

## Report on Macedonia 2008 project - Odonata

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### Introduction

The project Macedonia 2008 was initiated to obtain an overview of the current situation of the dragonfly fauna in Macedonia. Macedonia here refers to the territory of a former federal unit of the SFR Yugoslavia, and not to whole Macedonia. The records collected during this project are to become part of the data base for an Atlas of Odonata of Europe coordinated by Vincent Kalkman (European Invertebrate Survey, The Netherlands). Similar to other countries in this region, the odonate fauna of Macedonia is underresearched. So far, the largest research interest was directed towards the large lakes in Macedonia (Ohrid, Dojran and Prespa Lakes) (Filevska, 1954; Karaman, 1981; Karaman, 1984-85, Peters & Hackethal, 1986), the parts of the country under great influence of Mediterranean climate (Adamović, 1990) and the area around the capital city, Skopje (Adamović, 1949; Karaman, 1969; Peters & Hackethal, 1986). Some of the goals of Macedonia 2008 were: i) to visit places that had not been previously studied, ii) to re-visit places that have significantly changed compared to previous research and iii) to visit localities that are characteristic for this region. Within 15 days in the field this could only be achieved in a preliminary way. The period from the end of May to the beginning of June had been chosen because both spring and summer species do occur, because there should be enough ground water, and the high summer temperatures characteristic for Macedonia are still relatively infrequent. The disadvantage is the higher likelihood of rain which indeed had been one of the biggest problems during this research. The unstable security situation and some technical problems have also obstructed the realization of some ideas and will be addressed at a later time.

The physical geography of the Former Yugoslav Republic of Macedonia, comprises five major regions: E Macedonia, W Macedonia, Povardarje (the area along the river Vardar), Mariovo and Pelagonia, each consisting of numerous subregions (Marković, 1980). E and W Macedonia mainly consist of mountains and valleys. Povardarje is a valley region along the river Vardar, Pelagonija is a



wide valley in the SW part of the country and Mariovo is a mountainous region in S Macedonia. Decreasing sea level of the Aegean Sea had divided the water surface and left its remains in valleys where they have become lakes. Water streams had cut their way in the rails between valleys and made a system which tributaries mostly run towards the Vardar river. The confluents of the river Crni Drim and Radika make the elements of the catchment of the Adriatic Sea while the rest of the water streams belong to catchment of the Vardar and Aegean Sea.

The climate of the S Povardarje and the Strumica basin is Aegean (a form of subtropic climate). High mountains are in the zone of alpine climate. The valleys on higher altitudes have, despite relatively low geographic latitude, moderate continental climate with significant temperature extremes. The Ohrid and Prespa valleys have climate which is under the great influence of the lakes situated there. The Povardarje is the driest part of Macedonia with prairie vegetation while some of its parts are dry and look much like deserts (e.g. the Ovče Polje field).

The large lakes of Macedonia are of tectonic origin, the lakes Ohrid, Prespa and Dojran. There are some glacier lakes in the mountains, too. The largest rivers of Macedonia are the Vardar, Strumica, Bregalnica, Treska, Crna Reka, Crni Drim and Radika.

### **Field work**

The research was done in the period from 29 May till 12 June 2008. During those 15 days in the field Odonata were collected and observed at 38 localities. Places that were very close but very different ecologically were considered as different localities) (Fig. 1).

### **Results and discussion**

The total number of recorded species was 34. Some species have been only observed but not captured.



