NEW LOCALITIES FOR SOME IMPORTANT ODONATA SPECIES IN CENTRAL AND SOUTHWESTERN REPUBLIC OF NORTH MACEDONIA AND THE TRANS-BOUNDARY OHRID – PRESPA REGION BETWEEN REPUBLIC OF NORTH MACEDONIA AND ALBANIA

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Data related to the 41 species of the dragonfly fauna of central and southwestern Republic of North Macedonia and nearby Albania, gathered during the post European Congress on Odonatology 2012 fieldtrip on July 6-13th, 2012 are presented. The Ohrid – Prespa region was particularly investigated. The majority of previous data available for this area is old and outdated. Additionally, recent
degradation of habitats, combined with sporadic records of some patrimonial species made new surveys necessary. The presence of *Gomphus schneiderii* Selys, 1850 and *S. flavomaculata* in the region was confirmed whereas *L. pectoralis* was not found again. Conversely, *Coenagrion scitulum* (Rambur, 1842) was observed in Albania for the first time. The national Odonata checklists contain now 63 species in Republic of North Macedonia and 59 in Albania.

**Key words:** Odonata, Republic of North Macedonia, Albania, Ohrid – Prespa region

## INTRODUCTION

Dragonflies are often used as bio-indicators of the status, stability and integrity of freshwater ecosystems. Because of the complex habitat requirements of the individual species, their presence and abundance indicate the wealth and favourable conservation status of the freshwater ecosystem they inhabit (Corbet 1999, Hawking & New 2002). Additionally, their conspicuousness and sensitivity to small-scale changes in environmental conditions make them extremely valuable for a rapid assessment of the freshwater ecosystem’s quality (Moore 1997, Mortimer *et al.* 1998).

Many freshwater ecosystems habitats throughout the Balkans are endangered through the number of existing and projected hydro-power plants, water extraction and draining operations, and pollution (Freyhof 2012, Schwarz 2012, Zarfl *et al.* 2015). For most of the Mediterranean and southern species, freshwaters are important and precious habitats (Tierno de Figueroa *et al.* 2013) and to maintain high species diversity and population densities, their habitats should be preserved from any kind of degradation. In that manner assessing the dragonfly fauna composition and species distribution is a good tool to identify important habitats (Clark & Samways 1996, Stewart & Samways 1998, Clausnitzer & Jodicke 2004). The goal of this paper is to contribute to the knowledge of the dragonfly fauna of central and southwestern Republic of North Macedonia and the trans-boundary Ohrid – Prespa region between Republic of North Macedonia and Albania. Most of the previous data for the region were rather old (Filevska 1954, Karaman 1969, 1984–1985, Peters & Hackethal 1986). Bedjanić *et al.* (2008) contributed with publication of old data from the dragonfly collection in the Natural History Museum in Struga, Republic of North Macedonia, and some new data were given by Jović (2009) and Zawal *et al.* (2010). Furthermore, we provide information about the
ecology of some patrimonial species which are rare and/or threatened in Europe such as e.g. *Caliaeschna microstigma* (Schneider, 1845), *Gomphus schneiderii* Selys, 1850, *Lindenia tetraphylla* (Vander Linden, 1825), *Cordulegaster insignis* Schneider, 1845 and *Cordulegaster heros* Theischinger, 1979. Habitat condition of the investigated localities is also commented.

**MATERIALS AND METHODS**

From 6th to 13th July 2012, 36 different freshwater localities covering both standing and running waters were visited in central and southwestern Republic of North Macedonia to investigate their dragonfly fauna (Fig. 1), particularly in the Ohrid – Prespa region. Data were collected by active searching, netting and photographing, and the species were identified to location. Voucher specimens of some interesting species were collected and preserved in absolute Ethanol (99.8%) or kept dry in envelopes (Dinova - personal collection). Biogeographical affiliation of the species is given according Boudot & Kalkman (2015).

![Fig. 1. – Investigated localities in Republic of North Macedonia (MKD) and Albania (ALB).](image-url)
RESULTS

The recorded species are presented both according to the visited localities (Fig. 1) and as a species list (Tab. 1).

Table 1. List of the recorded species (in alphabetical order).

