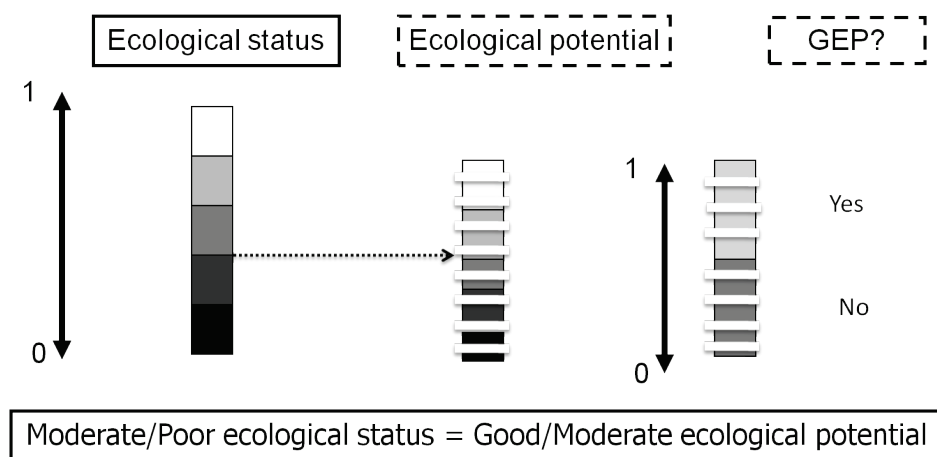


Figure 2. Relationship between ecological status and good ecological potential (GEP) in the hydromorphological alteration/general degradation module (modified after Urbanič et al. 2010).

Slika 2. Povezanost ekološkega stanja in dobrega ekološkega potenciala (DEP) v modulu hidromorfološke spremenjenosti/splošna degradiranost (spremenjeno po Urbanič et al. 2010).

The Drava river – case study

Seven HMWB candidates were defined on the Drava River in Slovenia (UL 2005), with which two artificial water bodies are also connected. In order to assess ecological status of the Drava River, fifteen sampling sites were selected (Fig. 3). Benthic invertebrates were sampled in winter at low water flow using Slovenian multi-microhabitat type sampling approach applied for river bioassessment in Slovenia (UL 2009). At each sampling site, twenty sub-sampling units with a total sampling area of 1.25 m² were selected in proportion to the coverage of microhabitat types. In the laboratory, sub-sampling was performed in order to obtain benthic invertebrates from a quarter of the whole field sample (Petkovska & Urbanič 2009). Benthic invertebrates were determined to the taxonomic level used for the assessment of ecological river status in Slovenia (UL 2009), i.e. mostly to the species or genus. Ecological status according to the hydromorphological alteration/general degradation module was defined using Slovenian multimetric index SMEIH_{VR} (Urbanič 2009):

$$SMEIH_{VR_i} = \frac{2 * RFI_{VR_i} + \%ALP(100\%)}{3} \quad \dots (1)$$

where RFI_{VR} is River Fauna Index of large rivers and %ALP (100%) is percentage of akal, lithal and psammal preferences (sum 100%). First metric was calculated according to indicative values defined in Urbanič (2009), whereas calculation programme Asterix 3.01 (Aqem consortium 2002) was used for calculation of the latter metric. Good to bad status sites were found on the Drava River (Fig. 3). However, at all water bodies of the »old« Drava River downstream of Maribor, most samples were classified as good or moderate. Therefore, only four of seven HMWB candidates were recognised as appropriate HMWB candidates (Urbanič et al. 2010). Sites at those four HMWB were classified according to the classification rules for ecological potential (Fig. 2). Only two sites close to the confluence of the Drava and Meža Rivers were classified as achieving GEP, but not other (Fig. 4). Locally, the Meža has a positive influence on the benthic invertebrate community of the Drava River, but not further downstream. It is evident that inflow streams and rivers can locally improve ecological potential, but due to additional alterations the effect is soon diminished. Nevertheless, Urbanič et al. (2010) found that none of the four HMWB of the Drava River achieves GEP at the water body level. Therefore mitigation measures are needed to achieve the WFD objectives.

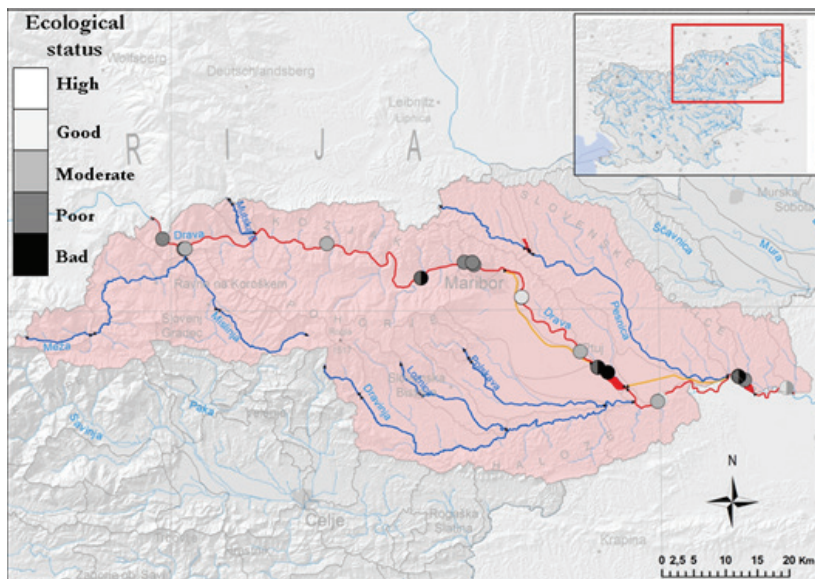


Figure 3. Sampling sites of the Drava River with assessed ecological status according to the hydromorphological alteration/general degradation module.

Slika 3. Vzorčna mesta na reki Dravi z ocenjenim ekološkim stanjem po modulu hidromorfološka spremenjenost/splošna degradiranost.

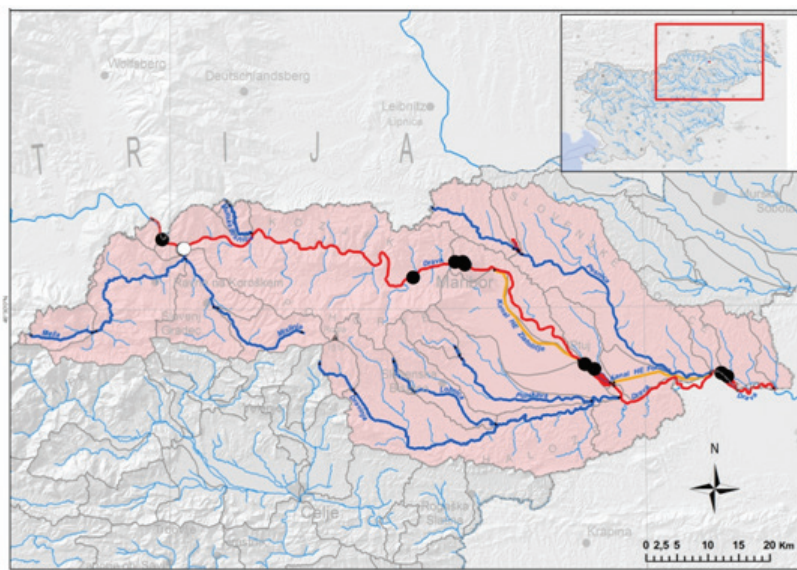


Figure 4. Sampling sites of the Drava River with assessed ecological potential;
○ - good ecological potential is achieved, ● - good ecological potential is not achieved.

Slika 4. Vzorčna mesta na reki Dravi z ocenjenim ekološkim potencialom;
○ - dober ekološki potencial je dosežen, ● - dober ekološki potencial ni dosežen.

Acknowledgements

I would like to thank colleagues who helped to determine benthic invertebrates, and Maja Kregar for cartography. The paper was prepared based on the lecture given at the International Conference on the Drava River in 2010 at Dravograd.

Povzetek

Sprejetje Vodne direktive (Direktiva 2000/60/ES) je v državah članicah Evropske unije vplivalo na upravljanje voda. Spremembe se odražajo tudi na vrednotenju ekološkega stanja vodnih teles. V prispevku podajamo pregled razvoja metodologij vrednotenja ekološkega stanja za reke v Sloveniji s poudarkom na določitvi ekoloških tipov rek in vrednotenju ekološkega stanja z biološkimi elementi. Izhodišče vrednotenja ekološkega stanja so za tip vodnega telesa značilne referenčne razmere. Določitev ekoloških tipov smo opravili v skladu s sistemom B aneksa II Vodne direktive. Poleg deskriptorja bioregija oz. velika reka smo za opis tipov uporabili še devet naravnih deskriptorjev, ki so bili v literaturi prepoznani kot pomembni za združbe vodnih organizmov v Sloveniji. Določili smo 74 ekoloških tipov rek Slovenije daljših od 5 km. Ekološko stanje rek v skladu z Vodno direktivo vrednotimo s štirimi biološkimi elementi. V Sloveniji smo razvili metode vrednotenja ekološkega stanja za biološka elementa fitobentos in makrofiti ter bentoški nevretenčarji. Fitoplankton v rekah v Sloveniji ni relevanten biološki element, medtem ko metode vrednotenja ekološkega stanja rek z ribami še razvijamo. Značilnost vseh razvitih metod vrednotenja ekološkega stanja je, da so za obremenitev značilne. Vsaka metoda vrednotenja in razvrščanja vodnih teles naslavlja vpliv ene od treh najpomembnejših obremenitev; obremenitev z organskimi snovmi (saprobnost), obremenitev s hranili (trofičnost) in hidromorfološko spremenjenost/splošno degradiranost. Končna ocena vodnega telesa in uvrstitev v enega od pet razredov ekološkega stanja je določena z uporabo pravila »najslabše določi«. Vseh vodnih teles ne razvrščamo v razrede ekološkega stanja. Umetna in močno preoblikovana vodna telesa (MPVT) uvrščamo v razrede ekološkega potenciala. Za MPVT uporabljamo manj stroge kriterije kot za primerljiva naravna vodna telesa, vendar le glede na vpliv hidromorfoloških obremenitev. Za preverjanje doseganja okoljskih ciljev MPVT po Vodni direktivi smo mejno vrednost za dober/zmerni ekološki potencial izenačili z mejno vrednostjo zmerno/slabo ekološko stanje. Ovrednotenje reke Drave po modulu hidromorfološka spremenjenost/splošna degradiranost smo opravili na podlagi bentoških nevretenčarjev z indeksom SMEIH za velike reke. Ugotovili smo, da na odseku reke Drave v Sloveniji najdemo mesta z dobrim do zelo slabim stanjem. Večina mest na »stari« Dravi smo uvrstili v razred dobro ali zmerno stanje, medtem ko so taka mesta na odseku reke Drave med Dravogradom in Mariborom redka. Večina preverjenih mest gorvodno od Maribora ni dosegla dobrega ekološkega potenciala, ki je eden od okoljskih ciljev za MPVT. Metode vrednotenja ekološkega stanja se bodo v prihodnosti še dopolnile, predvsem z biološkimi elementi, na podlagi katerih še nimamo razvitih metod vrednotenja.

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Appendix 1. List of ecological types of rivers in Slovenia.

