

THE RIVER ZRMANJA – ANOTHER HOTSPOT OF DRAGONFLY DIVERSITY IN THE DINARIC KARST, CROATIA

Ana Štih¹, Toni Koren¹, Adrijana Bobinec², Marija Matejčić³
& Matija Franković⁴

¹Croatian Herpetological Society – Hyla, Lipovac I n. 7, 10 000 Zagreb, Croatia,
e-mail: ana.stih2@gmail.com

²Primevigilance Ltd., Oreškovićeva 20a, Zagreb

³Planck Institute of Molecular Cell Biology and Genetics, Pfortenhauerstrasse 108,
01307 Dresden, Germany

⁴State Institute for Nature Protection, Radnička cesta 80/7, 10 000 Zagreb, Croatia

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The Zrmanja is one of the largest rivers in Dalmatia, along with the rivers Krka and Cetina. At the same time it is one of the least surveyed larger rivers in the region, with only a few published records about its dragonfly fauna so far. Between 1984 and 2010 the authors collected data about the dragonflies around the river Zrmanja and its surroundings. Altogether 29 species were recorded at 17 localities. Of those, 12 species were recorded for the first time for the region. The most valuable record is that of *Coenagrion ornatum*, a local and rare Natura 2000 species. With the overview of the data from museum collections, private field data, published data and data collected during this survey the number of species known from the Zrmanja river increases to 31, making this river one of the best studied areas in Croatia. However, this is probably not the final number of species and new records are to be expected with further research.

Zrmanja, Krupa, dragonflies, distribution, Natura 2000, *Coenagrion ornatum*

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Uz Krku i Cetinu, Zrmanja je jedna od najvećih rijeka Dalmacije. Unatoč tome, fauna vretenaca rijeke Zrmanje prilično je neistražena, sa svega nekoliko publiciranih podataka o fauni vretenaca do sada. U periodu od 1984. do 2010. autori su prikupljali podatke o fauni vretenaca rijeke Zrmanje i njezine okolice. Ukupno je zabilježeno 29 vrsta na 17 lokaliteta, od čega je 12 vrsta po prvi put zabilježeno u okolini rijeke Zrmanje. Najznačajniji je nalaz rijetke i lokalne Natura 2000 vrste *Coenagrion ornatum*. Pregledom muzejskih zbirki, privatnih i publiciranih podataka te podataka prikupljenih ovim istraživanjem, broj vrsta

za rijeku Zrmanju i njezinu okolicu porastao je na 31, čime je postala jednom od najbolje istraženih rijeka. Međutim navedeni broj vrsta najvjerojatnije nije konačan te se daljnjim istraživanjima očekuje njihov porast.

Zrmanja, Krupa, vretenca, rasprostranjenost, Natura 2000, *Coenagrion ornatum*

Introduction

Croatia, compared to its relatively small land area of 56 542 km² (Jelić & Klarić, 1995), has a rich dragonfly fauna of about 71 recorded species (Franković & Bogdanović, 2009; Finkenzyler, 2010), which represents 59.16 % of the 120 dragonfly species that inhabit Europe (Dijkstra & Lewington, 2006). Still, most parts of the country remain poorly explored, with only a handful of papers about the dragonfly fauna published in the last few decades (e. g. Franković, 1995; Perović & Perović, 2006; Bogdanović et al., 2008; Bobinec & Matejčić, 2010; Štih et al., 2011; Vilenica et al., 2011; Vilenica & Dijkstra, 2014). The most comprehensive data about the dragonfly fauna of Croatia can be found in the Red Book of Dragonflies, in which the status and distribution of most species in Croatia were presented and discussed (Belančić et al., 2008). Still, even with all the known data, the gaps in knowledge remain huge, which makes it impossible for decision makers to use the data in the protection and management of important areas. The Zrmanja River is one of the biggest rivers in Croatia belonging to the Adriatic Sea drainage area. Along with the Cetina and Krka, it is one of the most important rivers in the area of central Dalmatia. The data about the dragonfly fauna of the surroundings of the Zrmanja are relatively scarce, and can be found in only two published papers (Dumont, 1977; Franković, 1998) and one MSc thesis work (Pongrac, 2000). The first data about the dragonfly fauna of the area were collected in the second half of the 20th century, which is relatively late in comparison with other regions of Croatia (Belančić et al., 2008). Dumont (1977) was the first entomologist who visited the spring of the Zrmanja during his trips in ex-Yugoslavia and reported eight species of dragonflies. Some 20 years later, Franković (1998) recorded 11 additional species for the region. No additional records exist from the region, which initiated the need for additional systematic surveys.