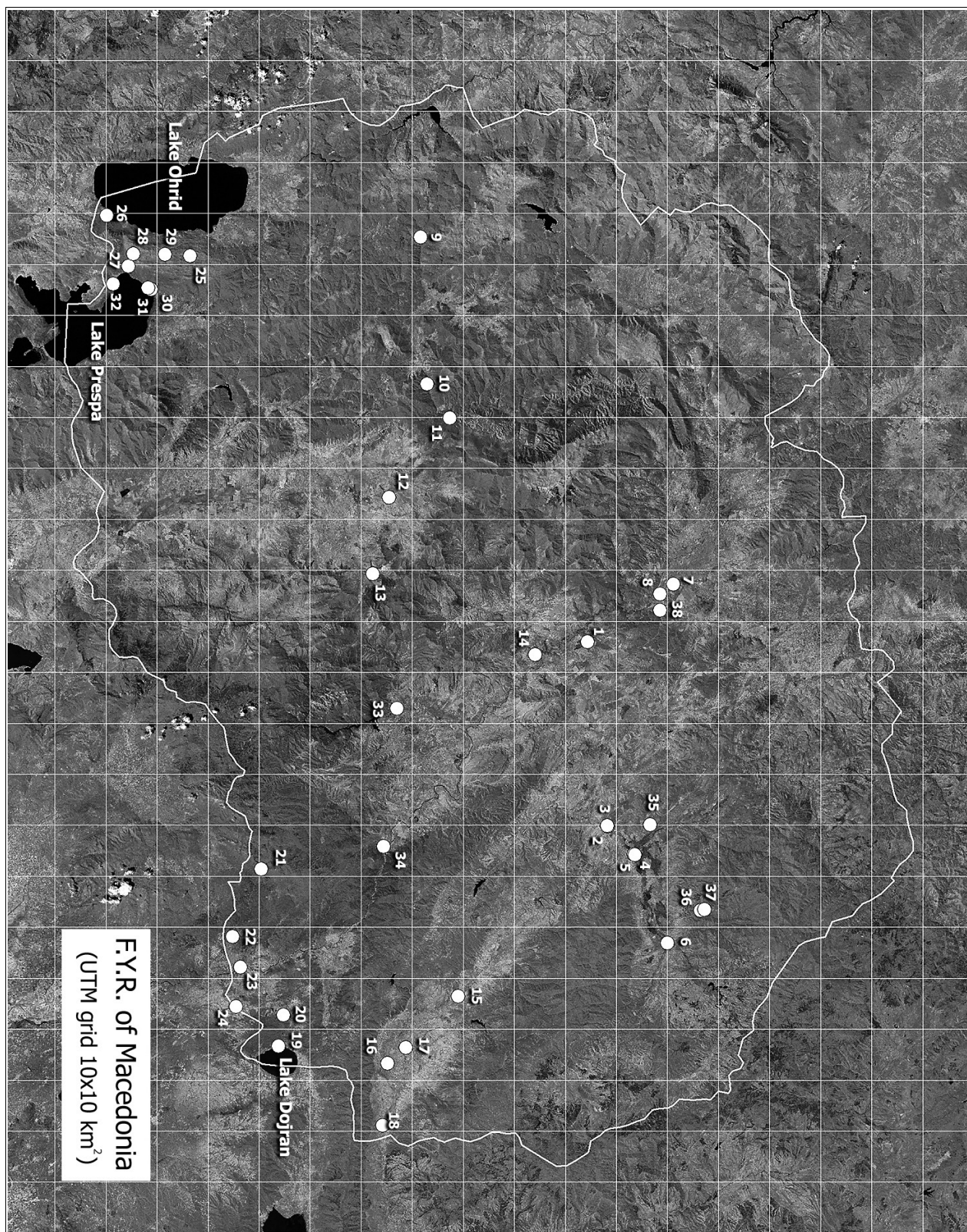


Fig. 1: Satellite image of the F.Y.R. of Macedonia with the positions of visited localities (for details see the text). The image was downloaded from the website <https://zulu.ssc.nasa.gov/mrsid>.



List of collected and observed species with ordinal numbers of locations on which they have been found. (see Fig. 1 and the following text):

1. *Calopteryx virgo* (Linnaeus, 1758): 10, 11, 12, 15;
2. *Calopteryx splendens* (Harris, 1782): 2, 5, 7, 14, 15, 17, 18, 20, 23, 33, 34, 38;
3. *Sympecma fusca* (Vander Linden, 1820): 4, 13, 35;
4. *Lestes virens* (Charpentier, 1825): 12;
5. *Lestes barbarus* (Fabricius, 1798): 12;
6. *Lestes dryas* Kirby, 1890: 12;
7. *Pyrrhosoma nymphula* (Sulzer, 1776): 9;
8. *Coenagrion puella* (Linnaeus, 1758): 8, 12, 25;
9. *Coenagrion pulchellum* (Vander Linden, 1825): 12;
10. *Coenagrion ornatum* (Selys, 1850): 7, 25;
11. *Coenagrion scitulum* (Rambur, 1842): 25, 35;
12. *Enallagma cyathigerum* (Charpentier, 1840): 25, 26, 27, 30, 32, 35;
13. *Erythromma viridulum* (Charpentier, 1840): 7, 8, 19;
14. *Erythromma lindenii* (Selys, 1840): 7, 22, 35;
15. *Ischnura elegans* (Vander Linden, 1820): 1, 4, 7, 8, 13, 14, 16, 18, 19, 23, 24, 25, 32;
16. *Ischnura pumilio* (Charpentier, 1825): 13, 25;
17. *Platycnemis pennipes* (Pallas, 1771): 2, 4, 6, 7, 8, 14, 15, 17, 18, 20, 21, 23, 33, 34, 35, 36, 37, 38;
18. *Aeshna isoceles* (Müller, 1767): 7, 16, 18;
19. *Anax imperator* Leach, 1815: 18, 24, 25, 33, 35;
20. *Anax parthenope* (Selys, 1839): 24;
21. *Anax ephippiger* (Burmeister, 1839): 4;
22. *Gomphus vulgatissimus* (Linnaeus, 1758): 2, 15, 32;
23. *Onychogomphus forcipatus* (Linnaeus, 1758): 5, 14, 15, 17, 18, 22, 23, 32, 33, 34;
24. *Ophiogomphus cecilia* (Fourcroy, 1785): 15, 23;
25. *Cordulegaster heros* Theischinger, 1979: 13;
26. *Libellula depressa* Linnaeus, 1758: 5, 6, 16, 25, 29, 33;
27. *Libellula fulva* Müller, 1764: 1, 7, 18;
28. *Orthetrum cancellatum* (Linnaeus, 1758): 7, 8, 24, 25, 28, 31, 32, 35, 36;
29. *Orthetrum albistylum* (Selys, 1848): 2, 5, 7, 14, 16, 18, 24;
30. *Orthetrum brunneum* (Fonscolombe, 1837): 2, 5, 18, 33, 34;
31. *Orthetrum coerulescens* (anceps) (Fabricius, 1798): 2, 3, 18;
32. *Crocothemis erythraea* (Brullé, 1832): 3, 8, 18, 24, 34;
33. *Sympetrum fonscolombii* (Selys, 1840): 4, 25, 26, 28, 32;
34. *Sympetrum sanguineum* (Müller, 1764): 12.