Eco-region	Type no.	River type name
3	1	Small rivers/Lower Vipava valley and Brda hills
	2	Medium-sized rivers/Lower Vipava valley and Brda hills
4	3	Small rivers/Carbonate Alps of the Danube river basin
	4	Small mountainous rivers/Carbonate Alps of the Danube river basin
	5	Small rivers downstream of karst spring/Carbonate Alps of the Danube river basin
	6	Small rivers downstream of limnocene spring/Carbonate Alps of the Danube river basin
	7	Small intermittent rivers/Carbonate Alps of the Danube river basin
	8	Medium-sized rivers/Carbonate Alps of the Danube river basin
	9	Medium-sized rivers downstream of lake/Carbonate Alps of the Danube river basin
	10	Medium-sized rivers downstream of karst spring/Carbonate Alps of the Danube river basin
	11	Small rivers/Silicate Alps
	12	Small mountainous rivers/Silicate Alps
	13	Medium-sized rivers/Silicate Alps
	14	Small rivers/Subalpine hills of the Danube river basin
	15	Small rivers downstream of karst spring/Subalpine hills of the Danube river basin
	16	Small intermittent rivers/Subalpine hills of the Danube river basin
	17	Medium-sized rivers/Subalpine hills of the Danube river basin
	18	Small rivers/Carbonate Alps of the Adriatic river basin
	19	Small mountainous rivers/Carbonate Alps of the Adriatic river basin
	20	Small rivers downstream of karst spring/Carbonate Alps of the Adriatic river basin
	21	Medium-sized rivers/Carbonate Alps of the Adriatic river basin
	22	Medium-sized rivers downstream of karst spring/Carbonate Alps of the Adriatic river basin
	23	Small rivers/Subalpine hills of the Adriatic river basin
	24	Small rivers downstream of karst spring/Subalpine hills of the Adriatic river basin
	25	Small meandering rivers/Subalpine hills of the Adriatic river basin
	26	Medium-sized rivers/Subalpine hills of the Adriatic river basin
	27	Medium-sized rivers downstream of karst spring/Subalpine hills of the Adriatic river basin
5	28	Small rivers/Dinaric karst
	29	Small meandering rivers downstream of karst spring/Dinaric karst
	30	Small intermittent meandering rivers downstream of karst spring/Dinaric karst
	31	Small intermittent rivers downstream of karst spring/Dinaric karst
	32	Small periodically flooding rivers/Dinaric karst
	33	Medium-sized meandering rivers downstream of karst spring/Dinaric karst
	34	Medium-sized intermittent meandering rivers downstream of karst spring/Dinaric karst
	35	Medium-sized periodically flooding rivers/Dinaric karst
	36	Small rivers/Dinaric mountains

Eco-region	Type no.	River type name
	37	Small rivers downstream of karst spring/Dinaric mountains
	38	Medium-sized rivers downstream of karst spring/Dinaric mountains
	39	Small rivers/Subdinaric hills and plains
	40	Small meandering rivers downstream of karst spring/Subdinaric hills and plains
	41	Small meandering rivers/Subdinaric hills and plains
	42	Small intermittent rivers downstream of karst spring/Subdinaric hills and plains
	43	Medium-sized rivers/Subdinaric hills and plains
	44	Medium-sized rivers downstream of karst spring/Subdinaric hills and plains
	45	Medium-sized meandering rivers downstream of karst spring/Subdinaric hills and plains
	46	Medium-sized meandering rivers/Subdinaric hills and plains
	47	Medium to large rivers downstream of karst spring/Subdinaric hills and plains
	48	Medium to large meandering rivers/Subdinaric hills and plains
	49	Small rivers/Submediterranean hills without surface outflow
	50	Small intermittent rivers/Submediterranean hills without surface outflow
	51	Medium-sized rivers/Submediterranean hills without surface outflow
	52	Medium-sized intermittent rivers/Submediterranean hills without surface outflow
	53	Small rivers/Submediterranean hills with surface outflow
	54	Small intermittent rivers/Submediterranean hills with surface outflow
	55	Medium-sized rivers downstream of karst spring/Submediterranean hills with surface outflow
	56	Small intermittent rivers/Coastal hills
11	57	Small rivers/Pannonian hills and plains
	58	Medium-sized rivers/Pannonian hills and plains
	59	Small rivers/Pannonian plains with alpine influence
	60	Medium-sized rivers/Pannonian plains with alpine influence
	61	Medium to large rivers/Pannonian plains with alpine influence
	62	Small rivers/Krško-Brežice basin
	63	Medium-sized rivers/Krško-Brežice basin
	64	Medium to large rivers/Krško-Brežice basin
Large rivers	65	Alpine Sava River
	66	Soča River
	67	Dinaric Sava River
	68	Ljubljana River
	69	Kolpa River
	70	Pannonian Sava River-braided
	71	Pannonian Sava River-non-braided
	72	Krka River
	73	Interlupine Drava River
	74	Mura River and Plain Drava River

Mlake – a hotspot of butterfly diversity in Slovenia

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Abstract. The Mlake military area in Vipava Valley has been recognized as possibly the most prominent 'hot spot' of butterfly diversity in Slovenia. An area of less than one square kilometre hosts 102 butterfly species or almost 57% of the total species confirmed for Slovenia. Among these, 23 species have been recognized as nationally or continentally threatened. Due to recent urbanization, the total area suitable for butterflies has been reduced to less than half, however, the effects on butterfly diversity of the area are not yet visible. The loss of several habitat specialist butterfly species and declines visible from transect monitoring in the last five years do, however, indicate the ongoing process of habitat degradation in Mlake military area. A focused management of the remaining habitats will be required to reverse this process.

Key words: biodiversity, military area, threatened species, nature conservation, Lepidoptera

Izvleček. MLAKE – VROČA TOČKA VRSTNE PESTROSTI DNEVNIH METULJEV V SLOVENIJI –

Vojaško območje Mlake v Vipavski dolini je verjetno ena izmed najbolj 'vročih točk' pestrosti dnevnih metuljev v Sloveniji. Na območju, manjšem od enega kvadratnega kilometra, sta bili namreč najdeni kar 102 vrsti dnevnih metuljev, ali skoraj 57 % vseh za Slovenijo potrjenih vrst. Med njimi je tudi 23 vrst s statusom ogroženosti bodisi na nivoju Slovenije ali Evrope. Zaradi nedavnih gradbenih posegov se je območje ustreznih habitatov za dnevne metulje skrčilo za več kot polovico, vendar učinek tega neposredno na pestrost vrst vsaj za zdaj še ni opazen. O degradaciji habitatov pričata izguba nekaterih specializiranih vrst dnevnih metuljev v zadnjem obdobju in zmanjševanje pestrosti in številčnosti metuljev na transektu v zadnjih petih letih. Nadaljnji degradaciji bi se lahko izognili le z načrtnim upravljanjem še ohranjenih habitatov.

Ključne besede: biodiverzitet, vojaško območje, ogrožene vrste, varstvo narave, Lepidoptera

Introduction

The Vipava Valley has long been known as one of the butterfly richest regions in Slovenia. It was also the first region of the current Slovenian territory surveyed, with Josef Mann publishing the list of species as early as in the mid-19th century (Mann 1854). He recorded 78 butterfly species for the Vipava Valley, mainly in the surrounding of Vipava town. The next important publication was published by Ivan Hafner who visited the valley regularly when producing the first comprehensive list of Macrolepidoptera of Kranjska (Hafner 1909 – 1912). In addition, he published a separate faunistic report for the lower Vipava Valley, the surrounding of Gorica, where he recorded 106 butterfly species. After that, not much was published about distribution of butterflies in this region, apart from the report from the Biology Student Research Camp in Šempas 1998 (Verovnik 2000). This report includes the first records for the Mlake military area, which was already recognized for its great potential of exceptionally high butterfly diversity. In two visits at the end of July, 40 species were observed within the military area.

Due to military activities by the Yugoslav Army, the area was off limits for most of the time after the Second World War. That has helped saving the humid grasslands that have been drained with extensive hydro-meliorations elsewhere in the Vipava Valley (Urbanc & Perko 2002). Due to regular military activities, this merely one square kilometre large area was exceptionally diverse in terms of habitat and structure. It included dry calcareous grasslands on the slopes, wet grasslands on the flatter part of the area and several man-made hills and ditches with sparse vegetation coverage. Unfortunately, soon after the discovery of its high conservation value, the area was doomed to be overrun by a highway and rearranged into a modern military shooting facility. Even inclusion of the site into the NATURA 2000 network (Uradni list RS, no. 49/2004) did not help, as building permits had already been approved. Thus the construction of the highway started in 2002, followed by the building of a modern shooting range in 2005. Due to various NGO activities, the route of the highway was moved to the edge of the Mlake military area, thus only partially affecting the humid part of the site (Fig. 1).

In order to compare how these changes have affected the butterfly fauna of the Mlake military area, the results of faunistic surveys carried out in the 1998-2002 period are compared to the 2007-2011 period. During the first period, the site was visited on several occasions, also as organized field trips for biology students of the Biotechnical Faculty, providing a good overview of the butterfly fauna. During building activities, the area was not visited regularly and the surveys continued from 2007 onwards, when transects for long term monitoring of butterflies in Slovenia were set in the remaining part of the Mlake military area as part of a wider evaluation of the military areas in Slovenia (Tome et al. 2008). As intensive surveys were carried out in both periods, the comparison of the butterfly fauna composition is possible, despite different approaches. Our main aims are: 1 – to evaluate the changes in butterfly fauna composition; 2 – to advocate great butterfly diversity and importance of the Mlake military area; and 3 – to show how current changes have negatively affected the abundance of the butterflies in this area.



Figure 1. Mlake military area from the slopes of Mt. Nanos before (above) and after (bellow) the highway and shooting range construction. (photo: Peter Valič)

Slika 1. Vojaško območje Mlake, fotografirano s pobočja Nanosa pred (zgoraj) in po (spodaj) gradbenih posegih. (foto: Peter Valič)

Materials and methods

The Mlake military area is approximately 97 hectares of land wedged between the foothills of Mt. Nanos and the Podnanos - Vipava main road (Fig. 1). Due to highway and shooting facility construction, the size of the suitable area for butterflies has shrunk to approximately 45 ha (Fig. 2). This has also lead to the abandonment of grasslands on the slopes above the shooting range, which are now subject to rapid overgrowing.



Figure 2. Aerial photograph of the Mlake military area in the past (left) and present (right). The boundaries show approximate extent of habitat important for butterflies. The position of the transect with 5 sections is given on the right map.

Slika 2. Zračni posnetek vojaškega območja Mlake v preteklosti (levo) in danes (desno). Meje prikazujejo območje življenjskega prostora, pomembnega za dnevne metulje. Postavitev petih odsekov transekta je prikazana na recentni karti.

During the first period (1998 – 2002), altogether 26 surveys were carried out. Butterfly net was used for netting butterflies, which were released after determination. The Tolman & Lewington (1997) field guide was used for determination. In the second period (2007 – 2011), transect with 5 sections in total length of 1320 m was established (Fig. 2) in the remaining part of the open grassland habitat. Transect was walked 6 to 8 times during the season (end of April – August) following the standard transect protocol (Pollard & Yates 1993). Comparing to the first period, the survey effort was greater with 43 visits, and qualitative data on species relative abundances were gathered. In order to exclude the effect of different sampling effort between years, the relative abundances of butterflies on the transect were calculated according to the following formula:

$$RA = (\text{No. of specimens} \times 1000) / (\text{length of transect} \times \text{number of visits})$$

Results

In all years pooled together, 102 butterfly species or approximately 57% of all butterflies confirmed for Slovenia were found at the site (Tab. 1). Among these, seven species were found only in the first time period and 10 species only in the second period. High nature value of the surveyed area is underlined by the presence of 23 species listed in the Red Data Book of Slovenia (Uradni list RS, no. 82/2002). Among these, five are also included in annexes of the Habitats Directive (Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora).

Table 1. The list of butterfly species observed in the Mlake military area. Records of species are given for the two time periods. The threat status in Slovenia (SLO) according to the Red Data Book (Uradni list RS, no. 82/2002) and the inclusion into the annexes of the Habitats Directive (FFH) are indicated (Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora). The taxonomy and nomenclature follow van Swaay et al. (2010).

Tabela 1. Seznam dnevnih metuljev, opaženih na vojaškem območju Mlake v dveh časovnih obdobjih. Podana sta status ogroženosti vrst v Sloveniji (SLO) po Rdečem seznamu (Uradni list RS, št. 82/2002) in vključenost vrst v Direktivo o habitatih (FFH) (Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora). Poimenovanje in razvrstitev metuljev sta povzeta po van Swaay et al. (2010).

Species	1998 – 2002	2007 – 2011	SLO	FFH
Hesperiidae				
<i>Pyrgus malvae</i>	•	•		
<i>Pyrgus malvoides</i>	•	•		
<i>Pyrgus alveus</i>		•	V	
<i>Pyrgus armoricanus</i>	•	•	V	
<i>Spialia sertorius</i>	•	•	V	
<i>Carcharodus alceae</i>	•	•	V	
<i>Carcharodus flocciferus</i>	•	•	E	
<i>Carcharodus lavatherae</i>	•		E	
<i>Erynnis tages</i>	•	•		
<i>Carterocephalus palaemon</i>		•		
<i>Heteropterus morpheus</i>	•	•		
<i>Thymelicus lineola</i>	•	•		
<i>Thymelicus sylvestris</i>	•	•		
<i>Hesperia comma</i>	•	•		
<i>Ochlodes sylvanus</i>	•	•		
Papilionidae				
<i>Papilio machaon</i>	•	•		
<i>Iphiclide podalirius</i>	•	•		
<i>Zerynthia polyxena</i>	•	•	V	IV
Pieridae				
<i>Aporia crataegi</i>	•	•		
<i>Pieris brassicae</i>	•	•		
<i>Pieris rapae</i>	•	•		
<i>Pieris mannii</i>	•	•	V	
<i>Pieris ergane</i>	•		V	
<i>Pieris napi</i>	•	•		
<i>Antiocharis cardamines</i>	•	•		
<i>Pontia edusa</i>	•	•		
<i>Colias croceus</i>	•	•		
<i>Colias alfacariensis</i>	•	•		