<table>
<thead>
<tr>
<th>Species name</th>
<th>Localities Nos.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aeshna affinis Vander Linden, 1820</td>
<td>8, 11, 20, 21</td>
</tr>
<tr>
<td>Aeshna cyanea (Müller, 1764)</td>
<td>14</td>
</tr>
<tr>
<td>Aeshna isocelis (Müller, 1767)</td>
<td>10, 19</td>
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<tr>
<td>Anax imperator Leach, 1815</td>
<td>1, 10, 11, 12, 18, 19, 21, 24, 25, 28, 35</td>
</tr>
<tr>
<td>Anax parthenope Selys, 1839</td>
<td>1</td>
</tr>
<tr>
<td>Caliaeschna microstigma (Schneider, 1845)</td>
<td>32</td>
</tr>
<tr>
<td>Calopteryx splendens (Harris, 1780)</td>
<td>3, 4, 10, 12, 13, 14, 15, 16, 17, 18, 19, 24, 26, 32</td>
</tr>
<tr>
<td>Calopteryx virgo festiva (Brullé, 1832)</td>
<td>8, 18, 29, 30, 31, 32, 36</td>
</tr>
<tr>
<td>Coenagrion puella (Linnaeus, 1758)</td>
<td>9, 18, 19, 26</td>
</tr>
<tr>
<td>Coenagrion pulchellum (Vander Linden, 1825)</td>
<td>9, 21</td>
</tr>
<tr>
<td>Coenagrion scitulum (Rambur, 1842)</td>
<td>28</td>
</tr>
<tr>
<td>Cordulegaster bidentata Selys, 1843</td>
<td>5, 6, 13, 14, 15, 29</td>
</tr>
<tr>
<td>Cordulegaster heros Theischinger, 1979</td>
<td>4, 31</td>
</tr>
<tr>
<td>Cordulegaster insignis Schneider, 1845</td>
<td>32</td>
</tr>
<tr>
<td>Cordulegaster sp.</td>
<td>18, 29</td>
</tr>
<tr>
<td>Crocothemis erythraea (Brullé, 1832)</td>
<td>1, 11, 20, 21, 22, 23, 24, 25, 28</td>
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<tr>
<td>Enallagma cyathigerum (Charpentier, 1840)</td>
<td>12, 20, 22, 33, 34, 35</td>
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<tr>
<td>Erythromma lindenii (Selys, 1840)</td>
<td>10, 11, 22, 35</td>
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<tr>
<td>Erythromma viridulum (Charpentier, 1840)</td>
<td>19, 24, 27, 28, 35</td>
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<tr>
<td>Gomphus schneiderii Selys, 1850</td>
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<tr>
<td>Gomphus sp.</td>
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</tr>
<tr>
<td>Gomphus vulgatissimus (Linnaeus, 1758)</td>
<td>29, 34</td>
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<tr>
<td>Ischnura elegans (Charpentier, 1825)</td>
<td>1,8,9,10,11,12,18,19,24,25,26,27,28,33,35</td>
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<tr>
<td>Lestes barbarus (Fabricius, 1798)</td>
<td>11, 18, 28</td>
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<td>Lestes dryas Kirby, 1890</td>
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<td>Lestes virens (Charpentier, 1825)</td>
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<td>Libellula depressa Linnaeus, 1758</td>
<td>5, 6, 9, 10, 11, 18, 32</td>
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<td>Libellula fulva Müller, 1764</td>
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<td>Libellula quadrirunculata Linnaeus, 1758</td>
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<td>Linednia tetraphylla (Vander Linden, 1825)</td>
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<td>Onychogomphus forcipatus (Linnaeus, 1758)</td>
<td>3, 11, 18, 21, 22, 28, 32, 34, 35</td>
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<tr>
<td>Orthetrum albistylum (Selys, 1848)</td>
<td>1, 2</td>
</tr>
<tr>
<td>Orthetrum brunneum (Fonscolombe, 1837)</td>
<td>28, 32</td>
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<tr>
<td>Orthetrum cancellatum (Linnaeus, 1758)</td>
<td>1, 8, 9, 11, 12, 18, 19, 21, 22, 27, 28, 33, 35</td>
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<tr>
<td>Orthetrum coerulescens (Fabricius, 1798)</td>
<td>10, 28</td>
</tr>
<tr>
<td>O. coerulescens anceps (Schneider, 1845)</td>
<td>5, 6, 18, 32</td>
</tr>
<tr>
<td>Platycnemis pennipes (Pallas, 1771)</td>
<td>3, 8, 9, 10, 18, 19, 20, 32, 33, 34, 35</td>
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<tr>
<td>Pyrrhosoma nymphula (Sulzer, 1776)</td>
<td>18</td>
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<tr>
<td>Somatochlora flavomaculata</td>
<td>5, 6</td>
</tr>
<tr>
<td></td>
<td>(Vander Linden, 1825)</td>
</tr>
<tr>
<td>Sympetrum fuscum (Vander Linden, 1820)</td>
<td>11, 28, 29</td>
</tr>
<tr>
<td>Sympetrum depressiusculum (Selys, 1841)</td>
<td>11</td>
</tr>
<tr>
<td>Sympetrum fonscolombii (Selys, 1840)</td>
<td>11, 12, 19, 21, 22, 28, 33</td>
</tr>
<tr>
<td>Sympetrum sanguineum (Müller, 1764)</td>
<td>8, 9, 10, 11, 12, 13, 19, 21, 22, 24, 28, 35</td>
</tr>
<tr>
<td>Sympetrum sp.</td>
<td>25</td>
</tr>
<tr>
<td>Sympetrum striolatum (Charpentier, 1840)</td>
<td>11, 20, 21, 22, 35</td>
</tr>
</tbody>
</table>
1. The West and 2. The East shore of Lake Mladost, near Veles, Republic of North Macedonia

Visited on the July 6\textsuperscript{th}, 2012
Coordinates: 41.77997° N, 21.76017° E
Altitude: 246 m

Lake Mladost (Fig. 2) is a reservoir constructed on the river Otovica. The shore of the lake is overgrown by reeds and in some places by willows. The surrounding vegetation is represented by degraded thermophilous white oak forest (dominated by \textit{Paliurus spina-christi}) and coniferous plantations (containing Mediterranean cypress and Black pine).