## List of localities

### Veles (central Macedonia)

#### 1. Lake Mladost, 41.76972222 N, 21.76969444 E

Lake shore, 29 May 2008. Lake Mladost is a relatively large artificial lake near the town of Veles. The lake shores are locally overgrown with reed. In addition to irrigation this lake is also used for recreation and fishing and so the level of disturbance of the wildlife is very high. Specimens of recorded species were mainly collected in wind-sheltered areas such as reed belts and a small slough with a stream running through it.

#### Recorded species:

- *Ischnura elegans*
- *Libellula fulva*

#### 14. The town of Veles, the River Babuna, 41.67694444 N, 21.79927778 E

River bank and main course, 4 June 2008. The River Babuna, on the locality that I have visited, flows out of the canyon and runs towards the town of Veles. The river course is quite wide and bottom is gritty. On the river bank, there are some trees and a lot of bushes. It is under significant anthropogenic influence because it is being used for recreation and fishing. The most numerous species were representatives of genera *Calopteryx*, *Platycnemis* and *Ischnura*.

#### Recorded species:

- *Calopteryx splendens*
- *Platycnemis pennipes*
- *Ischnura elegans*
- *Onychogomphus forcipatus*
- *Orthetrum albistylum*

### The River Bregalnica (NE Macedonia)

#### 2. The River Bregalnica: the village of Dolno Balvan, 41.80188889 N, 22.20538889 E

River bank, 30 May 2008. The River Bregalnica flows through the eastern part of Macedonia. The part I have visited flows through agricultural ecosystems. The river is shallow. The bottom is mostly rocky while the ground on the river banks



is sandy. There is no reed on the banks. On the spots that are used for exploitation of sand and grit, there are very small ponds around which *O. brunneum* and *O. coerulescens* fly.

**Recorded species:**

- *Calopteryx splendens*
- *Platycnemis pennipes*
- *Orthetrum albistylum*
- *Gomphus vulgatissimus* (only observed)

**3. The River Bregalnica: the village of Dolno Balvan, 41.80188889 N, 22.20538889 E**

Ponds in the sand, 30 May 2008.

**Recorded species:**

- *Crocothemis erythraea*
- *Orthetrum brunneum* (only observed)
- *Orthetrum coerulescens* (only observed)

**4. The village of Ularci, 41.84694444 N, 22.27227778 E**

Rice field (Fig. 2), 30 & 31 May 2008. In the region of SE Europe, Macedonia is known for its rice production. Numerous rice fields go along the valley of the river Bregalnica and its confluents: the Kočanska and Orizarska rivers. During my visit to these localities, the fields were under water. The dominating species was *Sympetrum fonscolombii*.



**Fig. 2: Rice field in the vicinity of the town of Kočani in E Macedonia.**



**Recorded species:**

- *Sympecma fusca*
- *Ischnura elegans*
- *Platycnemis pennipes* (teneral specimen)
- *Sympetrum fonscolombii* (copulation, oviposition)
- *Anax ephippiger* (only observed, tandem flight)

**5. The firth of the River Zletovska into the River Bregalnica, 41.84891667 N, 22.27369444 E**

River bank and main course, 30 & 31 May 2008. This locality is in the close vicinity of the previous one. The firth of the River Zletovska into the river Bregalnica is very shallow. Around rivers there are rice and other fields and a part of the river bank is overgrown with trees, too. The water is quite clear and cold. Along this stretch, the water potential of the river Zletovska is used for irrigation of adjacent rice fields so there is a certain circulation of water between these two types of ecosystems.