Species	1998 – 2002	2007 – 2011	SLO	FFH
<i>Gonepteryx rhamni</i>	•	•		
<i>Leptidea sinapis/reali</i>	•	•		
Lycaenidae				
<i>Callophrys rubi</i>	•	•		
<i>Satyrrium acaciae</i>	•	•		
<i>Satyrrium ilicis</i>	•	•		
<i>Satyrrium spini</i>	•	•		
<i>Satyrrium w-album</i>		•		
<i>Favonius quercus</i>		•		
<i>Lycaena phlaeas</i>	•	•		
<i>Lycaena dispar</i>	•		V	II, IV
<i>Lycaena tityrus</i>	•	•		
<i>Lycaena alciphron</i>	•	•	V	
<i>Leptotes pirithous</i>	•	•		
<i>Cupido alcetas</i>	•	•		
<i>Cupido argiades</i>	•	•		
<i>Cupido minimus</i>	•	•		
<i>Celastrina argiolus</i>	•	•		
<i>Pseudophilotes vicrama</i>	•	•	V	
<i>Scolitantides orion</i>	•		V	
<i>Glaucopsyche alexis</i>	•	•		
<i>Phengaris teleius</i>	•	•	V	II, IV
<i>Phengaris alcon</i>	•	•	E	
<i>Plebejus argyrognomon</i>	•	•	V	
<i>Plebejus argus</i>	•	•		
<i>Plebejus idas</i>	•		V	
<i>Aricia agestis</i>	•	•		
<i>Cyaniris semiargus</i>	•	•		
<i>Polyommatus amandus</i>	•			
<i>Polyommatus dorylas</i>		•		
<i>Polyommatus icarus</i>	•	•		
<i>Polyommatus bellargus</i>	•	•		
<i>Polyommatus daphnis</i>	•	•	V	
Riodinidae				
<i>Hamearis lucina</i>	•	•		
Nymphalidae				
<i>Libythea celtis</i>		•		
<i>Apatura ilia</i>	•	•	V	
<i>Limenitis reducta</i>	•	•		
<i>Limenitis camilla</i>	•	•		
<i>Nymphalis polychloros</i>	•	•		
<i>Aglais io</i>	•	•		
<i>Aglais urticae</i>	•	•		
<i>Vanessa atalanta</i>	•	•		
<i>Vanessa cardui</i>	•	•		
<i>Polygonia c-album</i>	•			
<i>Argynnis paphia</i>	•	•		
<i>Argynnis adippe</i>	•	•		
<i>Argynnis niobe</i>	•	•		
<i>Issoria lathonia</i>	•	•		
<i>Brenthis daphne</i>	•	•		
<i>Brenthis hecate</i>	•	•		

Species	1998 – 2002	2007 – 2011	SLO	FFH
<i>Brenthis ino</i>	•	•		
<i>Boloria dia</i>	•	•		
<i>Melitaea phoebe</i>	•	•		
<i>Melitaea cinxia</i>	•	•		
<i>Melitaea didyma</i>	•	•		
<i>Melitaea diamina</i>	•	•	V	
<i>Melitaea britomartis</i>	•		V	
<i>Melitaea aurelia</i>	•	•	V	
<i>Melitaea athalia</i>	•	•		
<i>Euphydryas aurinia</i>	•	•	V	II, IV
<i>Melanargia galathea</i>	•	•		
<i>Hipparchia fagi</i>	•	•		
<i>Arethusana arethusia</i>	•	•		
<i>Minois dryas</i>	•	•		
<i>Brintesia circe</i>	•	•		
<i>Erebia aethiops</i>		•		
<i>Erebia medusa</i>		•		
<i>Maniola jurtina</i>	•	•		
<i>Pyronia tithonus</i>	•	•		
<i>Lopinga achine</i>		•		IV
<i>Coenonympha pamphilus</i>	•	•		
<i>Coenonympha arcania</i>	•	•		
<i>Pararge aegeria</i>	•	•		
<i>Lasiommata maera</i>	•	•		
<i>Lasiommata megera</i>	•	•		

The number of newly recorded species (Fig. 3) shows a typical pattern of saturation with most species being recorded already in the first two years. The large number of newly discovered species in the second year (1999) is related to a late start in 1998 with the first visit to the site at the beginning of July. Thus, many spring species were not covered by the surveys in 1998. A moderate increase of newly found species in the 2007-2009 period could be related to the new survey technique, the transect walks. These are more regularly spread over the entire flight season and provide a greater chance of finding rare species.

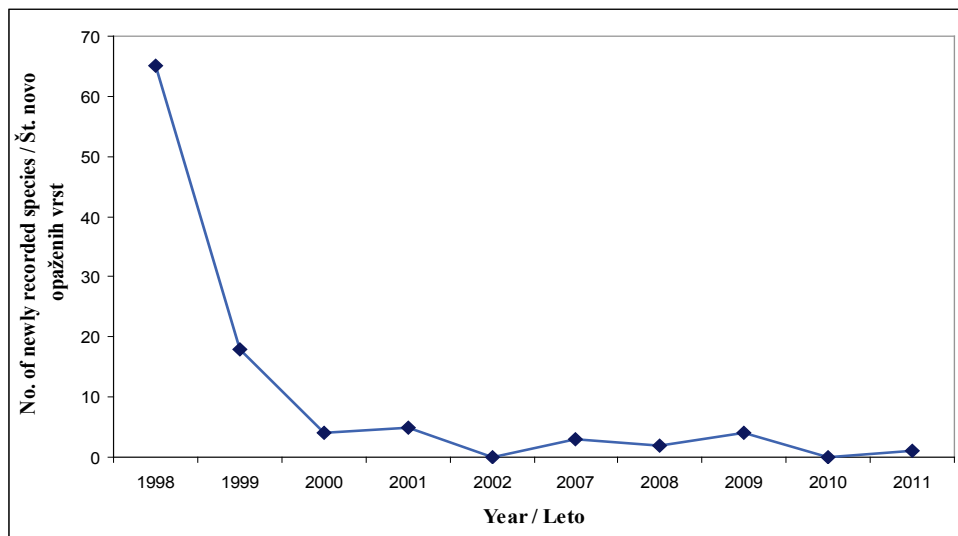


Figure 3. The number of newly recorded butterfly species in the Mlake military area in the 1998-2011 period.

Slika 3. Letno število na novo opaženih vrst dnevnih metuljev v vojaškem območju Mlake med letoma 1998 in 2011.

No data on abundances are available for the first period, therefore the comparison with recent transect data in that aspect is not possible. However, even in the last five years a negative trend both in terms of species diversity (Fig. 4) and relative abundances (Fig. 5) on the transect were observed. The number of species discovered and abundances depend on climatic conditions during the season, however, these can be related only to minimal fluctuations in the last four years, but not to the decline between the 2007 and 2008 seasons.

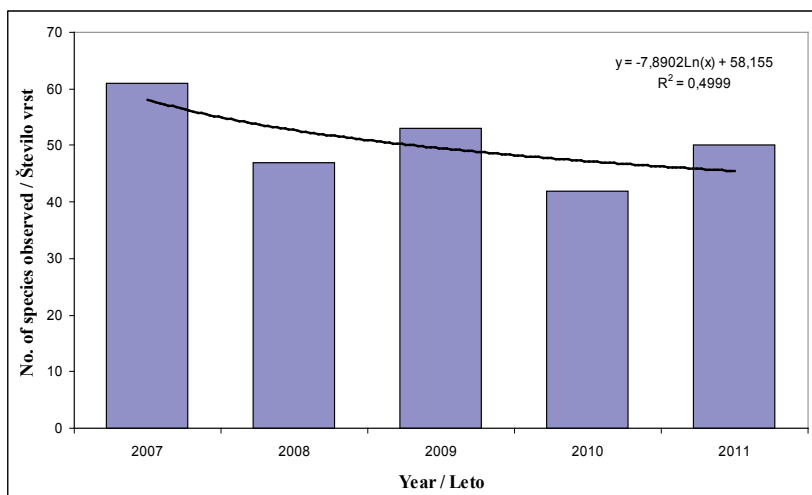


Figure 4. Number of butterfly species observed each survey year in the Mlake military area. The trendline shows a moderate diversity decline.

Slika 4. Letno število vrst dnevnih metuljev, opaženih v vojaškem območju Mlake. Trendna črta kaže zmeren upad števila vrst.

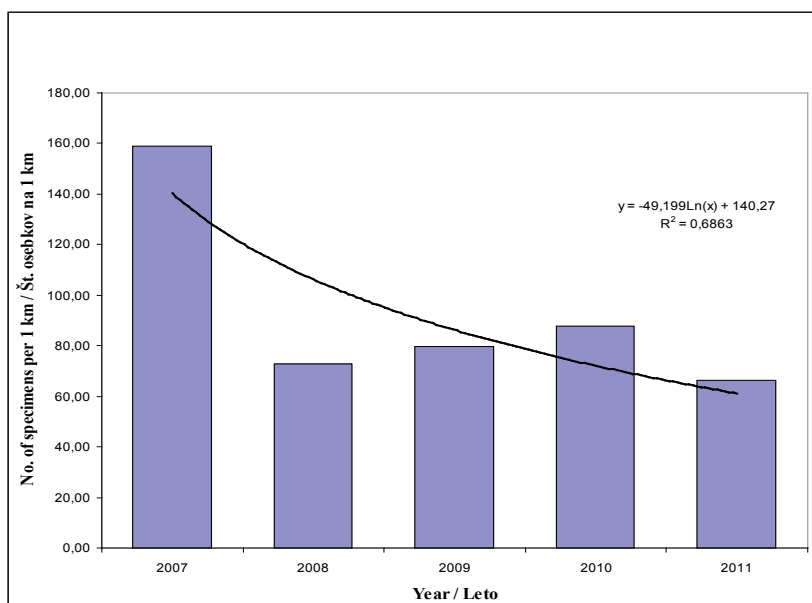


Figure 5. Relative abundances of butterflies recorded each survey year (see Methods for explanation) in the Mlake military area. The trendline shows a moderate decline in the number of specimens.

Slika 5. Relativne letne abundance dnevnih metuljev (glej Metode za pojasnilo) v vojaškem območju Mlake. Trendna črta kaže zmeren upad številčnosti opaženih osebkov.

Table 2. List of the 25 most common species observed on the Mlake transect during the 2007-2011 period and the number of specimens observed. The threatened species in Slovenia (Uradni list RS, no. 82/2002) are marked with bold font.

Tabela 2. Seznam 25 najpogostejših vrst, opaženih na transektu na vojaškem poligonu Mlake med letoma 2007 in 2011 in skupno število opaženih osebkov. Ogrožene vrste v Sloveniji (Uradni list RS, no. 82/2002) so označene z krepkim tiskom.

Species	No. of specimens
<i>Melanargia galathea</i>	962
<i>Maniola jurtina</i>	826
<i>Coenonympha pamphilus</i>	586
<i>Leptidea sinapis/reali</i>	160
<i>Coenonympha arcania</i>	143
<i>Melitaea didyma</i>	96
<i>Boloria dia</i>	82
<i>Ochlodes sylvanus</i>	77
<i>Vanessa cardui</i>	77
<i>Melitaea aurelia</i>	75
<i>Euphydryas aurinia</i>	72
<i>Phengaris teleius</i>	68
<i>Melitaea athalia</i>	68
<i>Melitaea phoebe</i>	60
<i>Brenthis hecate</i>	59
<i>Arethusana arethusa</i>	54
<i>Minois dryas</i>	50
<i>Thymelicus lineola</i>	47
<i>Erynnis tages</i>	35
<i>Brintesia circe</i>	29
<i>Pieris rapae</i>	28
<i>Polyommatus icarus</i>	28
<i>Plebejus argus</i>	27
<i>Pyrgus malvae/malvoides</i>	26

The three commonest species on the transect in the last five years make up almost 58% of all recorded specimens. All three belong to the Satyrinae subfamily and their larvae feed on different species of grasses (Poaceae). While most of the threatened species were seen only once or twice during the transect walks, the Scarce Large Blue (*P. teleius*), Marsh Fritillary (*E. aurinia*), and Nickerl's Fritillary (*M. aurelia*) were still reasonably common.

Discussion

There is no doubt that the Mlake military area is, or at least has been, one of the most remarkable hot spots of butterfly diversity not only in Slovenia, but also in Europe. Although information on diversity of comparable small size areas is lacking, the comparison can be drawn with transect monitoring scheme in Catalunya, where only three out of more than 100 transects have more than 100 species recorded (CBMS 2011). These transects are situated in the valleys of the western Pyrenees, where a mixture of alpine and mediterranean species facilitate such high diversity. One additional example is the Jelašnica Gorge in eastern Serbia, where 110 species were recorded along 2 km long stretch of the gorge (Đurić et al. 2010). The high diversity there is attributed to the surviving relict populations of thermophilous butterfly species in the microclimatically favourable conditions on southern exposed slopes and high level of habitat structuring. The latter is definitively true also for the Mlake where military activities have provided high level of structuring of habitat, exposition and vegetation coverage. The bare ground has an important role for thermoregulation for many butterfly species and is therefore an essential part of their habitat (Dennis 2010). Equally important for high butterfly diversity is also a gradient from wet unimproved grasslands to extremely dry stony grasslands on the slopes and presence of woodland edges. Such habitat diversity could be linked with larval host plant diversity, which is essential for the presence of many habitat or host plant specialist species.

The habitat diversity is well reflected in the presence of habitat specialist butterfly species. The humid grassland hosts species like the Scarce Large Blue (*P. teleius*), the Alcon Blue (*P. alcon*), the Marsh Fritillary (*E. aurinia*), the False Heath Fritillary (*M. diamina*), and the Large Copper (*Lycaena dispar*). The flower rich calcareous grassland, on the other hand, hosts species like the Marbled Skipper (*C. lavatherae*), the Eastern Baton Blue (*P. vicrama*), the Assmann's Fritillary (*Melitaea britomartis*), and the False Grayling (*Arethusana arethusa*). Other habitat specialists like the Chequered Blue (*Scolitantides orion*) and the Mountain Small White (*Pieris ergane*) were present on patchy overgrown man-made hills and along tracks. Most of the named species are considered threatened in Slovenia (Uradni list RS, No. 82/2002) due to their recent habitat loss.