The aim of this paper is:

- to present old unpublished and newly collected records for the area and
- to create the first list of dragonflies for the Zrmanja River and its surroundings.

Materials and Methods

Study Area

The Zrmanja is a karstic river situated on the border of two major regions – Lika and Dalmatia. With its length of about 69 kilometers, it is one of the longest rivers in Croatia. The area of the river's spring is a meeting point of two great mountain



Figure 1. Typical appearance of the Zrmanja River in its canyon.

massifs' edges – Velebit and Dinara. The river's spring is located near the village Zrmanja Vrelo, just below Nadvrelo, situated on the edges of eastern Velebit. From the spring it flows southwards for about 20 kilometers through a long, narrow valley and a 200 m deep canyon (Pelivan, 2003) (Fig. 1).

At Mokro polje the Zrmanja disappears beneath the ground for the following 20 km. Just above the settlement of Kaštel Žegarski the river is fed with the water from two smaller springheads. From this location onwards it again starts to flow above ground all the way to its estuary at Novigradsko more (Matoničkin & Pavlečić, 1961). The river Zrmanja has two notable tributaries – the main one is the Krupa and the other, much smaller, the Dobarnica. The Krupa river flows into the Zrmanja just above the Veliki Buk waterfall, while the second tributary, Dobarnica, joins with the Zrmanja close to Berberov Buk waterfall. This part of the river is probably under the strongest anthropogenic influence, as it is dammed for the Velebit Pumped Storage Power Plant. Downstream of the city of Obrovac, the Zrmanja enters a gorge for the last time (Pelivan, 2003). The special ecological and climate conditions that exist along the gorges are the main reason why many rare and endemic plant species are present in this region (Pelivan, 2004). The average flow rate of the Zrmanja is 5.2 m³/s in its spring part near Palanka, and 40 m³/s in the lower part near Jankovića Buk, upstream from Obrovac. The river is brackish downstream of Jankovića Buk (Beran, 2011). The upper part of the river is under the influence of the continental climate, which becomes gradually replaced by the Mediterranean climate toward the estuary. Vegetation patterns follow the climate conditions, except at locations where the vegetation has been substantially modified by humans. This is why some areas lack natural forests which used to exist along the river. Nowa-

days, they are replaced by maquis and garrigue, thickets and stone grasslands. The geological structure of the surrounding mountains as well as that of the riverbed is composed of carbonate rocks (Pelivan, 2004).

Data Collection

In order to gain a more complete insight into the dragonflies of the Zrmanja and its surroundings, we used four sources of data: 1. data from published references, 2. data from museum collections, 3. unpublished data from private collections and field diaries collected sporadically in the period of 1984 through 1998, 4. data collected during the field survey in 2010.

Only a few references about the dragonfly fauna of Croatia contain data about dragonflies of the Zrmanja river and its surroundings: Dumont, 1977; Franković, 1998; Pongrac, 2000.

Two museums holding significant entomological collections from Croatia were visited, the Varaždin City Museum and the Croatian Natural History Museum (CNHM) in Zagreb. In the collections of the Varaždin City Museum we did not find any specimens collected in the vicinity of Zrmanja, while in the CNHM collections only one specimen originated from there.

Table 1. List of surveyed localities along the river Zrmanja and its surroundings.

No.	Location name	Gauß-Krüger, 5 th Zone	
		X	Y
1	village Perice, near Karinsko Ždrilo	5540504	4899169
2	Jasenice village, pond near the village	5546333	4898216
3	Jurice village, pond near the village	5551326	4893011
4	Kruševo village, near Obrovac	5551964	4892958
5	town of Obrovac, River Zrmanja	5554920	4895330
6	Berberov Buk, River Zrmanja	5561665	4894854
7	Dobarnica stream	5562069	4895788
8	Ogarov Buk, River Zrmanja	5563273	4894626
9	Golubić village, near Obrovac, River Krupa	5567984	4894076
10	Nadvoda village, near Kaštel Žegarski, River Zrmanja	5568827	4891149
11	Krupa village, at the end of Manastirska luka, near Krupa Monastery, tributary of the river Krupa	5570651	4894437
12	Jakovljević stan village, pond near the village	5571656	4888385
13	spring of the River Krupa	5573001	4895146
14	Romići village, pond near the village	5577491	4884694
15	Zrmanja village, village spring and Gradina water tank	5584496	4893975
16	Begovac village, pond near the village	5585544	4898461
17	Zrmanja Vrelo village	5585683	4895919