**Recorded species:**

- *Calopteryx splendens*
- *Orthetrum brunneum*
- *Onychogomphus forcipatus* (teneral specimen)
- *Orthetrum albistylum*
- *Libellula depressa* (only observed)

**6. The River Dragobraška, the village of Jakimovo, 41.90425 N, 22.48327778 E**

River bank, 30 May 2008. The River Dragobraška is not very large and it flows through the valley of the river Bregalnica. Near the village of Jakimovo, this river flows through a 'tunnel' made of trees on the river banks. The bottom of the river is rocky. Unfortunately, the riverbed is turned into a local garbage disposal so I didn't notice any Odonata. Along the river flow, there were rice fields with some dragonflies.

**Recorded species:**

- *Platycnemis pennipes*
- *Libellula depressa* (only observed)



## Skopje (Povardarje, N Macedonia)

### 7. The Canal Petrovec, the village of Ržaničano, 41.92197222 N, 21.63491667 E

Dense vegetation, overgrown canal, 2 June 2008 (Fig. 3). The Canal Petrovec is one of a few canals that flow through the plain which extends on the E and the SE of the capital of Macedonia, Skopje. The whole region represents a complex of fields with different crops. The east part of this plain used to be a wide swamp called Katlanovsko Blato. Today, there are only very small remnants of this swamp and those are canals and some wet areas overgrown with hydrophilous vegetation. Canal Petrovec is under significant anthropogenic influence. Where the canal widens, it is not entirely overgrown and there is some open water but with floating vegetation. The narrower part of the canal is completely overgrown. This is one of three locations where I have found *Coenagrion ornatum* and the location with the most diverse community of Odonata during my visit to Macedonia.



Fig. 3: Canal Petrovec, part of the canal with open water is situated some 50m from the narrow, overgrown part of the canal. Species that inhabit this place are rather clearly divided between the two 'types' of habitat.





**Recorded species:**

- *Calopteryx splendens*
- *Coenagrion ornatum*
- *Ischnura elegans* (copulation)
- *Platycnemis pennipes*
- *Libellula fulva*

Dense vegetation on the bank, free water, 2 June 2008.

- *Erythromma viridulum*
- *Erythromma lindenii*
- *Orthetrum cancellatum*
- *Orthetrum albistylum*
- *Aeshna isoceles* (only observed)

**8. Katlanovsko Blato, 41.89872222 N, 21.65788889 E**

The remnants of a swamp, meadows and canals, 2 June 2008.

**Recorded species:**

- *Coenagrion puella*
- *Erythromma viridulum*
- *Ischnura elegans*
- *Platycnemis pennipes*
- *Orthetrum cancellatum*
- *Crocothemis erythraea*

**Velika Reka (W Macedonia)****9. The village of Klenovec, 41.47752778 N, 20.81547222 E**

3 June 2008. In the village of Klenovec, there is a spring (Fig. 4) of one of the streams that all together make the Velika Reka river. The ground is plane but because of the cloudy weather and the storm in this region a few days before my visit I found only a small population of species *Pyrrhosoma nymphula* on this spring. The spring consists of five water squirts that run out of the retaining wall and fill the pool made of concrete walls while the bottom of the pool was made of different size rocks. Out from the pool gushes the canal on which banks grows a very dense vegetation made of the Common Butterbur plants (*Petasites hybridus*) that make the tunnel through which this canal flows on several places.



**Recorded species:**

- *Pyrrhosoma nymphula*



Fig. 4: One of the springs of the Velika Reka river. Bushes near the spring were used as shelters by specimens of *Pyrrhosoma nymphula*.

**10. The River Velika Reka, the village of Latovo, 41.48963889 N,  
21.16122222 E**

River bank, 3 June 2008. The River Velika Reka flows through the plain between hills and mountains in west Macedonia. The localities I visited were mostly in the shade of the trees along the river. The river is relatively fast with rocky bottom. These groves represent the home of the species *Calopteryx virgo*. It turned out that this was the only species I found on these river banks (this refers also to the loc. 11).

**Recorded species:**

- *Calopteryx virgo* (teneral & adults)

**11. The River Velika reka, the village of Suvodol, 41.52877778 N, 21.24125 E**

The river bank, 3 June 2008.

**Recorded species:**

- *Calopteryx virgo*



## The town of Prilep (Pelagonia)

### 12. The field of Prilep, the village of Belo Pole, 41.42105556 N, 21.42716667 E

Irrigation canal, 3 June 2008. The field of Prilep is a wide field on the east side of the town of Prilep. This plain is used for growing different crop plants. The shores are overgrown with reed which locally overgrows the canal itself and the water is dark and certainly eutrophic. The characteristic of this locality is a very numerous population of species *Coenagrion pulchellum* and species of genus *Lestes*, as well.