When comparing the lists of species between the two periods, it is evident that the faunal composition has not changed much in such a short period of time, and that overall butterfly diversity did not decline, actually 3 more species were observed in the last period. As habitat loss due to overgrowing and urbanization of the area is over 50%, the discrepancy between the observed and expected biodiversity could only be explained by the change of survey methodology and almost doubled effort in the second time period. The transect method provides more systematic survey and greater chance of finding rare species, which can be achieved also by increasing the amount of field work (Schmitt et al. 2002). Out of 10 newly recorded species in the last period, six were observed only once, two on two occasions, and can therefore be considered rare species in the Mlake military area. The only species for which a genuine recent colonization is a plausible explanation is the Nettle-tree Butterfly (*Libythea celtis*), which has been regularly observed in last three years in the northern part of the area. However, this species is a known migrant with high fluctuations in densities. Its presence

could therefore be considered as temporary, even more so, as the larval host plant the Nettle Tree (*Celtis australis*) is not present at that site.

The losses, on the other hand, are much more indicative, as five out of seven species not recorded in the second time period are habitat specialists and are also included in the Red List of Threatened Species in Slovenia. Among species lost are the Marbled Skipper (*C. lavatherae*), the Assmann's Fritillary (*Melitaea britomartis*) and the Idas Blue (*Plebejus idas*), which were found on now rapidly overgrowing dry calcareous grasslands (Fig. 1). Also the two species from ruderal sites, the Chequered Blue (*Scolitantides orion*) and the Mountain Small White (*Pieris ergane*), have not been observed after the shooting range construction. These losses can thus be directly attributed to habitat loss and it is unlikely that they would be refound at this site. Surprisingly, none of the humid grassland specialists has disappeared, despite lowering the water table by an almost 1,5 metre deep ditch and reduction of the upstream water catchment by building the shooting range. The likely reason, a rather pessimistic one, is that the process of overgrowing is not as fast on the humid part as on dry calcareous grasslands, and the effects of it will be seen in the near future. The potential loss of the False Heath Fritillary (*M. diamina*), which was observed only in 2007, could be an indication of that process.

Even more worrying is the general decline both in species diversity (Fig. 3) and relative abundances (Fig. 4), as it indicates overall habitat degradation. As both variables are prone to seasonal variation due to climatic conditions, a longer time series would be needed to ascertain whether the decline is genuine, or only a short reaction to abrupt changes in the environment. The year 2007 could be considered as the closest to the previous conditions in the Mlake military area, as building of the shooting range has not yet been completed. The drastic decline in 2008, followed by stabilization in the next years, could thus be at least partially linked to habitat degradation. Although Mlake has at present retained the high species diversity of butterflies, we fear that its fauna and flora will become increasingly impoverished without proper management. Therefore we hope that recognition of the Mlake military area as one of the national conservation priorities would urge the authorities to revert the ongoing overgrowing and avoid any further activities that would enhance the lowering of the water table. This would then improve the chances of preserving this exceptionally high diversity for future generations.

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Povzetek

Vipavska dolina je znana po izjemni vrstni pestrosti dnevnih metuljev in ima dolgo zgodovino favnističnih raziskav. Vojaško območje Mlake je prišlo pod drobnogled po osamosvojitvi Slovenije ob razgrnitvi prostorskega načrta graditve avtoceste čez Rebrnice, ki bi to območje v celoti povozilo. Že prve raziskave (Verovnik 2000) so razkrile izjemen potencial vrstne pestrosti dnevnih metuljev tega območja. Pri ohranjanju le te je imela prav vojska ključno vlogo, saj so se zaradi nedostopnosti ohranili v Vipavski dolini sicer že zelo redki mokrotni travniki, ki proti pobočjem prehajajo v suhe kraške travnike. Poleg tega so aktivnosti vojske (graditev nasipov, tankovskih ovir, obstreljevanje) poskrbele tudi za izjemno strukturiranost mikrohabitata, ki je ključna za visoko pestrost rastlinskih in živalskih vrst.

Intenzivne favnistične raziskave dnevnih metuljev na Mlakah so potekale v dveh obdobjih: od 1998 do 2002 in od 2007 do 2011. V prvem obdobju je bilo opravljenih 26 obiskov območja, v drugem obdobju pa zaradi vzpostavitve transektnega monitoringa kar 43. Transektni monitoring je potekal šest do osemkrat letno na petih odsekih na tistem delu Mlak, ki je ostal bolj ali manj nedotaknjen med gradbenimi posegi. S transektnimi popisi smo dobili tudi kvantitativne podatke o pojavljanju vrst.

Gledano v celoti se pestrost in struktura vrst med obema obdobjema nista bistveno spremenili, število opaženih vrst se je celo povečalo za tri. To gre predvsem na račun transektne metode, kjer so obiski območja bolj enakomerno razporejeni v sezoni pojavljanja odraslih osebkov in večjega števila obiskov. Tako lahko odkrijemo večje število na območju redkih vrst in dejansko je večina na novo opaženih vrst bila najdena le enkrat ali dvakrat v petih letih. Med vrstami, ki jih v zadnjem obdobju nismo našli, pa je večina habitatnih specialistov, kar nakazuje izgubo habitata. V zadnjih petih letih je bilo na transektu opaziti upadanje vrstne pestrosti in številčnosti metuljev, kar je verjetno odsev splošne degradacije življenjskega prostora na tem območju. Vsekakor upamo, da bo predstavitev Mlak kot izjemne 'vroče točke' diverzitete metuljev pripomogla k bolj aktivnemu upravljanju s habitatom na tem območju in s tem k dolgoročnemu ohranjanju njenega naravovarstvenega pomena za Slovenijo.

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Coenagrion hastulatum (Charpentier, 1825), new for the dragonfly fauna of Bosnia and Herzegovina (Odonata: Coenagrionidae)

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Abstract. At the high-altitude Donje Bare and Gornje Bare Lakes in the surroundings of Tjentište village, Zelengora Mts., Sutjeska National Park, SE Bosnia and Herzegovina, *Coenagrion hastulatum* was recorded on 26 June 2011. The occurrence of the species on the southern border of its European range is outlined and discussed. Faunistic records on a total of 22 spp. observed at 11 localities in the southeastern part of the country between 26 and 29 June 2011 are appended.

Key words: dragonflies, distribution, disjunction, Bosnia and Herzegovina, the Balkans

Izveček. COENAGRION HASTULATUM (CHARPENTIER, 1825), NOVA VRSTA ZA FAVNO KAČJIH PASTIRJEV BOSNE IN HERCEGOVINE (ODONATA: COENAGRIONIDAE) – Na visokogorskih jezerih Donje Bare in Gornje Bare v okolici vasi Tjentište, Zelengora, Nacionalni park Sutjeska, JV Bosna in Hercegovina, je bil 26.6.2011 zabeležen barjanski škratec *Coenagrion hastulatum*. Opisano in prediskutirano je pojavljanje vrste na južnem robu njenega območja razširjenosti v Evropi. Dodani so favnistični podatki za skupno 22 vrst, ki so bile zabeležene med 26.6. in 29.6.2011 na 11 lokalitetah v jugovzhodnem delu države.

Gljučne besede: kačji pastirji, razširjenost, disjunkcija, Bosna in Hercegovina, Balkan

Bosnia and Herzegovina lies in the heart of the Balkans. In the past, limited odonatological attention has been devoted to it and even in the last decades, also due to war circumstances and numerous minefields left afterwards, this trend persists. In a brief overview of the dragonfly fauna of a broader region, Bedjanič & Bogdanović (2006) refer to 53 species for the entity of Bosnia and Herzegovina. Recently, in a first comprehensive review of available faunistic data and published literature on the dragonflies of the country published by Jović et al. (2010), a list of 57 species has been compiled. Since then, new faunistic data have been added (D. Kulijer pers. comm.), yet Bosnia and Herzegovina remains one of the odonatological white spots in the Balkans.

Between 26 and 29 June 2011, I undertook a brief odonatological survey in southeastern Bosnia and Herzegovina. Focus was set on the surroundings of Tjentište village in Sutjeska National Park. Additionally, some streams in northern direction towards Foča were explored and some interesting habitats in direction south of town Gacko were also visited.

A field trip to Zelengora Mts. on 26 June 2011 was devoted to the visit of high-altitude karst lakes Donje Bare (1490 m elev.) and Gornje Bare (1550m elev.) in the Zelengora Mts., situated approximately 7 km SW of Tjentište village. The weather was changing from sunny to cloudy, but due to strong wind it was not optimal for dragonfly observation. At Donje Bare Lake, numerous individuals of *Enallagma cyathigerum* and *Cordulia aenea* prevailed the scene, however, rather soon also a single »strange looking« male coenagrionid individual was discovered in the bank vegetation. My brief examination immediately revealed that, quite surprisingly, a male *Coenagrion hastulatum* was caught. Careful searching along the southeastern shore was rewarded with a total of 10♂ and 2♀ of the species, which were photographed and some voucher specimens were taken for the author's comparative collection and DNA analyses.

Donje Bare Lake is situated in a steep depression surrounded with forests and slopes, its length reaching about 250m, width 120 m and maximum depth around 4 m. It has permanent water level, no major inflows and a very small outflow on its southeastern shore, which almost instantly disappears underground. The shore vegetation belt is rather narrow, shallow water zones are overgrown by *Potamogeton natans*, *Carex* sp. and partly by *Typha latifolia* and some *Salix* sp. bushes. Typical peat-bog vegetation is absent, however, occasional patches of *Sphagnum* can be found at the southeastern shore. Apart from *C. hastulatum* and very abundant *E. cyathigerum*, *C. aenea* and *Libellula quadrimaculata*, only some individuals of *Ischnura pumilio* and *Pyrrhosoma nymphula* were flying, while *Aeshna cyanea* and *Aeshna grandis* were just emerging. It is interesting to note that only 300 m to the northeast of Donje Bare there is a big marshy depression with transitional mire, where *Sphagnum* is found in abundance. The area seems too dry in general for dragonflies, as there are only some shallow puddles of open water present, however, emerging *Lestes dryas* as well as some adults of *I. pumilio* and *L. quadrimaculata* were found at the spot.

In the afternoon, the nearby Gornje Bare Lake was visited as well. Its length is about 150 m, its width 80 m and its maximum depth around 2 m. It is a glacial lake surrounded by slopes and mountain meadows, its shore vegetation is a narrow belt of *Carex* sp. Here, the weather was windy and partly cloudy, too, thus not optimal for dragonflies. Again, *E. cyathigerum* and *C. aenea* were by far the most abundant, but 2♂ of *C. hastulatum* were also found resting in the dense *Carex* belt. Other observed species include *Ischnura elegans*, *L. dryas* and *L. quadrimaculata*, while *Aeshna juncea* and *A. cyanea* were just emerging.

Zoogeographically, *C. hastulatum* can be classified as a Eurosibirian species, distributed from east Siberia to Central Europe (Sternberg & Röhn 1999). The southern border of its European range runs over the southern Alps in France, northern Italy, Austria and Slovenia, with south-western disjunction in the Pyrenees and south-eastern disjunction in the Balkans in Serbia, Montenegro and Bulgaria (Boudot et al. 2009, Dijkstra & Lewington 2006). Records of *C. hastulatum* at Donje Bare and Gornje Bare lakes are the first from Bosnia and Herzegovina. According to Jović et al. (2010), its occurrence in the mountainous part of the country was expected, but it is interesting from a zoogeographical point of view in any case.



Figure 1. *Coenagrion hastulatum* male photographed on 26 June 2011 at Donje Bare Lake in Sutjeska National Park (photo: M. Bedjanič).

Slika 1. Samček barjanskega škrtca *Coenagrion hastulatum*, fotografiran 26.6.2011 na jezeru Donje Bare v Nacionalnem parku Sutjeska (foto: M. Bedjanič).

Following the rediscovery of *C. hastulatum* in Slovenia a decade ago, its distribution in the neighbouring Italy, Austria, Hungary and in the Balkans was summarized in detail already by Bedjanič & Weldt (2000). For Slovenia, the presence of *C. hastulatum* on the Pohorje Mts., where it was rediscovered, and in the Julian Alps, from where it has been known historically, could not have been confirmed recently. Up to now, the species has been reported only once from Croatia, however, the original historical record from the vicinity of Osijek is based on a species determination error (Belančić et al. 2008). Further south there are relict populations of *C. hastulatum* in Montenegro, where the species was first recorded from two mountain lakes in Durmitor National Park (Adamović et al. 1994, 1996a, 1996b). At one of these, namely Barno jezero Lake near Žabljak, I confirmed its presence on 30 June 2011. It is worth mentioning that Zelengora Mts. in Bosnia and Herzegovina and Durmitor Mts. in Montenegro are actually part of the same mountain massif, the localities of *C. hastulatum* presently known from both countries being only 45 kilometres apart. Additional published records from Montenegro are from the Zeta River northeast of Podgorica (Gligorović et al. 2007) and from the mountainous Lukavica area (Gligorović et al. 2009). However, the records from the lower flow of the Zeta River near Danilovgrad might actually belong to *Enallagma cyathigerum* (B. Gligorović, *in litt.*). In Serbia, *C. hastulatum* was found only at a high elevation Daićsko jezero Lake on Mt Golija in southern part of the country (Adamović 1990). According to Beshovski (1994), *C. hastulatum* also occurs at few localities in Bulgaria. Indeed, *C. hastulatum* probably occurs elsewhere at high-altitude lakes scattered around the Balkans, however, appropriate habitats for this boreoalpine species are probably rather scarce towards the south and much mountaineering field work will be needed to complete the picture of the species' distribution in this part of Europe.