Species observed at the west side of the lake: \textit{Ischnura elegans}, \textit{Anax imperator}, \textit{Anax parthenope}, \textit{Libellula fulva}, \textit{Orthetrum albistylum}, \textit{Orthetrum cancellatum} and \textit{Crocothemis erythraea}. Species observed at the east side of the lake: \textit{Lindenia tetraphylla} (Figs. 2 and 3) and \textit{Orthetrum albistylum}.

Fig. 2. – Lake Mladost, east bank side with willow belt and the coniferous plantations dominated of black pine. The locality where small population of \textit{Lindenia tetraphylla} was recorded (photo: Klaus-Jürgen Conze).

3. The Vardar River, near the mouth of the Treska River, Skopje, Republic of North Macedonia

Visited on July 7\textsuperscript{th}, 2012
Coordinates: 42.00354° N, 21.34429° E
Altitude: 271 m
The river Vardar is the largest river in the Republic of North Macedonia. The river is under significant anthropogenic pressure, especially in Skopje and its surroundings (Jovanovska et al. 2013), where the area is converted into an urban park and arable land. However, part of the natural riparian vegetation is still preserved and is mostly represented by poplar, willow and black alder belts and woodlands. Fragments of the willow belt are develop directly from the river, but at the researched locality the riverbed is not properly maintained.

Observed species: *Calopteryx splendens*, *Platycnemis pennipes* and *Onychogomphus forcipatus*.

4. The Treska River, north of the village Glumovo near the Treska Resort, Skopje, Republic of North Macedonia

Visited on July 7th, 2012

Coordinates: 41.98007° N, 21.31389° E

Altitude: 297 m

The Treska River is one of the Vardar’s tributaries. Both sides of the river are under a great anthropogenic impact. The area on the left side of Treska River is transformed into recreational facilities (parks, weekend settlements) while the right side of the valley contains vegetated areas composed of degraded oak forest. The immediate riparian vegetation is represented mainly by black alder belt. The river bed is stony. A reservoir, Matka dam, was built in 1939 on the Treska River at the Matka Canyon.
above the visited locality, with the basic purpose to generate electricity. According to the regulation of the water in the dam, the water level of the river changes from time to time. During the visit, the water level reached a high level.

Observed species: *Calopteryx splendens* and *Cordulegaster heros*.

**5. The marsh and** 6. **The peat bog areas in Bunec resort, north-east from Mavrovo Lake, National Park "Mavrovo", Republic of North Macedonia**

*Visited on July 7\(^{th}\), 2012*

*Coordinates: 41.72830° N, 20.79533° E*

*Altitude: 1238 m*

The Bunec wetland includes different types of wet habitats such as peat bogs and marshy areas in the northern part, and alder and willow woodlands in the part where the spring flows into the Mavrovo Lake (Melovski & Matevski 2008).

Observed species: *Cordulegaster bidentata, Somatochlora flavomaculata, Libellula depressa* and *Orthetrum coerulescens anceps*.

**7. The Mala Reka river, near the village Mogorce, Debar, Republic of North Macedonia**

*Visited on July 7\(^{th}\), 2012*

*Coordinates: 41.54245° N, 20.63003° E*

*Altitude: 677 m*

The Mala Reka river is a typical mountain river with well-developed riparian belt, while the surroundings included wet meadows and beech forest.

Observed species: one Aeshnid observed.

**8. The agricultural fields (small part of the old Struga swamp) near Struga, Republic of North Macedonia**

*Visited on July 8\(^{th}\), 2012*

*Coordinates: 41.18146° N, 20.66895° E*

*Altitude: 741 m*

During the intensification of the agricultural actions in the region, the old Struga swamp was almost completely destroyed. Although in quite bad condition, small residual patches still exist.

Observed species: *Calopteryx virgo festiva, Lestes dryas, Ischnura elegans, Platycnemis pennipes, Aeshna affinis, Orthetrum cancellatum* and *Sympetrum sanguineum.*
9. The drainage ditch in agricultural area west of Struga, Republic of North Macedonia

Visited on July 8th 2012
Coordinates: 41.18119° N, 20.66682° E
Altitude: 703 m

Drainage ditch in the former Struga swamp (now an agricultural area).

Observed species: *Coenagrion puella, Coenagrion pulchellum, Ischnura elegans, Platycnemis pennipes, Libellula depressa, Orthetrum cancellatum* and *Sympetrum sanguineum*.

10. The Crni Drim river, North Struga, Republic of North Macedonia

Visited on July 8th, 2012
Coordinates: 41.18338° N, 20.67842° E
Altitude: 697 m

The Crni Drim River flows out of the Ohrid Lake, the flow passing through the city is regulated, but the downstream line up to the Globocica dam has a natural stream. Riparian vegetation is represented by alder, willow and other species. Degradation of this belt is visible at the location. Wetlands, as swamps and marshy areas along the river are mainly destroyed by agricultural activities and urbanization.