Recorded species:

- *Lestes virens* (teneral specimen)
- *Lestes barbarus* (tenerals & adults)
- *Lestes dryas*
- *Coenagrion puella*
- *Coenagrion pulchellum*
- *Sympetrum sanguineum* (teneral specimen)

### 13. Lake Prilepsko, 41.39155556 N, 21.60533333 E

Lake shore, 3 June 2008. The Lake of Prilep is an artificial lake which is placed on the hill above the town of Prilep, in central Macedonia. One of the two long shores has a gentle slope and is overgrown with grasses. The other one is steep. I collected the material on both shores, including a small stream that flows into the lake. The shore of this stream with gritty bottom is the only place where I found exuviae of *Cordulegaster heros*. The stream flows through the remnants of some kind of a forest and the vegetation on the shore is pretty dense and composed of herbaceous plants. The lake is probably used for irrigation of arable land in the vicinity of Prilep, as well as for fishing and recreation by local residents. The meadows around the lake are also used for pasture.

Recorded species:

- *Calopteryx virgo*
- *Sympecma fusca*
- *Ischnura elegans*
- *Ischnura pumilio*
- *Cordulegaster heros* (exuviae)



## The valley of Strumica (SE Macedonia)

### 15. The River Strumica, the village of Vladevci, 41.53333333 N, 22.60027778 E

River bank, 6 June 2008. The River Strumica is one of the largest rivers in Macedonia. It flows from the mountain Plačkovica towards SE and from the town of Strumica to the East and the Bulgarian border. In Macedonia, this river mostly flows through the valley. Adamović (1990) was doing research on Odonata in this region. The most of this valley has been turned into agricultural areas, so the river flows between plains and parcels with crops and is under significant anthropogenic influence. In the village of Vladevci, on the river bank, there are alleys, so the greatest part of the water surface is in the shadow. The river is muddy. The Odonata specimens gather on the wicker fences nearby and fly over the plains. There, I also observed a single specimen of the species *O. cecilia*, which had, because of the strong wind, landed on a dry lump of dirt in one of the plains.

#### Recorded species:

- *Calopteryx virgo*
- *Calopteryx splendens*
- *Platycnemis pennipes*
- *Gomphus vulgatissimus*
- *Onychogomphus forcipatus*
- *Ophiogomphus cecilia* (only observed)

### 16. The valley of Strumica, the village of Monospitovo, 41.40625 N, 22.75494444 E

Irrigation canal, 6 and 7 June 2008. In the vicinity of the village of Monospitovo, there are remains of an old swamp called Monospitovsko Blato. This swamp used to be below the mountain Belasica which abruptly rises above the valley of Strumička. The only things that is left of the swamp are some irrigation canals and a wide area overgrown with reed with no ground water. Brown, eutrophic water covered with duckweed, flows through those canals. The shores are locally overgrown with reed, but Odonata were rather rare here (both in terms of abundance and diversity).

#### Recorded species:

- *Ischnura elegans*
- *Aeshna isoceles* (only observed)
- *Libellula depressa*
- *Orthetrum albistylum*



**17. The River Strumica, the village of Robovo, 41.43925 N, 22.71852778 E**

River bank, 6 June 2008. In the village of Robovo, the River Strumica is relatively wide with dikes on its shores. Between the riverbed and dikes dense hydrophilous vegetation grows, including reed. This is a habitat of a very numerous population of *Platycnemis pennipes*.

Recorded species:

- *Calopteryx splendens*
- *Platycnemis pennipes*
- *Onychogomphus forcipatus*

**18. The River Strumica, the village of Smolare, 41.39538889 N, 22.90013889 E**

River bank, 7 June 2008. This part of the River Strumica represents a very complex system of habitats. The dike that protects the road and arable fields from effusion of the river is densely grown with herbs, towards the river with bushes and trees. At the river bank reed alternates with open areas and a small tributary. Despite cloudy weather conditions there were many Odonata species. This diversity was most likely caused by the diversity of habitats river, stream, puddles, floating vegetation (water knotweed and duckweed), reed, gritty shore, herbaceous plants as well as shaded and open areas.

Recorded species:

- *Calopteryx splendens*
- *Ischnura elegans*
- *Platycnemis pennipes*
- *Anax imperator*
- *Aeshna isoceles* (only observed)
- *Onychogomphus forcipatus*
- *Libellula fulva*
- *Orthetrum albistylum*
- *Orthetrum brunneum*
- *Orthetrum coerulescens anceps* (teneral & adults)
- *Crocothemis erythraea* (teneral specimen)



**Kožuf, Gevgelija & Dojran (SE Macedonia)****19. Lake Dojran, the village of Nov Dojran, 41.2145 N, 22.70908333 E**

Lake shore, 7 June 2008. Lake Dojran is the third largest natural lake in Macedonia. It is situated in the valley between mountains Belasica and Kruša. The lake is shallow and represents a remnant of a much bigger and deeper lake. It is under strong anthropogenic influence because of the fishing tradition and the developing tourism. All the specimens I collected had been hidden in bushes behind a pebbled beach because of the cold and rainy weather.