New field data about the dragonflies of the Zrmanja and its surroundings were collected between 1984 and 2010 on 17 study sites (Tab. 1, Fig.2.) Dragonflies were recorded at different localities, mostly around the rivers Zrmanja, Krupa, and their tributaries.

A smaller proportion of data was collected in the surrounding localities, including ponds, other water bodies and grasslands. The data before 2010 were collected unsystematically and sporadically, but between May and September 2010 we visited the Zrmanja on 4 occasions, with a total number of 13 field days.

Adult dragonflies were observed or caught using entomological nets, identified using the standard keys for the determination of dragonflies (Dijkstra & Lewington, 2006) and released afterwards. At some localities exuviae and larvae were also collected, stored in 70 % alcohol and identified in the lab using Askew (1988). The nomenclature follows Dijkstra & Lewington (2006).

To assess the similarities between the recently surveyed areas in Croatia (Neretva: Bogdanović et al., 2008; Međimurje: Perović & Perović, 2006; Turopolje: Vilenica et al., 2011; Krka: Bogdanović et al., 2013 and Banovina: Vilenica & Dijkstra, 2014) we performed hierarchical *clustering* based on Bray-Curtis *distances* in the program PAST (Hammer et al., 2001).

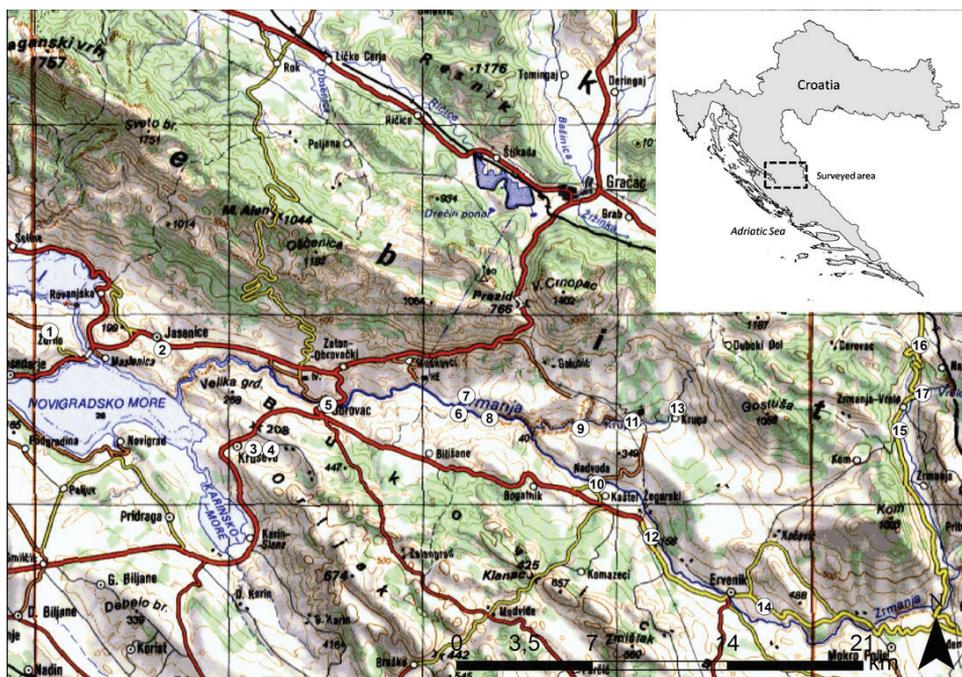


Figure 2. Map of the researched area and the location of the area in Croatia. Locality names are given in Table 1.