Due to the paucity of published odonatological faunistic records for the territory of Bosnia and Herzegovina, I list all my other observations made between 26 and 29 June 2011 in the southeastern part of the country, in addition to *C. hastulatum* records. It is my hope that this small addendum will nevertheless represent a valuable contribution to the knowledge of this interesting regional dragonfly fauna.

List of localities: **(1)** Donje Bare Lake, 7km SW of Tjentište village, Zelengora Mts., Sutjeska National Park, SE Bosnia and Herzegovina; N 43.3180°, E 18.6306°; alt. 1490m; 26-VI-2011; - **(2)** Peat bog with some shallow water holes 300 m NE of Donje Bare Lake, 7km SW of Tjentište village, Zelengora Mts., Sutjeska National Park, SE Bosnia and Herzegovina; N 43.3198°, E 18.6335°; alt. 1480m; 26-VI-2011; - **(3)** Gornje Bare Lake, 8.3 km SW of Tjentište village, Zelengora Mts., Sutjeska National Park, SE Bosnia and Herzegovina; N 43.3203°, E 18.6074°; alt. 1550 m; 26-VI-2011; - **(4)** Stream along the Gacko-Trebinje road in a small village, 9.5 km S of Gacko, SE Bosnia and Herzegovina; N 43.0813°, E 18.5384°; alt. 900 m; 27-VI-2011; - **(5)** Source and short flow of a disappearing river 9.7 km SW of Gacko, SE Bosnia and Herzegovina; N 43.0925°, E 18.4844°; alt. 820 m; 27-VI-2011; - **(6)** Lakes, 2.7 km SE of Gacko, SE Bosnia and Herzegovina; N 43.1472°, E 18.5593°; alt. 950 m; 27-VI-2011; - **(7)** Stream along the Gacko-Foča road 8.3 km NE of Gacko, SE Bosnia and Herzegovina; N 43.2308°, E 18.5832°; alt. 1150 m; 27-VI-2011; - **(8)** Stream along the Tjentište-Foča road 2.5 km NE of Tjentište, SE Bosnia and Herzegovina; N 43.3769°, E 18.7060°; alt. 570 m; 27-VI-2011; - **(9)** Small stream and spring along the Tjentište-Foča road 5.7 km NE of Tjentište, SE Bosnia and Herzegovina; N 43.3815°, E 18.7525°; alt. 800 m; 27-VI-2011; - **(10)** Forest edges along the road leading towards Perućica Forest Reserve, 1 km E of Tjentište village, SE Bosnia and Herzegovina; N 43.3531°, E 18.7046°; alt. 870 m; 28-VI-2011; - **(11)** Stream along the Brod-Hum road 500 m NWW of the border-crossing, SE Bosnia and Herzegovina; N 43.3505°, E 18.8385°; alt. 475 m; 29-VI-2011.

List of species: **(1)** *Lestes dryas* Kirby, 1890 - Loc 2: 20 juv. ♂♀, 5 ten. ♂♀, 5 ex; Loc 3: 2 ten. ♂; **(2)** *Coenagrion hastulatum* (Charpentier, 1825) - Loc 1: 10♂, 2♀; Loc 3: 2♂; **(3)** *Coenagrion puella* (Linnaeus, 1758) - Loc 5: 2♂, 1♀, Loc 6: >50♂, 5♀, >50 tand., cop.; **(4)** *Enallagma cyathigerum* (Charpentier, 1840) - Loc 1: >50♂, >50♀, 20 ten. ♂♀, 20 tand.; Loc 3: >50♂, >50♀, 20 ten. ♂♀, 20 tand.; **(5)** *Ischnura elegans* (Vander Linden, 1820) - Loc 3: 2♂; Loc 6: >50♂, 10♀, >50 tand., cop.; **(6)** *Ischnura pumilio* (Charpentier, 1825) - Loc 1: 2♂; Loc 2: 2♂; Loc 5: 10♂, 2 cop.; **(7)** *Pyrrhosoma nymphula* (Sulzer, 1776) - Loc 1: 2♂, 3♀; Loc 5: 5♂, 2 cop.; **(8)** *Platycnemis pennipes* (Pallas, 1771) - Loc 4: 2♂; Loc 6: 2♂, 20 juv. ♂♀; **(9)** *Aeshna cyanea* (Müller, 1764) - Loc 1: 2 emerg., 10 ex.; Loc 3: 2 emerg., 5 ex.; **(10)** *Aeshna grandis* (Linnaeus, 1758) - Loc 1: 3 emerg., 5 ex.; **(11)** *Aeshna isoceles* (Müller, 1767) - Loc 6: 1♂; **(12)** *Aeshna juncea* (Linnaeus, 1758) - Loc 3: 3 emerg., 5 ex.; **(13)** *Anax imperator* Leach, 1815 - Loc 6: 5♂; **(14)** *Cordulegaster bidentata* Selys, 1843 - Loc 8: 1 lar.; Loc 9: 3♂, 3 lar.; Loc 10: 2♂; Loc 11: 3 lar.; **(15)** *Cordulia aenea* (Linnaeus, 1758) - Loc 1: >50♂, 20♀, 30 cop., 10 ex.; Loc 3: 30♂, 5♀, 10 cop., 5 ex.; Loc 10: 10♂, 2♀; **(16)** *Crocothemis erythraea* (Brulle, 1832) - Loc 6: 1♀; **(17)** *Libellula depressa* Linnaeus, 1758 - Loc 4: 1♂; Loc 6: 1♂; **(18)** *Libellula fulva* Müller, 1764 - Loc 6: 20♂, 1♀, 3 cop.; **(19)** *Libellula quadrimaculata* Linnaeus, 1758 - Loc 1: 30♂, 10♀, 5 cop., 1ex.; Loc 2: 2♂; Loc 3: 3♂, 1 cop.; Loc 6: 2♂, 2 cop.; **(20)** *Orthetrum cancellatum* (Linnaeus, 1758) - Loc 6: 5♂; **(21)** *Orthetrum brunneum* (Fonscolombe, 1837) - Loc 4: 1♂; Loc 5: 5♂; **(22)** *Sympetrum flaveolum* (Linnaeus, 1758) - Loc 6: 1♀, Loc 7: 1♀.

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Ponovno odkritje ogroženega rumenega porečnika *Gomphus flavipes* (Charpentier, 1825) v Sloveniji po pol stoletja (Odonata: Gomphidae)

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Izvleček. Vrsta je bila 15.7.2011 ugotovljena na rokavu reke Mure vzhodno od Petišovcev, SV Slovenija. Prikazana je njena trenutno znana razširjenost v Sloveniji in sosednjih državah. Zaradi statusa zavarovane vrste z Dodatka IV Direktive o habitatih EU ter doslej tudi statusa domnevno izumrle in zavarovane vrste po slovenski zakonodaji avtorja poudarjata, da je treba nujno ohranjati njena bivališča in opraviti nadaljnje terenske raziskave na izbranih območjih v Sloveniji.

Ključne besede: kačji pastirji, reka Mura, ogrožene vrste, Direktiva o habitatih

Abstract. REDISCOVERY OF THE ENDANGERED RIVER CLUBTAIL *GOMPHUS FLAVIPES* (CHARPENTIER, 1825) IN SLOVENIA AFTER HALF A CENTURY (ODONATA: GOMPHIDAE) – The species was recorded on 15 July 2011 along the Mura River side arm channel east of Petišovci, NE Slovenia. Its currently known distribution in Slovenia and neighbouring countries is presented. Due to its status as a protected species according to Annex IV of the EU Habitat Directive and up to now also the status of probably extinct and protected species according to Slovene legislation, the need for preservation of its habitats as well as need for further field studies in Slovenia are exposed.

Key words: dragonflies, Mura River, endangered species, Habitat Directive

Uvod

Rumeni porečnik *Gomphus flavipes* (Charpentier, 1825) je kačji pastir z zelo širokim območjem razširjenosti, ki sega od Francije do vzhodne Sibirije, v Evropi pa na severu do Estonije ter na jugu do Grčije. Velja za vrsto velikih nižinskih rek za katere je značilna vsaj delno ohranjena naravna rečna dinamika in raznolike strukture rečnega ekosistema. Ličinke živijo v rečnih odsekih z bolj umirjenim tokom ter finim sedimentom, kot so droben pesek, mivka ali mulj (Suhling & Müller 1996, Dijkstra & Lewington 2006).

Rumeni porečnik je po vsej Evropi deležen posebne pozornosti odonatologov in naravovarstvenikov. Še do nedavnega je namreč veljal za redko in močno ogroženo vrsto (Schorr 1996, Suhling & Müller 1996). Šele v zadnjih dveh desetletjih so najprej posamične, v zadnjih letih pa vedno številčnejše najdbe nakazale, da rumeni porečnik v Evropi vendarle ni tako redek. Razlogi za ta razveseljivi trend so po Dijkstra & Lewington (2006) večinoma

neznani, lahko pa bi šlo za vpliv enega ali več dejavnikov, kot so npr. izboljšana kakovost vodotokov, klimatske spremembe, ekspanzija z vzhoda ali povečanje reliktnih in morda v preteklosti spregledanih populacij. V *Atlasu kačjih pastirjev Sredozemlja in Severne Afrike* (Boudot et al. 2009) je zapisano, da se stanje populacij rumenega porečnika po močnem zmanjšanju v 20. stoletju spet popravlja v večjih delih njegovega območja razširjenosti, kar je razlog, da je vrsta v Sredozemlju opredeljena kot potencialno ogrožena (IUCN: NT). Tudi nedavno objavljeni *Evropski rdeči seznam kačjih pastirjev* (Kalkman et al. 2010) opredeljuje rumenega porečnika celo kot neogroženo oz. najmanj ogroženo vrsto (IUCN: LC) in zanj navaja trend naraščanja oz. povečevanja populacij.

Rumenega porečnika varuje zajeten kupček domačih in mednarodnih naravovarstvenih aktov. Pri nas je uvrščen v *Pravilnik o uvrstitvi ogroženih rastlinskih in živalskih vrst v rdeči seznam* kot domnevno izumrla vrsta (IUCN: Ex?), zavarovan je z *Uredbo o zavarovanih prosto živečih živalskih vrstah* ter uvrščen na njeni prilogi 1A in 2A, za nameček pa je zavarovan tudi z Dodatkom 2 Bernske konvencije (Konvencija o varstvu prostoživečega evropskega rastlinstva in živalstva ter njunih naravnih življenjskih prostorov (Ur. l. RS, MP, št. 17/99) ter Dodatkom 4 Direktive o habitatih (The Council Directive 92/43 EEC on the Conservation of Natural Habitats and on Wild Fauna and Flora). Kljub evropskemu naravovarstvenemu pomenu in ogroženosti rumeni porečnik (kot tudi druge vrste kačjih pastirjev, vključene le na Dodatek 4 Direktive o habitatih) doslej pri nas ni bil deležen posebne pozornosti. Tako ni bil zajet v okvir obsežnega terenskega dela za pripravo odonatoloških strokovnih izhodišč za vzpostavljane omrežja Natura 2000 (Kotarac et al. 2003) in tudi ne v okvir kakšnega drugega s strani države naročenega projekta.

Doslej o rumenem porečniku v Sloveniji nismo vedeli domala nič. Prvič ga za našo državo v diplomskem delu omenja Kiauta (1959), in sicer kot »V okolici Ljubljane. VII. Redek.« V fenološki tabeli na koncu omenjenega dela pa lahko preberemo še »sporadično 8-28/7«. Na teh podatkih temelji tudi skoraj identično besedilo kasneje v Biološkem vestniku objavljenega klasičnega slovenskega odonatološkega dela *Prispevek k poznavanju odonatne favne Slovenije* (Kiauta 1961). Od takrat, kar velja tudi za zadnji dve desetletji, odkar se s kačjimi pastirji v Sloveniji aktivno ukvarjajo mlajše generacije odonatologov, nam rumenega porečnika ni uspelo najti. Vendar pa upanje ni zamrlo in tako že Kotarac (1997), zaradi bližnjega pojavljanja vrste na Hrvaškem v reki Dravi, govori o tem, da gre vsaj najdbe odraslih žuželk pričakovati kje v severovzhodni Sloveniji, medtem ko Bedjanič et al. (1999) predlagajo načrtno iskanje rumenega porečnika na posameznih odsekih reke Drave v Sloveniji. Ob oceni naravovarstvenega statusa vrste, ki je bil podlaga za uvrstitev rumenega porečnika v poprej omenjeni *Pravilnik o uvrstitvi ogroženih rastlinskih in živalskih vrst v rdeči seznam*, predlaga Bedjanič (2000) tudi skrbno pripravljeno strategijo iskanja vrste ter dodaja, da bi lahko načrtno terensko delo na reki Dravi in Muri obrodilo sadove. Duhu napovedovanja brez rezultata v naravi se pridružuje še Kotarac (2001), ki pravi, da so glede na znano razširjenost rumenega potočnika v drugih državah in njegove ekološke zahteve populacije teoretično mogoče v nižinskih delih Mure, Drave in Save ter v njihovih tamkajšnjih pritokih.