Recorded species:

- *Erythromma viridulum*
- *Ischnura elegans*

**20. The River Stara reka, the village of Bolovan, 41.22391667 N, 22.63655556 E**

River bank, 7 June 2008. Near the village of Bolovan the River Stara reka flows through the dense forest. The river is relatively shallow and a very dense cover of fern sporadically grows on its bank. The habitat is very dark. I collected the specimens of *C. splendens* and *P. pennipes* on the edge of the forest.

Recorded species:

- *Calopteryx splendens*
- *Platycnemis pennipes*

**21. Mt. Kožuf, The River Konjska Reka, the village of Smrdliva Voda, 41.18972222 N, 22.29466667 E**

Fig. 5: *Konjska Reka* river, on Mt. Kožuf, near the village of Smrdliva Voda.



River bank, 8 June 2008. The River Konjska Reka runs westwards from mountain Kožuf towards the river Vardar near the town of Gevgelija. The village of Smrdлива Voda (“stinky water”) is a spa with sulphuric water. The upper course of the river Konjska Reka runs through a forest. The river banks and bed are rocky. On this location the stream is not wide enough to be a river (Fig. 5).

Recorded species:

- *Platycnemis pennipes*

22. The River Konjska Reka, the village of Mojin, 41.13741667 N, 22.45183333 E

River bank, 8 June 2008. This part of the River Konjska Reka has significantly different characteristics compared to the previous locality: the river is wider, the riverbed consists of pebbles, stones, and rocks and there are few bushes only. The pollution is very high and a part of the course is turned into a garbage dump.

Recorded species:

- *Onychogomphus forcipatus* (teneral specimen)

23. The town of Gevgelija, The River Vardar, 41.14969444 N, 22.52291667 E

River banks, 8 June 2008. The River Vardar is the largest river in Macedonia. Flowing from the NW to the SE, it divides Macedonia on two halves. In the vicinity of Gevgelija, this long and wide river runs through the plain which lays between the sides of mountain Kožuf on the West and Belasica on the East. There is a spot where a highway viaduct passes the river. In that part, the bottom of the river is gritty just as the banks and it is evident that grit exploitation is being done. There are some plains nearby and the west shore is overgrown with high bushes and trees. On the bushes, I found a very young specimen of *O. cecilia*.

Recorded species:

- *Calopteryx splendens*
- *Platycnemis pennipes*
- *Onychogomphus forcipatus*
- *Ophiogomphus cecilia* (teneral specimen)
- *Erythromma lindenii*
- *Ischnura elegans*



## 24. The village of Stojakovo, 41.14091667 N, 22.61452778 E

Fishpond, 8 June 2008. This man-made pond is placed between plains in a very dry area. In some parts of the shore there is a well-developed belt of reed and sedges. However, in the water, close to the shore, there are, locally, very numerous plants of some kind of water knotweed. In one part, the coastline is ribbed with numerous miniature gulfs which extend into the plains and parcels with crops. These bays represent shelters for *Ischnura elegans* and the *Orthetrum* species.

### Recorded species:

- *Ischnura elegans*
- *Orthetrum cancellatum*
- *Orthetrum albistylum*
- *Crocothemis erythraea*
- *Anax imperator* (only observed)
- *Anax parthenope* (only observed)

## Mt. Galičica, Lakes Ohrid & Prespa (SW Macedonia)

### 25. Mt. Galičica, the pond Džafa, 41.07102778 N, 20.86052778 E

Artificial pond (Fig. 6), 10 June 2008. The pond Džafa is man-made as a watering place for cattle. The pond's edges are fenced with rocks. The pond's dimensions are 50 x 30 m. The water is shallow and the bottom is gritty, in combination with the red soil. There is no vegetation in the water, while the surrounding



Fig. 6: The Džafa pond on Mt. Galičica, one of the places with the richest diversity of Odonata, probably thanks to its isolated position in a landscape with very few freshwater habitats.





vegetation is made of herbaceous plants. Although it is quite isolated and placed on a high altitude (approx. 1470 m), the pond harbours a rich Odonata fauna. Mt. Galičica is a dry mountain with almost no ground water. Few ponds are scattered throughout the small plateaus. The altitudinal distance between ponds on Mt. Galičica (1450 m a.sl.) to the valleys of Lakes Ohrid and Prespa (about 700 and 800 m, respectively) suggest that the damselflies developed on Mt. Galičica rather than being vagrants from Lakes Ohrid and Prespa. Three out of six *Zygoptera* species were only found at a few other places in Macedonia (*C. scitulum*, *C. ornatum* and *I. pumilio*).