Results

During our survey we recorded 29 dragonfly species, of which 12 were recorded for the first time in the area: *Lestes barbarus* (Fabricius, 1798), *Sympecma fusca* (Vander Linden, 1820), *Ischnura pumilio* (Charpentier, 1825), *Coenagrion puella* (Linnaeus, 1758), *Coenagrion ornatum* (Selys, 1850), *Coenagrion scitulum* (Rambur, 1842), *Erythro-mma viridulum* (Charpentier, 1840), *Aeshna cyanea* (Müller, 1764), *Anax imperator* Leach, 1815, *Orthetrum albistylum* (Selys, 1848), *Sympetrum fonscolombii* (Selys, 1840), and *Sympetrum meridionale* (Selys, 1841). After checking of all the available data, the known number of dragonfly species for the River Zrmanja has increased to 31 (Appendix I). Two species that were mentioned in the literature for the region, *Aeshna isosceles* (Müller, 1767) and *Sympetrum sanguineum* (Müller, 1764), were not found during this survey. The recorded number of species represents 43.6 % of the total number of 71 dragonfly species listed for Croatia.

The most common species we recorded in the area were *Ischnura elegans* (Vander Linden, 1820) (seven localities), *Calopteryx virgo* (six localities), *Calopteryx splendens* (Harris 1782) and *Libellula depressa* Linnaeus, 1758 (five localities each). Ten species were recorded at only one locality, making them the rarest species in the area: *I. pumilio*, *Enallagma cyathigerum* (Charpentier, 1840), *C. ornatum*, *E. viridulum*, *Aeshna mixta* Latreille, 1805, *A. cyanea*, *O. albistylum* (Selys, 1848), *Orthetrum brunneum* (Fonscolombe, 1837), *Cordulegaster bidentata* Selys, 1843 and *Somatochlora meridionalis* Nielsen, 1935.

All known records of Odonata species along the Zrmanja River and its surroundings are listed below, with dates of their collection. Species newly recorded for the area are printed bold, while species not confirmed during this study are underlined.

ZYGOPTERA

Family CALOPTERYGIDAE

Calopteryx splendens (Harris, 1782)

Published records: Franković 1998; Pongrac 2000.

New records: 01.08.1984, Golubić village, near Obrovac, river Krupa; 04.08.1984, Golubić village, near Obrovac, river Krupa; 08.08.1984, Golubić village, near Obrovac, River Krupa; 09.07.1998, Golubić village, near Obrovac, River Krupa; 09.07.1998, 09.07.1998, Nadvoda village, near Kaštel Žegarski, river Zrmanja; 30.04.2010, Nadvoda village, near Kaštel Žegarski, River Zrmanja; 03.05.2010, Nadvoda village, near Kaštel Žegarski, River Zrmanja; 03.05.2010, Berberov Buk, River Zrmanja; 05.05.2010, Ogarov BBuk, River Zrmanja; 03.07.2010, Nadvoda village, near Kaštel Žegarski, River Zrmanja; 12.08.2010, spring of the River Krupa.

Calopteryx virgo (Linnaeus, 1758)

Published records: Dumont 1977; Franković 1998.

New records: 01.08.1984, Golubić village, near Obrovac, River Krupa; 03.08.1984, Golubić village, near Obrovac, River Krupa; 09.07.1998, Golubić village, near Obrovac, River Krupa; 30.04.2010, Nadvoda village, near Kaštel Žegarski, River Zrmanja; 02.05.2010, Krupa village, at the end of the Manastirska luka, near the Krupa Monastery, tributary of the River Krupa; 03.05.2010, Nadvoda village, near Kaštel Žegarski, River Zrmanja; 01.07.2010, Zrmanja village, village spring and Gradina water tank; 04.07.2010, Dobarnica Stream; 11.08.2010, Zrmanja village, village spring and Gradina water tank; 12.08.2010, Zrmanja village Vrelo.

Family LESTIDAE

Lestes barbarus (Fabricius, 1798)

New records: 03.07.2010, Jakovljević stan village, pond near the village; 04.07.2010, Jasenice village, pond near the village; 11.08.2010, village Begovac, pond near the village; 11.08.2010, Jakovljević stan village, pond near the village; 11.08.2010, Zrmanja village Vrelo; 12.08.2010, Jurice village, pond near the village.

Sympecma fusca (Vander Linden, 1820)

New records: 03.05.2010, Nadvoda village, near Kaštel Žegarski, River Zrmanja; 11.08.2010, Zrmanja village Vrelo.