Najdba rumenega porečnika *Gomphus flavipes* ob reki Muri

Ob tolikih napovedih najdbe rumenega porečnika nekje v severovzhodni Sloveniji ne preseneča, da se nam je sreča slednjič vendarle nasmehnila. A za to je bilo treba k nam povabiti odonatologe iz Slovenije, Srbije, Hrvaške, Bosne in Hercegovine, Italije in Slovaške, da so se med 11. in 18. julijem 2011 udeležili 1. mednarodnega srečanja odonatologov Balkana - BOOM 2011. Med zaključnim delom odonatološkega srečanja, ki je potekal v Gornjem Lakošu pri Lendavi, smo tako 15.7.2011 v manjši skupini obiskali tudi stranski rokav reke Mure 6,7 km jugovzhodno od Petišovcev (N46.4876, E16.5227; alt. 150 m). Rumeni porečnik je seveda bil najvišje na seznamu naših želja, še posebej vsled bogatih izkušenj in poznavanja vrste slovaškega kolega Dušana Šache. Iskanje levov in odraslih kačjih pastirjev je po skoraj eni uri postreglo z vrstami: modri bleščavec *Calopteryx virgo* (Linnaeus, 1758), pasasti bleščavec *C. splendens* (Harris, 1782), sinji presličar *Platycnemis pennipes* (Pallas, 1771), bledi peščenec *Onychogomphus forcipatus* (Linnaeus, 1758), kačji potočnik *Ophiogomphus cecilia* (Fourcroy, 1785), pegasti lesketnik *Somatochlora flavomaculata* (Vander Linden, 1825), temni modrač *Orthetrum albistylum* (Selys, 1848) in opoldanski škrlatec *Crocothemis erythraea* (Brulle, 1832). Ko smo dodobra in v iskanju levov rumenega porečnika neuspešno pregledali nekaj sto metrov obrežja rokava Mure, se je slednjič sreča nasmehnila prav Dušanu. Na presenečenje in splošno veselje vseh je v mrežo ujel odraslega samčka rumenega porečnika. Dodatno iskanje odraslih žuželk in levov ni obrodilo sadov. Tudi terenski pregledi tega Murinega rokava in bližnjih lokalitet ob Muri dne 16.7., 6.8. in 13.8.2011 niso postregli z novimi opazovanji rumenega porečnika. Kljub neposredni bližini hrvaške meje pa lahko tokratno najdbo tudi brez arbitraže vendarle razglasimo za uradno nesporno slovensko.



Slika 1. Rokav reke Mure vzhodno od Petišovcev, blizu mesta, kjer je bil ujet samček rumenega porečnika *Gomphus flavipes* (foto: M. Bedjanič).

Figure 1. Mura River side arm channel east of Petišovci, near the place where a male River Clubtail *Gomphus flavipes* was recorded (photo: M. Bedjanič).



Slika 2. Odrasel samček rumenega porečnika *Gomphus flavipes*, reka Laba, Češka (foto: M. Waldhauser).

Figure 2. Adult male River Clubtail *Gomphus flavipes*, Labe River, Czech Republic (photo: M. Waldhauser).

Razprava

Najdba rumenega porečnika ob reki Muri je bila pričakovana, predvsem z vidika siceršnje razširjenosti vrste v tem delu Evrope in tudi z vidika domnevnega širjenja populacij vrste v zadnjih letih (Boudot et al. 2009, Dijkstra & Lewington 2006, Kalkman et al. 2010). V sosednji Avstriji je vrsta redka in kritično ogrožena, pojavlja pa se le na nekaj lokalitetah v severovzhodnem delu države (Raab et al. 2007). Proti vzhodu je rumeni porečnik razširjen na Slovaškem, kjer je razmeroma pogost v panonskem delu, ob velikih nižinskih rekah Donavi, Moravi, Latorici in Ipelu (Šácha et al. 2007). Sicer je vrsta na Slovaškem zavarovana in opredeljena kot ranljiva (David 2001). Tudi na Madžarskem je rumeni porečnik pogost ob velikih panonskih rekah, kot sta Drava in Tisa, na zahodu pa ob reki Rabi in Dravi, na slednji vzdolž celotne meje s Hrvaško (Ambrus et al. 1992, Toth 2005). Na Hrvaškem obsežnejše in sistematične raziskave za vrsto doslej niso bile opravljene, kar se posebej nanaša na Muro in manjše pritoke Donave in Save, z izjemo Une in Drave. Rumeni porečnik velja na Hrvaškem za neogroženega (Belančić et al. 2008), pojavlja se npr. dokaj pogosto ob srednjem in spodnjem toku Drave (Bogdanović 2001) in na Donavi (M. Franković, *in litt.*) ter Savi do Zagreba in nekaterih njenih pritokih (Vilenica et al. 2011, M. Franković, *in litt.*). V Međimurju oz. ob reki Muri rumeni porečnik doslej še ni bil najden (Mihoković 2008, Perović & Perović 2007), čeprav se vrsta nedvomno pojavlja vsaj v spodnjem toku reke Mure pred izlivom v Dravo. Tudi v Srbiji je doslej znana razširjenost rumenega porečnika vezana na velike reke, kot so Donava, Sava in Tisa (Boudot et al. 2009).

Kar se tiče ponovne najdbe rumenega porečnika v Sloveniji po več kot pol stoletja, ostaja neodgovorjenih še vedno veliko vprašanj. Iz najdbe enega samega odraslega osebkja je o stalnem pojavljanju vrste ob reki Muri zelo težko ugibati. Na odprta vprašanja o dejanski razširjenosti, velikosti populacij in ogroženosti rumenega porečnika ob Muri in v Sloveniji, tudi v kontekstu obvez, ki jih ima naša država iz naslova evropskih direktiv ter nenazadnje lastne zakonodaje, lahko odgovori le terensko delo v naslednjih letih. Kam natančno umestiti stare podatke o pojavljanju vrste v okolici Ljubljane (Kiauta 1959, 1961), je težko odgovoriti, od potencialno ustreznih bivališč prideta pogojno v poštev le Sava in Ljubljanka. V kontekstu redkosti vrste je pomembno dodati, da je bilo kar nekaj odsekov večjih slovenskih rek, npr. Drava od Dravograda do Zavrča, Mura od Šentilja do Razkrižja, Dravinja, Sava od Ljubljane do Radeč in Ljubljanka, v zadnjih letih odonatološko obdelanih s čolnom. Čeprav raziskave niso bile namenjene rumenemu porečniku, so potekale v času in na način, ki bi zelo verjetno zaznal tudi to vrsto (A. Šalamun, *ustno*). Vendar pa bi bile ciljane terenske raziskave, ki temeljijo predvsem na iskanju levov, za rumenega porečnika mnogo bolj potrebne in smiselne zlasti v spodnjem toku reke Drave in Mure. Predlog terenskih raziskav ter monitoringa, ki ga za ekološko in fenološko sorodno vrsto - kačjega potočnika *Ophiogomphus cecilia* - predlagata Šalamun & Kotarac (2010), je moč z nekaj prilagoditvami in skoraj brez dodatnih stroškov hkrati uporabiti tudi za rumenega porečnika.

Z naravovarstvenega vidika najdba rumenega porečnika ob reki Muri še dodatno potrjuje izjemni pomen enega zadnjih predelov s še vedno dokaj ohranjeno rečno dinamiko Mure v Sloveniji. Brez pretiravanja lahko trdimo, da murska rečna loka od Avstrije, prek Slovenije in zlasti na Hrvaškem do izliva v Dravo predstavlja enega najbogatejših ekosistemov v srednji Evropi in je zaradi izjemne biotske raznolikosti zasluženo deležna posebne pozornosti domačih in tujih raziskovalcev in naravovarstvenikov (Bedjanič & Urbanek 2001, Gogala 2002, Schneider-Jacoby 1996). Širše območje ob reki Muri je na podlagi Ptičje Direktive in Direktive o habitatih že vključeno v evropsko omrežje naravovarstveno pomembnih območij Natura 2000. Na izjemni odonatološki pomen območja je opozoril že Bedjanič (2002), jasno pa na to kaže že skup podatek, da na ozkem območju ob reki Muri v okolici Petišovcev najdemo kar 5 vrst kačjih pastirjev z dodatkov Direktive o habitatih, in sicer kačjega potočnika *Ophiogomphus cecilia* (Dodatek 2 in 4), dristavičnega spreletavca *Leucorrhinia pectoralis* (Dodatek 2 in 4), mrtvičnega spreletavca *Leucorrhinia caudalis* (Dodatek 4), zeleno devo *Aeshna viridis* (Dodatek 4) in rumenega porečnika *Gomphus flavipes* (Dodatek 4). Vsekakor bo v prihodnjih letih potrebna kakovostna inventarizacija celotne favne in flore omenjenega območja, ki bo dala doslej zbranim podatkom še večjo težo, pridobila nove argumente in hkrati služila kot podlaga za pravilno naravovarstveno vrednotenje in upravljanje neprecenljive naravne dediščine reke Mure na mejnem odseku med Slovenijo in Hrvaško – tudi v kontekstu za zdaj s strani države nerazumljivo odloženih prizadevanj za razglasitev Regijskega parka Mura.

Zahvala

Dr. Matija Franković (Zagreb, Hrvaška) je prijazno pomagal s podatki o statusu in razširjenosti rumenega porečnika na Hrvaškem. Martin Waldhauser (Jablonné v Podještědī, Češka) je prijazno prispeval sliko rumenega porečnika *Gomphus flavipes*. Damjan Vinko (Mengeš, Slovenija) je »kriv« za vzorno in uspešno organizacijo 1. mednarodnega srečanja odonatologov Balkana - BOOM 2011, ki je botrovalo zanimivi najdbi in nastanku pričujočega prispevka.

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Cupido osiris (Lepidoptera, Rhopalocera): an overlooked species of the Slovenian butterfly fauna

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Abstract. There are only a few historical records of the Osiris Blue from Slovenia, and two are plausible based on the species habitat requirements. The record from gravel banks of the Sava River north of Ljubljana has been confirmed by a single female preserved in the collection of the Slovenian Museum of Natural History. Additionally, several collected specimens from Potoče village in the Vipava Valley indicate its wider distribution in the past. Currently, the species is confined to a narrow belt of the Kraški rob between Predloka and Mt. Lipnik. The habitat requirements of the species and its threat status in Slovenia are discussed.

Key words: distribution, historical records, threat status, habitat requirements

Izvleček. CUPIDO OSIRIS (LEPIDOPTERA, RHOPALOCERA): PREZRTA VRSTA DNEVNEGA METULJA V SLOVENIJI – Znanih je zgolj nekaj zgodovinskih najdb modrega kupida v Sloveniji in od teh sta glede na prisotnost ustreznega življenjskega prostora verjetni le dve. Podatek s prodišč reke Save pri Črnučah potrjuje samica, hranjena v muzejški zbirki (PMS). Poleg tega je med materialom tudi serija osebkov iz vasi Potoče v Vipavski dolini, kar dokazuje širšo razširjenost te vrste v Slovenji v prejšnjem stoletju. Glede na recentne podatke je vrsta pri nas razširjena le v ozkem pasu ob Kraškem robu od Predloke do gore Lipnik. Podane so glavne značilnosti habitata vrste in njena ogroženost v Sloveniji.

Ključne besede: razširjenost, zgodovinski podatki, ogroženost, habitat vrste

The Osiris Blue (*Cupido osiris* (Meigen, 1829)) is generally a Mediterranean species in Europe with its range extending to the east towards central Asia (Tolman & Lewington 1997). It is rather local in the northern part of its range, becoming increasingly more widespread towards the south. It has been first reported for Slovenia by Hoffmann and Klos (1913) who mention it as *Cupido sebrus* for Maribor. This record remains questionable both due to possible misidentification with similar *Cupido minimus* and lack of suitable habitat in this region. More plausible is the record by Stauder (1923) who cites Alois Naufock who found several males in 1907 at Boršt in Istria. Unfortunately, Stauder never saw the specimens and doubted Naufock's correct determination (Stauder 1923). During the survey of collections kept by the Slovenian Museum of Natural History, additional specimens of the Osiris Blue were discovered. They were all collected by Štefan Michieli near Potoče in the Vipava Valley between 1965 and 1968. Unfortunately, these records remain unpublished. Additional record was published by Sijarić in the catalogue of Boro Mihljević's collection from Gore at HraštNIK in central Slovenia (Sijarić 1991). The specimen was supposed to be collected by Matjaž Črnila, but he is not aware of this exceptional find (Črnila, pers. com.), therefore a misidentification, as in case of the record from Maribor, is a more likely explanation, particularly due to the lack of larval habitat at this site.