Recorded species:

- *Coenagrion puella*
- *Coenagrion ornatum*
- *Coenagrion scitulum*
- *Ischnura elegans*
- *Ischnura pumilio*
- *Enallagma cyathigerum*
- *Anax imperator* (only observed)
- *Libellula depressa* (teneral specimen)
- *Orthetrum cancellatum* (exuvia, adults, copula)
- *Sympetrum fonscolombii*

26. Lake Ohrid, the village of Ljubaništa, 40.92402778 N, 20.76733333 E

Lake shore, auto camp, 10 June 2008, SE coast of the lake. One of the few places where the tarmac road does not lead directly along the coastline. This bay continues into a relatively narrow plain which extends to the border with the Republic of Albania. This area mostly consists of agro-ecosystems. Under the sides of mountain Galičica, there's an auto camp and a gritty beach. Behind the beach I found a quite numerous population of species *E. cyathigerum*.

Recorded species:

- *Enallagma cyathigerum*
- *Sympetrum fonscolombii*

27. Mt. Galičica, 40.9625 N, 20.88502778 E

11 June 2008, small rain puddle in the gap beside the tarmac road that goes through the forest.

Recorded species:

- *Enallagma cyathigerum*



**28. Mt. Galičica, 40.97102778 N, 20.85616667 E**

11 June 2008. Tarmac road that leads from the foot of the mountain, beside Lake Prespa, to the plateau Asan Gjura. On some spots along the road I noticed single specimens of *O. cancellatum* that would descend to the road from time to time. Similar behaviour of this species, I have noticed around the tarmac roads in Adriatic Montenegro, too.

Recorded species:

- *Orthetrum cancellatum*

**29. Mt. Galičica, pond Asan Gjura, 41.02702778 N, 20.85761111 E**

11 June 2008. Small pond (Fig. 7) fed by rain. Its maximum diameter estimated from the width of the zone of dried mud surrounding the pond is ca. 30 m. The pond has an almost regular round shape and is almost completely covered with water crowfoot. Here, I saw only few dragonflies. A single specimen of *Libellula depressa* was relentlessly flying above the water surface.

Recorded species:

- *Libellula depressa* (teneral specimen)
- *Sympetrum fonscolombii*



Fig. 7: The Asan Gjura pond on Mt. Galičica.



**30. Lake Prespa, 41.00225 N, 20.93947222 E**

Lake shore, meadows, 11 June 2008. Lake Prespa is placed in the valley which is edged by mountain Galičica on its west side. The NW part of the shore is flat but toward the south the shore is closer to the mountain sides and becomes more flat and consists of flood meadows.

**Recorded species:**

- *Enallagma cyathigerum* (copulation)

**31. Lake Prespa, 40.99772222 N, 20.93511111 E**

Lake shore, reed belt, 11 June 2008. The reed belt on the lake shore is divided by small beaches used for landing of boats. Behind the reed belt there are grasses and bushes. The most common Odonata species on the coast of Lake Prespa, just like in the rest of the region, was *Enallagma cyathigerum*.

**Recorded species:**

- *Enallagma cyathigerum*
- *Orthetrum cancellatum*

**32. Lake Prespa, the village of Stenje, 40.93563889 N, 20.92619444 E**

Lake shore, beach, 11 June 2008. In the close vicinity of the village there used to be a swamp called Stenjsko Blato but today this ecosystem is almost vanished and is hard to detect even when passing by closely. Beside grit, the beach is locally consisted of remnants of lake shells, and that is the reason why some parts of the beach appear entirely white. The weather was windy.

**Recorded species:**

- *Ischnura elegans*
- *Enallagma cyathigerum* (teneral & adults)
- *Gomphus vulgatissimus*
- *Onychogomphus forcipatus*
- *Orthetrum cancellatum* (copulation)
- *Sympetrum fonscolombii*



**33. The River Crna reka, the village of Vozarci, 41.43258333 N,  
21.92166667 E**

River bank, 12 June 2008. This part of the river flows through the plateau which is dominated by agro-ecosystems. The river is relatively wide and shallow, the bed consists of pebbles and rocks with only scarce trees. At one location, a small tributary produces a few small cascades. The whole area is under great anthropogenic influence because of agricultural development, busy roads and garbage disposals on the river bank.

**Recorded species:**

- *Calopteryx splendens*
- *Platycnemis pennipes*
- *Anax imperator* (photographed by Zoran Nikolov)
- *Onychogomphus forcipatus*
- *Libellula depressa* (photographed by Zoran Nikolov)
- *Orthetrum brunneum*

**34. The town of Demir Kapija, the River Bošava, 41.40586111 N,  
22.24602778 E**

River bank, 12 June 2008. This place is known for its dry climate and high summer temperatures. I collected Odonata along the river bank that is probably used for grit exploitation. Some water lingers in the shallow sloughs. These puddles are populated by *Orthetrum brunneum*.