The river bed is muddy and sandy. During our visit the submerged vegetation was well present and the water was clear.

Observed species: *Calopteryx splendens, Ischnura elegans, Erythromma lindenii, Platycnemis pennipes, Aeshna isceles, Anax imperator, Gomphus sp., Libellula depressa, Libellula fulva, Orthetrum coerulescens* and *Sympetrum sanguineum*.

11. The swamp near the Republic of North Macedonian-Albanian border, border pass Kjafasan, west of Struga, Republic of North Macedonia

Visited on July 8th, 2012
Coordinates: 41.09313° N, 20.61266° E
Altitude: 967 m

A very small wetland in a depression filled with temporary water and invaded with vegetation over its whole surface. It is drying out in the late summer. The vegetation is dominated by *Typha, Phragmites, Scirpus, Juncus* and wet meadows. Most of the surrounding area is covered with the Italian and Turkey oak forest.

Observed species: *Lestes dryas, Lestes virens, Lestes barbarus, Sympecma fusca, Ischnura elegans, Erythromma lindenii, Aeshna affinis, Anax*
imperator, Onychogomphus forcipatus, Libellula depressa, Orthetrum cancellatum, Crocothemis erythraea, Sympetrum sanguineum, Sympetrum depressiusculum, Sympetrum fonscolombii and Sympetrum striolatum.

12. A former gravel-pit 1.2 km east of the village Dolna Belica, northwest of Struga, Republic of North Macedonia

Visited on July 8th, 2012
Coordinates: 41.20624° N, 20.64571° E
Altitude: 923 m

A pool in an abandoned gravel-pit surrounded by scarce bushes, grass and hydrophyllous vegetation.

Observed species: Calopteryx splendens, Lestes virens, Ischnura elegans, Enallagma cyathigerum, Anax imperator, Orthetrum cancellatum, Sympetrum fonscolombii and Sympetrum sanguineum.

13. Podgorechka Reka river west of the village Podgorci, Struga, Republic of North Macedonia

Visited on July 9th, 2012
Coordinates: 41.26120° N, 20.58762° E
Altitude: 1026 m

The Podgorechka Reka river is a small rocky brook with swift water below a spring in the lower part of its catchment. The upper mountain part is fed with water only during the high rainfall events and was dry at the time of the visit. The banks are covered with dry grassland and the slopes with degredated oak forest.

Observed species: Calopteryx splendens, Cordulegaster bidentata and Sympetrum sanguineum.

14. Vevčanski Izvori spring, above Vevčani, Struga, Republic of North Macedonia

Visited on July 9th, 2012
Coordinates: 41.23934° N, 20.58489° E
Altitude: 990 m

The karstic spring of Vevchanski Izvori at Jablanica Mountain is situated in beech forest. It’s natural values are legally protected by the state.

Observed species: Calopteryx splendens, Aeshna cyanea and Cordulegaster bidentata.
15. Tributary of the Lakavica River on the road from the village Borovec to Jablanica, near the village Asovci, Struga, Republic of North Macedonia.

Visited on July 9th, 2012
Coordinates: 41.29180° N, 20.59078° E
Altitude: 976 m

Typical mountain river in the beech forest with stony and sandy bed, surrounded by wet meadows. At the researched locality, the water was cold and clear.

Observed species: *Calopteryx splendens* and *Cordulegaster bidentata*.

16. The Lakavica River, south of the village Jablanica, north of Struga, Republic of North Macedonia

Visited on July 9th, 2012
Coordinates: 41.30668° N, 20.57497° E
Altitude: 925 m

The same habitat type as at loc. 15.
Observed species: *Calopteryx splendens*.

17. Lakavica River, south of the village Jablanica (bridge), north of Struga, Republic of North Macedonia

Visited on July 9th, 2012
Coordinates: 41.31167° N, 20.56637° E
Altitude: 943 m

The same habitat type as at loc. 15.
Observed species: *Calopteryx splendens*.

18. Sateska River near the village Moroista, north of Struga, Republic of North Macedonia

Visited on July 9-10th, 2012
Coordinates: 41.20860° N, 20.70421° E
Altitude: 696 m

The Sateska River (Fig. 4) is the largest river in the basin of the Ohrid Lake. The river's source region is located in the mountain region, while the middle and lower reaches of the river are in the lowland area. At the researched locality, the water was cold and clear with dense aquatic vegetation (submerged or dense floating plants). Although the river passes through agricultural areas that load it with the numerous organic
substances, the researched locality seemed not overly affected by waste water.

Fig. 4. – On top: Sateska River, a typical *Gomphus schneiderii* habitat (photo: Klaus-Jürgen Conze) and at the bottom: Turkish Clubtail - *Gomphus schneiderii* (photo: Erland R. Nielsen).


**19. Sateska Reka, East of Struga, Republic of North Macedonia**

Visited on July 10th, 2012
Coordinates: 41.16845° N, 20.72702° E
Altitude: 696 m

Sateska Reka is a slow flowing river within well-developed riparian vegetation with dense submerged and aquatic vegetation and is connected with wetlands in some parts.