In recent years, the species has been known to fly near Kraški rob, but no exact records are given (Carnelutti & Tonkli 1990). There are only two specimens from Rižana in the collection of Boro Mihljević (Sijarić 1991), which is a rather misleading information as there is no larval habitat in or around Rižana village. The records listed below (in chronological order) are therefore the first exact information on the recent distribution of the Osiris Blue in Slovenia:

- 27.5.2000 – along the path on SE slopes of Vrh hill above Hrastovlje; coordinates: 45°30'35"N, 13°53'52"E; Verovnik, R.
- 17.5.2001 – grassland along the road to Brezovica at the source of Rižana River; coordinates: 45°31'30"N, 13°53'16"E; Verovnik, R.
- 1.6.2002 – road verge along the Predloka-Loka road, 250 m W of Predloka; coordinates: 45°32'25"N, 13°53'03"E; Verovnik, R.
- 23.5.2003, 9.6.2006 – along the path in a small valley of Hrastovski potok, S of Hrastovlje; coordinates: 45°30'01"N, 13°53'55"E; Verovnik, R.
- 9.6.2006 – grasslands along the road to Zaniograd, 500 m N of village Dol pri Hrastovljah; coordinates: 45°30'23"N, 13°54'38"E; Verovnik, R.
- 10.6.2006 – grasslands on the upper terrace below Mt. Lipnik, N of Rakitovec village; coordinates: 45°30'23"N, 13°54'38"E; Kogovšek, N.
- 11.6.2006 – grasslands on the slopes S of Hrastovlje village; coordinates: 45°30'19"N, 13°53'58"E; Kosmač, M.
- 24.5.2008, 15.5.2009, 21.5.2009 – small gully along the road W of Hrastovlje village; coordinates: 45°31'24"N, 13°53'27"E; Verovnik, R.
- 24.5.2008 – small glade on the path bellow the wall of Štrkljevica hill, 200 m NW of Zaniograd village; coordinates: 45°30'59"N, 13°54'28"E; Verovnik, R.
- 24.5.2008, 1.5.2011 – grasslands on Podračje hill, N of Hrastovlje village; coordinates: 45°31'07"N, 13°54'00"E; Verovnik, R.
- 21.5.2009 – stony grasslands on S slopes of Na Reti hill, N of Hrastovlje village; coordinates: 45°31'00"N, 13°54'16"E; Verovnik, R.
- 21.5.2009, 17.5.2011 – along the path to Podračje hill from Hrastovlje village; coordinates: 45°31'00"N, 13°54'13"E; Verovnik, R.
- 1.5.2011 – grasslands between the main road and the Hrastovski potok, N of Hrastovlje village; coordinates: 45°31'15"N, 13°53'44"E; Verovnik, R.
- 17.5.2011 – at the bridge over Hrastovski potok bellow Hrastovlje village; coordinates: 45°30'43"N, 13°54'14"E; Verovnik, R.
- 17.5.2011 – along railway lines bellow Podpeč village; coordinates: 45°31'14"N, 13°54'03"E; Verovnik, R.

The Osiris Blue was currently observed at 15 sites in Slovenia, mostly concentrated around Hrastovlje village bellow Kraški rob. Kraški rob forms the boundary between the Kras plateau and the flysch hills in the coastal part of Slovenia. Due to southern exposition, it is one of the warmest parts of Slovenia with typical xerophilous vegetation. This concentration of locations indicates a possibly contiguous distribution of the species in this part of Kraški rob, with displaced record at Predloka, indicating its potential wider distribution. The most outstanding record is from Mt. Lipnik (Kogovšek, pers. comm.) about 5 km away towards SE. The butterfly was found in dry grassland at the altitude of 700 m, which is about 500 higher than all the other known sites in Slovenia. Whether this is an exceptional record of a blown away specimen, or a permanent population, remains to be verified.

The habitat of the Osiris Blue is well characterized by the presence of larval host plants Sainfoins (*Onobrychis* spp.). These are relatively widespread on Kraški rob, however, adults of Osiris Blue have been found mostly in a more disturbed habitat, especially along roads and paths where Sainfoins flower in abundance. Additionally, they were found also in rocky or open sandy areas, and only rarely in open grasslands. Adults were mostly observed nectaring on different flowers including the Sainfoins. Although imbibing minerals on wet soils is common in blues, it was observed only once in Osiris Blue during recent surveys in Slovenia. Adults are usually present in low densities with commonly only single specimens observed at the site. In the last three years, the butterfly seems to have been more widespread, but maintains to be observed in low numbers. It flies only in a single generation from beginning of May until mid June. Specimens of the second generation commonly observed further south have not been recorded so far.

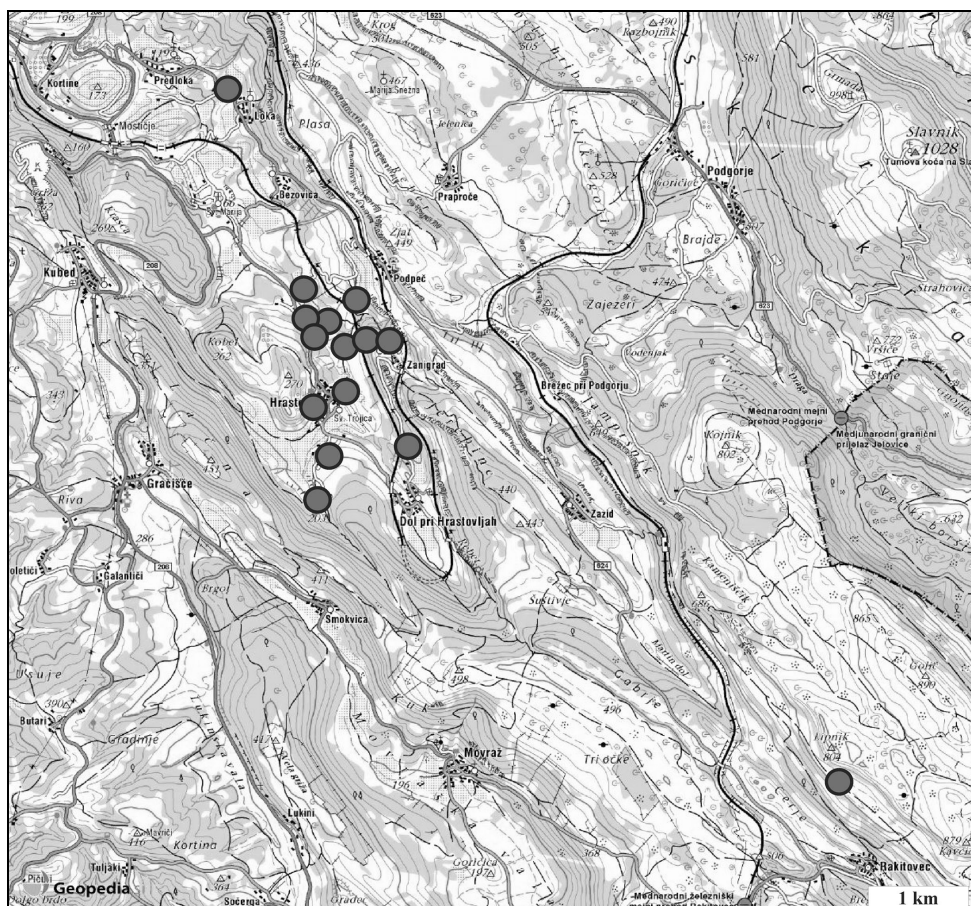


Figure 1. The recent distribution (records after year 1999) of the Osiris Blue (*Cupido osiris*) in Slovenia.
Slika 1. Recentna razširjenost (podatki po letu 1999) modrega kupida (*Cupido osiris*) v Sloveniji.

The species is listed as endangered (E) in Slovenian Red List (Uradni list 2002) due to the severe contraction of its range and the specific nature of its larval habitat. Definitely its low abundances indicate that the habitats for the species in Slovenia are suboptimal, possibly due to climatic conditions and sparseness of suitable larval microhabitat. Certainly this is the key to understanding the threat status of the species; however, nothing is known on the larval ecology in Slovenia. In general, the abandonment of grasslands including the infrastructure (paths and roads) does pose the biggest threat in the long term, as larval host plant will become less abundant and widespread. It remains to be seen how the climatic changes will affect the Osiris Blue in Slovenia along the northern boundary of its distribution in the region.

Povzetek

Modri kupido je v Evropi razširjen pretežno v Mediteranu. Za Slovenijo je znanih le nekaj zgodovinskih najdb, ki pa razen v enem primeru niso preverljive. Vsekakor je vrsta nekoč živel v Vipavski dolini in na prodiščih Save v Ljubljanski kotlini. Recentni podatki so omejeni na območje Kraškega roba od Predloke do gore Lipnik. Tu je večina lokalitet skoncentrirana v okolici Hrastovelj, kar verjetno ponazarja sklenjeno razširjenost te vrste pri nas. Tudi podatek iz Predloke bi lahko šteli v območje sklenjene razširjenosti, nikakor pa ne najdbe na pobočjih gore Lipnik, kjer je bil metulj najden skoraj 500 m višje kot na drugih lokalitetah. Ponovitev te najdbe bi bila vsekakor zaželena.

Vrsta je v Sloveniji vezana na suha skalnata območja, poti in kolovoze, kjer deloma tudi na golih tleh uspeva larvalna gostiteljska rastlina, turška medena detelja (*Onobrychis* spp.). Ta je tudi pomemben vir nektarja za modrega kupida. Vrsta se pri nas pojavlja v nizkih gostotah, večinoma so opaženi le posamezni primerki na lokaliteto. To je verjetno odsev suboptimalnih klimatskih razmer in pomanjkanja ustreznega larvalnega mikrohabitata. Žal o larvalni biologiji vrste, ki je ključna za razumevanje njene ogroženosti, v Sloveniji ne vemo nič. V splošnem pa velja, da je glavni dejavnik ogrožanja opuščanje košnje suhih skalnatih travšč in infrastrukture (poti, kolovozi), ki vodi v zaraščanje in izgubo rastišč gostiteljske rastline.

Acknowledgments

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Occurrences of the brown colour form of Western Whip (*Hierophis viridiflavus carbonarius* (Bonaparte, 1833)) in Slovenia

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Abstract. This article presents the first documented records of brown coloured adults of *Hierophis viridiflavus carbonarius* in Slovenia, and overviews some of the historical notes on unconfirmed sightings of *Hierophis gemonensis* in the same area of distribution.

Key words: reptiles, snakes, colubrids, western whip snake, *Hierophis viridiflavus*, Slovenia

Izvleček. POJAVLJANJE RJAVE BARVNE OBLIKE ČRNICE (*HIEROPHIS VIRIDIFLAVUS CARBONARIUS* (BONAPARTE, 1833)) V SLOVENIJI – V članku so opisane nove potrjene najdbe rjavo obarvanih odraslih osebkov črnice (*Hierophis viridiflavus*) v Sloveniji. Te najdbe na območju več nepotrjenih najdb belice (*Hierophis gemonensis*) nakazujejo na možnost, da se slednja v Sloveniji sploh ne pojavlja.

Ključne besede: plazilci, kače, črnica, belica, Slovenija, *Hierophis viridiflavus*, *Hierophis gemonensis*

The Western Whip Snake (*Hierophis viridiflavus* (Lacépède, 1789)) lives throughout much of the southern Europe, spanning from the Pyrenees in the west through southern France and entire Italy to north-west Croatia in the east (Gasc et al. 1997). In Slovenia, its range is limited to the south-western part of the country (Krofel et al. 2009). On the European mainland the species probably occurs, according to some authors, in two separate subspecies (Rato et al. 2009); adults of the eastern *Hierophis viridiflavus carbonarius* (which occurs in Slovenia) are completely black with a slight pattern on the head – only the supralabial, preocular and postocular shields along with the throat have some lighter colouration. Juveniles are coloured uniform light brown with a highly contrasting pattern, especially on the head, which has a distinct yellowish crossbar between the posterior margins of the eyes, which is broken in the middle (Kreiner 2007).

From 2008 onwards, several brown coloured adult individuals (Fajdiga pers. comm. 2008, Kumar pers. comm. 2010) were observed and photographed in the wider Vipava Valley area. The animals were determined as *Hierophis* sp., since they were very similar to the Balkan Racer (*Hierophis gemonensis* (Laurenti, 1768)) due to their brown colour and lighter juvenile-like markings on the head; unfortunately, no animals were caught for determination, since the only certain way to differentiate the two species apart is via ventral scale count: 160-187 in *Hierophis gemonensis* and 187-227 in *Hierophis viridiflavus* (Kreiner 2007). Until then, only few records of such unusually coloured specimens of *Hierophis viridiflavus carbonarius* existed, although they are supposed to be not particularly uncommon in the wider Trieste area (Bressi pers. comm. 2010), and in other parts of Italy (Zuffi 2008).

From 23rd to 25th September 2011, altogether 6 brown specimens of *Hierophis* sp. were observed during field research in a relatively small area of the Koper municipality in south-western Slovenia. All the animals were adults of over 1m in length, with unusual light brown ground colour with fine white speckles on dorsal scales and a yellowish juvenile-like pattern on the head (Figs. 1-2); also, all animals obviously lacked the normal dark colouration of *H. v. carbonarius* subspecies adults (Figs. 3-4). 4 animals were caught and determined as *Hierophis viridiflavus* via ventral scale count; their ventral scale count ranged from 199 to 209 ventral scales. After determination and photo documentation, the animals were released. In the same area, only 2 adults of normal dark colouration were seen, along with several juveniles.