**Recorded species:**

- *Calopteryx splendens*
- *Platycnemis pennipes*
- *Onychogomphus forcipatus*
- *Orthetrum brunneum* (oviposition)
- *Crocothemis erythraea*

**Osogovija (NE Macedonia)**

**35. Lake Pišica, 41.876397 N, 22.203349 E**

Lake shore (Fig. 8), 31 May 2008. Artificial lake in the valley between hills. The vegetation on the slopes of the surrounding hills is probably degraded by pasture of cattle. There is no water vegetation in the lake. Submerged terrestrial



plants form shore vegetation where numerous Zygoptera were found.



**Fig. 8:** Lake Pišica in E Macedonia, almost without any vegetation. In spite of that, a number of *C. scitulum* copulas were observed there.

**Recorded species:**

- *Sympecma fusca*
- *Coenagrion scitulum* (copulation)
- *Erythromma lindenii* (copulation)
- *Enallagma cyathigerum*
- *Platycnemis pennipes*
- *Anax imperator* (adults only observed, exuviae collected by Despina Kitanova)
- *Orthetrum cancellatum* (oviposition)

**36. Lake Kočansko, 41.963392 N, 22.407847 E**

Lake shore, 1 June 2008. Artificial lake near the town of Kočani. This lengthened and serpentine water body is used for tourism, recreation and irrigation. The shore is under great anthropogenic influence because of the beach and other touristic offers of the hotel at the shore. The opposite shore descends steeply into the lake and research is impossible without boat. At certain time of day, both lake shores are in the shadow of trees that grow on the shore. Some unidentified Aeshnidae were observed.

**Recorded species:**

- *Platycnemis pennipes*
- *Orthetrum cancellatum*



### 37. The River Kočanska Reka, 41.970283 N, 22.405559 E

Dam, 1 June 2008. Rocky sides of the Osogovske Mountains relatively abruptly descending to the valley of the River Bregalnica. The rocks are grown with xerophilous vegetation and the number of water courses is relatively small. There is a dam on the river Kočanska Reka making a waterfall. Below the waterfall the river becomes wider and slower. Trees and bushes grow densely by the bank. The water was brown, probably because of the heavy rain from the past few days. The only species I managed to record was *P. pennipes* but other species are most likely to be found such *Calopteryx*.

Recorded species:

- *Platycnemis pennipes*

### Pčinja (NE Macedonia)

### 38. The River Pčinja, the village of Katlanovska Banja, 41.8983 N, 21.6969 E

Spa, 2 June, 2008. The River Pčinja sources in Serbia and flows from the N to Macedonia. Here the river is relatively fast and runs out of the canyon. The bottom of the river is rocky and locally there is well-developed sedge belt on the river bank. Downstream from Katlanovska Banja, the river goes into the plain. Vegetation is mostly xerophilous which indicates a relatively dry climate.

Recorded species:

- *Calopteryx splendens*
- *Platycnemis pennipes*

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## References

- Adamović, Ž. 1949. La liste des Odonates du Muséum d'Histoire Naturelle du Pays Serbe. *Bulletin du Muséum d'Histoire Naturelle du Pays Serbe*, B(1/2): 275-293. [in Serbian with French title and summary]
- Adamović, Ž. 1990. Odonata collected in Strumička Kotlina, Macedonia, Yugoslavia. *Bulletin of the Natural History Museum in Belgrade*, B(45): 47-59.
- Filevska, A. 1954. Odonata der Umgebung des Ohridsees. *Fragmenta balcanica Musei macedonici scientiarum naturalium*, 1(9): 79-91. [in Macedonian with German title and summary]
- Karaman, B. 1969. Contribution a la connaissance de la faune des Odonates en Macedoine. *Fragmenta balcanica Musei macedonici scientiarum naturalium*, 7[11(169)]: 93-102.
- Karaman, B. 1981. Contribution a la connaissance de la faune des Odonates du lac de Doiran. *Ann. Fac. Biol. Univ. Skopje*, 34: 215-222.
- Karaman, B. 1984-85. Les Odonates du lac de Prespa (Macedoine, Yougoslavie) I partie: La composition qualitative et l'analyse zoogeographique de la faune. *Ann. Fac. Sci. Nat., Biol., Skopje*, 37/38: 98-110.
- Marković, J. 1980. Regionalna geografija SFR Jugoslavije. *Građevinska knjiga, Beograd*. [in Serbian]
- Peters, G. & Hackethal, H. 1986. Notizen über die Libellen (Odonata) in Mazedonien. *Acta musei macedonici scientiarum naturalium*, 18(5/151): 125-158.