Observed species: *Enallagma cyathigerum, Platycnemis pennipes, Gomphus vulgatissimus, Gomphus schneiderii* and *Onychogomphus forcipatus*.

**20. Lake Ohrid, East of Struga, Republic of North Macedonia**

Visited on July 10th, 2012

Coordinates: 41.17030° N, 20.70178° E

Altitude: 690 m

The northern shore of the lake with cultivated fields. Lake Ohrid is an ancient aquatic ecosystem (Wagner *et al.* 2017), with considerable diversity and endemism of aquatic species (Levkov & Williams, 2012), which is threatened by human activities and climate change (Kostoski *et al.* 2010; Matzinger *et al.* 2006; Matzinger *et al.* 2007). Therefore, inventories of species diversity are an important task (Levkov & Williams, 2012). The first review of Odonata fauna of Ohrid Lake was given by Filevska (1954), as a first regional investigation in the Republic of North Macedonia. Additional data are published by Peters & Hackethal (1986), Bedjanič *et al.* (2008), Jovič (2009), Zawal *et al.* (2010) and others. During our visit, just six species of Odonata were registered on locality 33 where human pressure on natural habitats was clearly visible (the reed belt was degraded, the lake shore was transformed into agricultural areas and under strong pressure from the tourist infrastructure. More detailed investigations are needed in the Ohrid and neighbouring Prespa regions to assess the current diversity and status of Odonata in both lakes and the associated wetlands. Upon this, protection measures should be established.

Observed species: *Enallagma cyathigerum, Ischnura elegans, Platycnemis pennipes, Libellula fulva, Orthetrum cancellatum* and *Sympetrum fonscolombii*.

**21. The pond in the front of the Hydrobiological Institute Ohrid, Ohrid, Republic of North Macedonia**

Visited on July 10th, 2012

Coordinates: 41.10168° N, 20.81426° E

Altitude: 695 m
A man-made pond surrounded by vertical concrete walls, with dense floating and submerged hydrophytes and small patches of *Typha* near the banks.

Observed species *Calopteryx splendens, Coenagrion puella, Erythromma viridulum, Ischnura elegans, Platycnemis pennipes, Aeshna isosceles, Anax imperator, Libellula quadrimaculata, Libellula fulva, Orthetrum cancellatum, Sympetrum fonscolombii* and *Sympetrum sanguineum*.

22. **Studenishishko swamp, near Lake Ohrid, Republic of North Macedonia**

Visited on July 10th, 2012  
Coordinates: 41.09691° N, 20.80465° E  
Altitude: 664 m

This area, which is the remains of a larger swamp on the eastern bank of Lake Ohrid is now reduced to only about 30 ha. The Macedonian wetland habitats, including this area, are under strong anthropogenic pressure due to construction works (concrete), waste disposal, road constructions, enlargement of touristic areas and agriculture intensification. The most important community represented here is a *Caricetum elatae* (Micevski 1969) considered to be a very rare relict in the Republic of North Macedonia.

Observed species: *Enallagma cyathigerum, Platycnemis pennipes, Aeshna affinis, Crocothemis erythraea* and *Sympetrum striolatum*.

23. **The Springs of Crni Drim, near the Monastery St. Naum, Lake Ohrid, Republic of North Macedonia**

Visited on July 10th, 2012  
Coordinates: 40.912950° N, 20.744254° E.  
Altitude: 694 m

Karstic spring system with clear water, with characteristic oligotrophic vegetation.

Observed species: *Calopteryx virgo festiva*.

24. **The Stenje swamp, south of the village Stenje, Republic of North Macedonia**

Visited on July 11th, 2012  
Coordinates: 40.93369° N, 20.92053° E  
Altitude: 852 m
A residual swamp invaded by *Typha* and *Phragmites* vegetation, with a very small patches of open water area with emergent plants. Large quantities of construction waste and municipal solid waste from the village Stenje were dumped into the swamp, thus one part of this habitat has completely changed. This site is the only known locality for *Leucorrhina pectoralis* in the Republic of North Macedonia, which was not confirmed during the visit.

Observed species: *Lestes virens, Coenagrion pulchellum, Anax imperator, Aeshna affinis, Onychogomphus forcipatus, Orthetrum cancellatum, Crocothemis erythraea, Sympetrum fonscolombii, Sympetrum sanguineum* and *Sympetrum striolatum*.

**25. Prespa Lake, village Stenje, Republic of North Macedonia**

Visited on July 11\textsuperscript{th}, 2012  
Coordinates: 40.93459° N, 20.93240° E  
Altitude: 842 m

The locality is situated in the western part of the lake shore near the village Stenje. The shore vegetation is one of the most natural ones in the Republic of North Macedonia. However, parts of the lake shore are under pressure by the development of agricultural fields and infrastructure construction works.

Observed species: *Enallagma cyathigerum, Erythromma lindenii, Onychogomphus forcipatus, Orthetrum cancellatum, Crocothemis erythraea, Sympetrum fonscolombii, Sympetrum striolatum* and *Sympetrum sanguineum*.