Figure 1. Photograph of the head pattern of a brown coloured Western Whip Snake (*Hierophis viridiflavus carbonarius*) found in SW Slovenia (photo Erika Ostanek).

Slika 1. Fotografija vzorca glave rjavega osebka črnice (*Hierophis viridiflavus carbonarius*), najdene v JZ Sloveniji (foto Erika Ostanek).



Figure 2. Photograph of a brown coloured Western Whip Snake (*Hierophis viridiflavus carbonarius*) found in SW Slovenia (photo Tomaž Jagar).

Slika 2. Fotografija rjavega osebka črnice (*Hierophis viridiflavus carbonarius*), najdene v JZ Sloveniji (foto Tomaž Jagar).



Figure 3. Photograph of the head of a normal dark coloured Western Whip Snake (*Hierophis viridiflavus carbonarius*) found in SW Slovenia.

Slika 3. Fotografija glave normalnega, črnega osebka črnice (*Hierophis viridiflavus carbonarius*) iz JZ Slovenije.



Figure 4. Photograph of a normal dark coloured Western Whip Snake (*Hierophis viridiflavus carbonarius*) found in SW Slovenia.

Slika 4. Fotografija normalnega, črnega osebka črnice (*Hierophis viridiflavus carbonarius*) iz JZ Slovenije.

Such findings of this relatively unknown and rare colour variety of *Hierophis viridiflavus* in an area of Slovenia, where multiple unconfirmed sightings (no caught specimens) of *Hierophis gemonensis* (Krofel et al. 2009) were made in the past, suggest that at least some can be contributed to mistaken identity with these brown coloured *H. viridiflavus*. Also, there is a possibility that the first specimen of *H. gemonensis*, described by Laurenti in 1768 near Gemona (northeastern Italy), was in fact such an animal, as the holotypic specimen was never found (Schätti et al. 1991). In the future, additional studies of the brown colour variety of *H. viridiflavus* are needed; genetic research will show whether these animals are a colour morph with decreased levels of the pigment melanin in the scales and skin that appears only in small areas of the species distribution, or possibly a separate clade within the species.

Povzetek

Črnica (*Hierophis viridiflavus*) se v Sloveniji pojavlja le na jugozahodu države. Značilna obarvanost odraslih osebkov je enotno črna z rahlo svetlo obarvanostjo glave in grla. Juvenilni osebki so enotno rjavi z močnim, kontrastnim vzorcem na glavi. Po letu 2008 je bilo opaženih več rjavo obarvanih odraslih osebkov na območju Vipavske doline, ki jih ni bilo mogoče določiti z vso gotovostjo. Septembra 2011 je bilo na manjšem območju v občini Koper opaženih 6 rjavo obarvanih odraslih osebkov, od katerih so bili 4 ujeti ter po številu trebušnih lusk določeni za črnico. Vse živali so bile odrasle (v dolžino so merile več kot 1 m), po telesu obarvane svetlo rjavo z močnim svetlim vzorcem na glavi, podobnim vzorcu juvenilnih osebkov. Število trebušnih lusk je znašalo od 199 do 209. Takšni nenavadno obarvani osebki so precej redki in slabo poznani, zato je o njih le malo znanega. Rjava barvna oblika črnice se pojavlja tudi v severovzhodni Italiji, vključno z okolico Trsta, ter v jugozahodni Sloveniji. Pri nas je bilo v preteklosti na tem območju več nepotrjenih najdb belice (*Hierophis gemonensis*), kar lahko nakazuje na napačno določitev, saj sta si rjava barvna oblika črnice ter belica na prvi pogled zelo podobni. V prihodnosti bodo potrebne nadaljnje genetske raziskave teh nenavadno obarvanih črnice, ki bodo pokazale, ali so le nenavadna barvna oblika ali pa so doslej nepoznana, genetsko ločena skupina znotraj vrste *Hierophis viridiflavus*.

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***Proterebia afra dalmata* (Godart, 1824) (Lepidoptera, Satyrinae) recorded for the first time in Bosnia and Herzegovina**

PROTEREBIA AFRA DALMATA (GODART, 1824) (LEPIDOPTERA, SATYRINAE) PRVIĆ ZABELEŽENA V BOSNI IN HERCEGOVINI

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Bosnia and Herzegovina is located on the western edge of the Balkan Peninsula. The largest amount of the country is covered with mountains, highland karst, forests and pastures. A substantial part of the country is still strewn with mines that have remained there since the last war. The research of butterflies of Bosnia and Herzegovina has a very long tradition, with the first list of butterflies published more than 100 years ago (Apfelbeck 1892). Later researchers only contributed to the number of recorded species (Rebel 1904, Sijarić 1980, Lelo 2000, 2004, 2005-2007, 2007) resulting in a number of 190 species (Lelo 2007). However, the presence of some species is still doubtful and need to be checked in the future (Lelo 2007).

In the last year, the distribution map of the Dalmatian Ringlet, *Proterebia afer dalmata* (Godart, 1824), was published (Koren et al. 2010) and the question about its presence in the neighbouring Bosnia and Herzegovina has arisen. Dalmatian Ringlet flies from April to May in one generation (Tolman & Lewington 2008). In the last few years, substantial new data about *P. afra dalmata* were published, revealing that it is not so rare and localized in Croatia as previously expected (Mihoci & Šašić 2005, 2007, Koren et al. 2010). After the records from Kamešnica and Dinara mountains, close to Bosnia and Herzegovina (Koren et al. 2010), we wished to explore the possibility of its presence in that country.

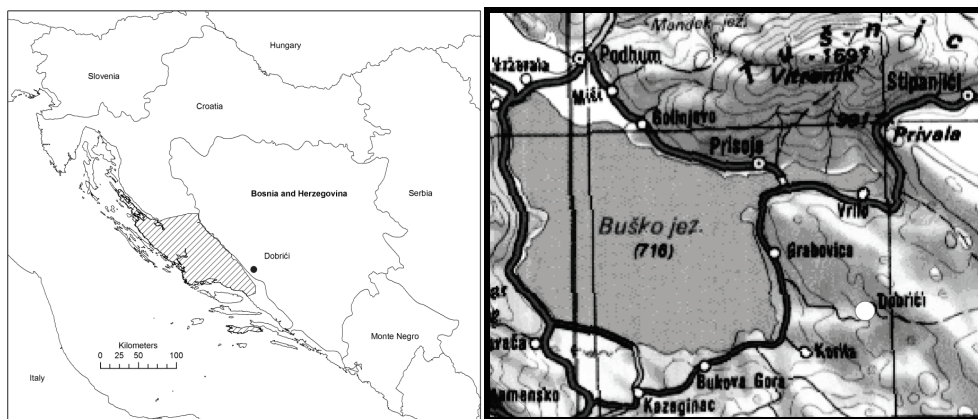
On 28 April 2011, we took a field trip from Bosnian side of the Neretva River towards the city of Livno and eventually to Lake Buško. After a prolonged search we managed to locate a favourable habitat, and soon the first specimens of *P. afra dalmata* were spotted just near the road in the small village of Dobrići (Figs. 1-2). The habitat is a dry karst rocky pasture, with low grassy vegetation scarcely covered with single trees. In general, the habitat was very similar to the typical habitat of the species in Croatia. Only five specimens of *P. afra dalmata* were observed, which is a small number compared to the locations in Croatia, where this species can even be dominant (Koren et al. 2010). After finding this population, we continued searching the area around Lake Buško, but were unable to find additional suitable habitat or additional specimens of *P. afra dalmata*. As it seems that there is no continuous karst habitat between Dobrići village and the nearest locations in Croatia (e.g. Dinara and Kamešnica), it is possible that the newly discovered population is isolated.

Still, we can probably assume that it will be also recorded on other locations in Bosnia, especially in the mountains near the border with Croatia, especially on Mt Kamešnica and Mt Dinara. We would like to encourage the Bosnian entomologists to continue searching for additional populations of *P. afra dalmata* in Bosnia and Herzegovina in order to gain better knowledge about the distribution and status of this species in their country. This is the 191st species recorded in Bosnia and Herzegovina.

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Figures 1 and 2. Distribution of *P. afra dalmata* in Croatia with location of the newly discovered site in Bosnia and Herzegovina.

Sliki 1 in 2. Razširjenost vrste *P. afra dalmata* na Hrvaškem z lokacijo novega odkritega najdišča v Bosni in Hercegovini.

First record of partial melanism in Horvath's rock lizard (*Iberolacerta horvathi*) from Slovenia

PRVA NAJDBA DELNO MELANISTIČNE
HORVATOVE KUŠČARICE (*IBEROLACERTA
HORVATHI*) V SLOVENIJI

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Horvath's rock lizard (*Iberolacerta horvathi* (Mehely, 1904)) is a species of the family Lacertidae with a relatively small distributional range confined to southern Austria, north-eastern Italy and parts of Slovenia and western Croatia (Gasc et al. 1997). In Slovenia, it is known from localities in the Julian Alps (Brelji 1954), mountainous parts (above 650 m a.s.l.) of the Alpine and Dinaric regions (Tome 1996, 2001), lower altitudes at Cerknica, Rakek, and Planina (Žagar et al. 2007), from 200 to 1100 m a.s.l. in the Kolpa Valley and other parts of the Kočevska region (Žagar 2008, Krofel et al. 2009), and from the Karavanke Mts. (Cafuta 2010). Adult individuals of this species measure up to 6 cm from snout to the vent and have dorsally flattened head and trunk (Mršić 1997, Arnold 2002). Typical colouration of the body's dorsal side is grey, brown or light brown with two contrasting darker (dark brown) temporal stripes (De Luca 1989, Mršić 1997, Arnold 2002). Dark occipital line or, alternatively, dark dots of dark brown colour are present in the middle of the back, but can also be absent (De Luca 1989). Individuals differ in the amount of dark brown spots on the back from no, middle or large number of spots that can in some cases be joined together in large irregular hues (De Luca 1989). Ventral side of the body is whitish or yellowish (Mršić 1997, Arnold 2002), or even greenish (De Luca 1989), with underside of the head usually whiter than belly (Žagar A., personal observations). Black spots are rarely present on

the belly of adult lizards, but when so, they are distributed around the edge of the throat and belly (De Luca 1989). Many adult animals have particularly characteristic olive-green reflection of the back (De Luca 1989, Mršić 1997, Arnold 2002).

On 19.05.2011, the first stated author caught a male of *I. horvathi* on Žurgarska stena at Žurje near Čabar in Slovenia (904 m a.s.l.). Both dorsal and ventral body colouration of this male was darker than typical of this species. The body's dorsal side resembled normal colouration of the species, but was slightly darker and did not have an olive-green reflection. The back was grey with black temporal stripes and black spots in two lines above the temporal stripe that were absent closer to the hind legs, but continued in one line along the middle dorsal side of the tail. The belly and underside of the head were almost black with a yellowish reflection. The colour of the iris (eye) was dark grey. The observed coloration is characteristic of melanism – occurrence of an increased amount of dark pigmentation in an organism, resulting from the presence of melanin (Webster's Revised Unabridged Dictionary 1913). The individual was photographed from ventral and dorsal views (Figs. 1-2). Standard biometric measurements are given in Tab. 1. Other members of this species observed at the same locality had normal colouration.

Table 1. Standard biometric measurements of a melanistic Horvath's rock lizard (*Iberolacerta horvathi*) male from Žurgarska stena, Slovenia.

Tabela 1. Standardne biometrične meritve melanističnega samca horvatove kuščarice (*Iberolacerta horvathi*) iz Žurgarske stene, Slovenija.

Snout-vent length / dolžina glave in trupa	48.0 mm
Head length / dolžina glave od konice gobca do ovratnika	17.1 mm
Pileus length / dolžina pileusa	11.6 mm
Head width / širina glave	7.3 mm
Head height / višina glave	5.1 mm
Tail length / dolžina repa	95.0 mm
Weight / teža	2.5 g

Melanism occurs sporadically in some lacertids. It is especially common in *Podarcis* populations on small islands and in *Dalmatolacerta* at high altitudes (Arnold et al. 2007). In Slovenia, two cases of melanism in lacertids have been reported previously for different species: *Podarcis siculus* (Krofel 2005) and *Algyroides nigropunctatus* (Žagar & Ostanek 2011). According to the available literature, the find of this partly melanistic individual of *Iberolacerta horvathi* from Slovenia seems to be the first record of partial melanism reported in this species. The finding is even more important, as cases of dark pigmentation in lacertids from the genus *Iberolacerta* are only few (i.e., for *I. galani*, Arribas et al. 2006).

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Figure 1. Ventral view of a partially melanistic Horvath's rock lizard male (*Iberolacerta horvathi*) found on 19 May 2011 at Žurgarska stena, Kočevska region, Slovenia (Photo: Miha Krofel).

Slika 1. Trebušna stran delno melanističnega samca horvatove kuščarice (*Iberolacerta horvathi*), najdenega 19.5.2011 na Žurgarski steni, Kočevsko, Slovenija (Foto: Miha Krofel).

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