**26. Goricë e Vogël ("Prespa" National Park), Republic of Albania**

Visited on July 11\textsuperscript{th}, 2012  
Coordinates: 40.88204° N, 20.92076° E  
Altitude: 812 m

The western shore of Lake Prespa, a dry area in a degraded oak forest with individual threes of *Pinus nigra* in front of the Prespa National Park Administration Building in the village Goricë e Vogël.

Observed species: *Crocothemis erythraea*.

**27. The Small Prespa Lake, an artificial canal (a small dam) NW from the village Treni, Republic of Albania**

Visited on July 11\textsuperscript{th}, 2012  
Coordinates: 40.67240° N, 20.98697° E  
Altitude: 836 m
The locality is at the South-West end of the Small Prespa Lake, with eutrophicated water covered with dense algae and hydrophytes aggregations.

Observed species: Calopteryx splendens, Erythromma viridulum, Ischnura elegans, Anax imperator, Crocothemis erythraea and Sympetrum sanguineum.

28. The Small Prespa Lake, south of the village Shuec, NP "Prespa", Republic of Albania
   Visited on July 11th, 2012
   Coordinates: 40.68366° N, 20.99738° E
   Altitude: 839 m
   The locality is at the South-West end of the Small Prespa Lake. The eutrophic water is invaded by dense reed (Typha and Phragmites).
   Observed species: Ischnura elegans, Anax imperator, Crocothemis erythraea and Sympetrum sp.

29. The irrigation canal in the agricultural fields, close to the village Vranisht, Republic of Albania
   Visited on July 11th, 2012
   Coordinates: 40.66802° N, 20.94164° E
   Altitude: 851 m
   The locality is a typical irrigation canal within the Devoll river watershed with slow flowing water, and partly overgrown by Typha and submersed vegetation.
   Observed species: Calopteryx splendens, Coenagrion puella and Ischnura elegans.

30. Devoll River, by the road between the village Changonj and the village Zemblak, Republic of Albania
   Visited on July 11th, 2012
   Coordinates: 40.69938° N, 20.89253° E
   Altitude: 836 m
   The locality is a non-channelized part of the Devoll River with slow flowing water.
   Observed species: Erythromma viridulum, Ischnura elegans and Orthetrum cancellatum.

31. Pond north of the village Lajhtize, Republic of Albania
   Visited on July 12th, 2012
Coordinates: 40.78183° N, 20.89225° E
Altitude: 875 m

A man-made reservoir (Fig. 5) with earth banks and surrounded by fields and grassland. The banks are covered with few of helophytes. Water from the small spring enters the pond from its north banks.

Fig. 5. – On top: the pond N of Lajhtize (photo: Klaus-Jürgen Conze), at the bottom: Coenagrion scitulum (photo: Michael Prost).

Observed species: Lestes barbarus, Sympecma fusca, Coenagrion scitulum, Erythromma viridulum, Ischnura elegans, Anax imperator, Oncychogomphus forcipatus, Orthetrum cancellatum, Orthetrum brunneum, Orthetrum coerulescens, Crocothemis erythraea, Sympetrum fonscolombii and Sympetrum sanguineum.
32. Swamp Ralnik, and southern coast of Lake Prespa, east of the village Zaroshke, Republic of Albania

Visited on July 11th, 2012
Coordinates: 40.76549° N, 20.92268° E
Altitude: 840 m

Swampy area developed in the depression south of the shore of the Great Prespa Lake. At the research site aquatic vegetation was well-developed, but the overgrazing by cattle was visible in the whole area of the swamp. The stony lake shore separates the swamp from the lake. Wet meadows are developed on the other side where the habitats are gradually replaced by the dry grasslands and oak forests in the foothills of Mt. Galichica.

Observed species: *Enallagma cyathigerum*, *Erythromma lindenii*, *Erythromma viridulum*, *Ischnura elegans*, *Platycnemis pennipes*, *Anax imperator*, *Onychogomphus forcipatus*, *Orthetrum cancellatum*, *Sympetrum sanguineum* and *Sympetrum striolatum*.

33. Brajchinska Reka river, above (East of) the village Brajchino, Republic of North Macedonia

Visited on July 12th, 2012
Coordinates: 40.91188° N, 21.19853° E
Altitude: 1235 m

The Brajchinska Reka river is a mountain river with forested surroundings (composed of beech forest and a riparian belt) with sparse abandoned pastures.

Observed species: *Calopteryx virgo festiva*, *Sympecma fusca*, *Gomphus vulgarissimus*, *Cordulegaster bidentata* and *Cordulegaster* sp.

34. Brajchinska Reka river, in the village Brajchino, Republic of North Macedonia

Visited on July 12th, 2012
Coordinates: 40.90686° N, 21.15802° E
Altitude: 1008 m

A mountain river with similar characteristics than at loc. 34.

Observed species: *Calopteryx virgo festiva*

35. The stream Dzupanica, close to the village Krstec, north of Prilep, Republic of North Macedonia

Visited on July 12th, 2012
Coordinates: 41.40398° N, 21.66753° E
Altitude: 975 m

The locality is situated at the spring area and upper course of the stream Dzupanica, surrounded by riparian vegetation and situated in the mosaic landscape of dry pastures, patches of oak forest and bushes of *Paliurus spina-christi* on a steep slope.

Observed species: *Calopteryx virgo festiva* and *Cordulegaster heros*.

36. Raec River, Drenovo Gorge, Raec, Republic of North Macedonia

Visited on July 13\textsuperscript{th} 2012

Coordinates: 41.43673° N, 21.86527° E

Altitude: 209 m

This locality (Fig. 6) is an important area proposed to be protected by the state law, but still without any protection measures. It is one of the most important refugia in the Republic of North Macedonia. The riparian belt is well developed and mostly represented by poplar, willow and black alder, whereas a petrifying seepage spring with tufa formation (*Cratoneurion*) overgrown with grassy vegetation constitutes one of the two breeding places of *Cordulegaster insignis* in the Republic of North Macedonia. Unfortunately, this locality was completely destroyed in 2016/2017 due to the construction of a regional road.

Fig. 6. – Left: Drenovo Gorge - a petrifying seepage spring with tufa formation is a typical habitat of *Cordulegaster insignis* (photo: Klaus-Jürgen Conze), right: *Cordulegaster insignis* (photo: Klaus-Jürgen Conze).

Observed species: *Calopteryx splendens*, *Calopteryx virgo festiva*, *Platycnemis pennipes*, *Caliaeschna microstigma*, *Onychogomphus forcipa-
During the survey, a total of 41 species of Odonata were recorded. Here we present a critical review of the existing regional data on some rare or internationally important species.

**Coenagrion scitulum**

This Atlanto-Mediterranean species was discovered in Albania close to the border with the Republic of North Macedonia. This is the first documented record for Albania. Until now just an historic general indication "Albania" was available (Selys 1850: 282). That old record was unreliable for the contemporary Albania because: i) the political border of the country changed since that time, ii) the area of origin of this record is titled under the section “Greece and European Turkey” and iii) Albania is not listed as a country with $C. \text{scitulum}$ records in more recent papers written by the same author. This Bluet is rare in the Republic of North Macedonia, too, with few older records from the southern and central parts (Karaman 1981, Peters & Hackethal 1986, Adamović 1990, Jović & Mihajlova 2009) and only one recent record (Jović 2009). The status of the formerly known populations in the Republic of North Macedonia needs to be reassessed.

**Caliaeschna microstigma**

This species is distributed from Iran through Anatolia to the Adriatic coast of Croatia (Kalkman & Jović 2015). This lotic species is common from Asia Minor to the southern Balkans but becomes rare and vulnerable going further north, where drying up of brooks in the Summer is now more frequent and has lead to the extinction of some populations (Kalkman 2010, Kalkman et al. 2018). In the Republic of North Macedonia, the species inhabits mainly the warmest parts of the country in hilly regions and absent from both the mountains and flat lowlands. The species is found near the Drenovska Gorge, in the river with sandy and stony bottom covered by macrophytes, at the location where riparian vegetation forms a canopy.

**Gomphus Schneiderii**

Republic of North Macedonia, Montenegro and the south of Bosnia and Herzegovina constitute the north-western limit of the range of this Gomphid, which is closely allied to the European $G. \text{vulgatissimus}$. The Sateska River near Lake Ohrid represents a new locality for $Gomphus$
schneiderii in the Republic of North Macedonia, as it was previously known only from Galichica Mt (Jović & Mihajlova 2009).

**Lindenia tetraphylla**

This Southwest Asian and Mediterranean eremic species, is rare in the Republic of North Macedonia. A stable population, known since the mid 70's and 80's (Peters & Hackethal 1986) still persists in the north at Mladost Lake, near Veles. Other populations were known from the SE of the country in the past (Karaman 1969, 1981), but their present status is poorly known in North Macedonia.

**Cordulegaster insignis**

This southwest Asian and Balkan species was recorded in a tufa seepage and swamp above the Raec River in the Drenovo Gorge, South of Skopje. This locality constitutes the westernmost limit of its range together with Serbia (Kulijer & Boudot 2013, Kulić et al. 2013, Boudot et al. 2015). This is the second record ever published of this species in the Republic of North Macedonia (Holuša & Holušova 2012, Holuša & Krivan 2012, Kitanova et al. 2013). A dead adult specimen of *C. insignis* was found in 2015, which was published by Vinko et al. (2017). Like other members of the so-called ‘bidentata group’, this species is linked to seepages and headwater stretches, as the larvae do not resist the strong current of the middle and lower stretches, where they drift downstream over long distances (Leipelt 2005). Thus, the Tufa wetland and spring of the Drenovo Gorge fit perfectly to the ecological requirements of this species. During the construction of the new regional road (Prilep-Skopje), the whole area has been destroyed recently, which resulted in total loss of this important habitat and probably loss of the local *C. insignis* micro-population. Monitoring of this locality is needed to confirm whether this micro-population managed to survive such a local biological disaster.

**Cordulegaster heros**

The range of this Balkan endemic goes from SE Czech Republic and SW Slovakia to the Balkans, extending to the central Peloponnese, Romania and the West of Ukraine (Boudot & Holuša 2015). This is not a rare species but it seems to be rather scattered in Republic of North Macedonia. The small river stream where the species was found is situated in the area with Sub-Mediterranean climate.

Three years after the present survey new field investigations brought further data from the southern half of Republic of North Macedonia, including the first records of *Selysiothemis nigra* (Vander Linden, 1825) for Republic of North Macedonia (Vinko et al. 2017), showing that further field research remains to be done over the whole country in order to obtain a comprehensive knowledge of its dragonfly fauna.
Considering the checklist of Odonata of Albania and Republic of North Macedonia given by Boudot & Kalkman (2015) and the subsequent discovery of some species in Republic of North Macedonia by Vinko et al. (2017) and in Albania by De Knijf & Demolder (2015) and Buczynski et al. (2017), the national Odonata lists now reach 63 species for Republic of North Macedonia and 59 for Albania. We expect that further research will increase these numbers even more.

Ohrid and Prespa Lakes and their surroundings are able to support stable dragonfly populations with high diversity (Karaman 1984-85). Therefore, it is important to protect the local species by protecting their habitats. The variety of habitat conditions in Republic of North Macedonia and Albania around Lakes Ohrid and Prespa may be suitable for dragonflies and their various activities (mating, oviposition, foraging, resting in places sheltered from predators), which enables a number of dragonfly species to coexist (Suh & Samways 2005). Some dragonfly species even prefer a particular plant species composition for laying eggs and shelter (Dijkstra & Lewington 2006), so the heterogeneous composition of swamp, reed, hydrophytic and floating vegetation provides opportunities for various dragonfly species to be well adapted to the local environment. The diversity of wetland habitats in the researched region provides conditions for the settlement of most of the important dragonfly species listed on the IUCN Red List (Riservato et al. 2009, Kalkman et al. 2010, 2018), the Bern Convention and the EU Habitat Directive (Council Directive 92/43/EEC) and related Directives. However, at the same time most of these wetlands lost their natural conditions. Wetlands are more and more degraded by drainage, intensive agricultural practices, pollution, construction, industry and tourism development and here like in other European countries their ability to harbour biological diversity decrease. For example, the old Struga swamp is totally degraded, resulting in the loss of Somatochlora flavomaculata in this area. The swamp Ralnik in Albania, close to the Republic of North Macedonia, is obviously threatened by overgrazing. The mountain rivers across the whole Balkan Peninsula including Republic of North Macedonia are more and more targeted for energy production (e.g. Freyhof 2012), which is a threat for the larval stages of Odonata (Reels et al. 2012).

CONCLUSION

During this survey, we recorded a total of 41 Odonata species. The data for Coenagrion scitulum is the first documented record for Albania. The national Odonata lists reach now 59 for Albania and 63 species for North
Macedonia. Most previous data for the region were rather old, thus the data presented here bring significant updates to the regional database, and should be used during the development of protection and management measures. However, the distribution patterns of odonatan fauna in both countries is still insufficiently known, also higher diversity is expected to be observed with more research. Further investigations are needed to understand and assess the local diversity, distribution and its population status. Monitoring of the locality Raec River in the Drenovo Gorge where *Cordulegaster insignis* was recorded is needed to confirm whether this micro-population managed to survive the destruction of the tufa seepage and the swampy area at the locality.

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НОВИ ЛОКАЛИТЕТИ ЗА НЕКЕ ЗНАЧАЈНЕ ВРСТЕ ODONATA У ЦЕНТРАЛНОЈ И ЈУГОЗАПАДНОЈ РЕПУБЛИЦИ СЕВЕРНОЈ МАКЕДОНИЈИ И У ПРЕКОГРАНИЧНОМ РЕГИОНУ ОХРИД – ПРЕСПА ИЗМЕЂУ СЕВЕРНЕ МАКЕДОНИЈЕ И АЛБАНИЈЕ

ДЕСПИНА ДИНОВА, ЖАН-ПЈЕР БУДО, КЛАУС-ЈИРГЕН КОНЦЕ, МАРИНА ВИЛЕНЦА, СОЊА ФЕРЕИРА, ЕРЛАНД РЕФЛИНГ НИЛСЕН, МИЛОШ ЈОВИЋ

РЕЗИМЕ

Подаци о 41 врсти Odonata са подручја централне и југозападне Републике Северне Македоније и из прекограничног региона Охрид – Преспа између Северне Македоније и Албаније сакупљени су током екскурзије организоване поводом другог Европског одонатолошког конгреса, у периоду од 6. до 13. јула 2012. године. Чињенице да су подаци из наведеног региона углавном стари и да је нарушање природних станишта узело маха биле су разлог за планирање нових теренских истраживања. Резултати обухватају веома важне информације о локалној дистрибуцији врста од међународног значаја. Присуство врста Gomphus schneiderii и Somatochlora flavomaculata у региону је потврђено док врста Leucorrhina pectoralis није поново регистровања. Врста Coenagrion scitulum је први пут регистровања на територији Албаније. Национални спискови врста сада обухватају 63 врсте у Републици Северној Македонији и 59 врста у Републици Албанији.