Family COENAGRIONIDAE

Ischnura elegans (Vander Linden, 1820)

Published records: Dumont 1977; Franković 1998.

New records: 01.08.1989, town of Obrovac, River Zrmanja; 01.08.1989, Kruševo village, near Obrovac; 01.05.2010, village Begovac, pond near the village; 01.05.2010, Jakovljević stan village, pond near the village; 03.05.2010, Nadvoda village, near Kaštel Žegarski, Zrmanja river; 04.07.2010, Jasenice village, pond near the village; 12.08.2010, Jurice village, pond near the village.

Ischnura pumilio (Charpentier, 1825)

New records: 01.08.1989, Kruševo village, near Obrovac.

Enallagma cyathigerum (Charpentier, 1840)

Published records: Dumont 1977.

New records: 03.07.2010, Jakovljević stan village, pond near the village.

Coenagrion puella (Linnaeus, 1758)

New records: 03.05.2010, Nadvoda village, near Kaštel Žegarski, River Zrmanja; 04.07.2010, Jasenice village, pond near the village.

Coenagrion ornatum (Selys, 1850)

New records: 04.05.2010, Berberov Buk, River Zrmanja.

Coenagrion scitulum (Rambur, 1842)

New records: 01.08.1989, Kruševo village, near Obrovac; 03.07.2010, Jakovljević stan village, pond near the village; 04.07.2010, Jasenice village, pond near the village.

Erythromma viridulum (Charpentier, 1840)

New records: 01.08.1989, Kruševo village, near Obrovac.

Erythromma lindenii (Selys, 1840)

Published records: Dumont 1977.

New records: 01.08.1989, Kruševo village, near Obrovac; 04.05.2010, Berberov Buk, River Zrmanja.

Pyrrhosoma nymphula (Sulzer, 1776)

Published records: Franković 1998.

New records: 01.05.2010, Zrmanja village, village spring and Gradina water tank; 03.05.2010, Nadvoda village, near Kaštel Žegarski, River Zrmanja; 03.05.2010, Dobarnica stream; 03.05.2010, Berberov Buk, River Zrmanja.

Family PLATYCNEMIDIDAE

Platycnemis pennipes (Pallas, 1771)

Published records: Franković 1998.

New records: 09.07.1931, town of Obrovac, River Zrmanja; 01.08.1984, Golubić village, near Obrovac, River Krupa; 09.07.1998, Golubić village, near Obrovac, River Krupa; 03.05.2010, Nadvoda village, near Kaštel Žegarski, River Zrmanja; 05.05.2010, Ogarov Buk, River Zrmanja; 03.07.2010, Nadvoda village, near Kaštel Žegarski, River Zrmanja; 04.07.2010, Jasenice village, pond near the village.

ANISOPTERA

Family AESHNIDAE

Aeshna mixta Latreille, 1805

Published records: Franković 1998.

New records: 29.09.2010, Nadvoda village, near Kaštel Žegarski, River Zrmanja.

Aeshna cyanea (Müller, 1764)

New records: 02.05.2010, Krupa village, at the end of the Manastirska luka, near the Krupa Monastery, tributary of the River Krupa.

Aeshna isoceles (Müller, 1767)

Published records: Franković 1998.

Anax imperator Leach, 1815

New records: 01.08.1989, town of Obrovac, River Zrmanja; 01.08.1989, Kruševo village, near Obrovac; 03.07.2010, Nadvoda village, near Kaštel Žegarski, River Zrmanja; 04.07.2010, Jasenice village, pond near the village.

Family CORDULEGASTRIDAE

Cordulegaster bidentata Selys, 1843

Published records: Dumont 1977.

New records: 01.07.2010, Zrmanja village, village spring and Gradina water tank.

Family CORDULIIDAE

Somatochlora meridionalis Nielsen, 1935

Published records: Franković 1998.

New records: 02.05.2010, Krupa village, at the end of the Manastirska luka, near the Krupa Monastery, tributary of the River Krupa.

Family GOMPHIDAE

Gomphus vulgatissimus (Linnaeus, 1758)

Published records: Franković 1998.

New records: 09.07.1998, Golubić village, near Obrovac, River Krupa; 03.05.2010, Nadvoda village, near Kaštel Žegarski, River Zrmanja; 04.05.2010, Berberov Buk, River Zrmanja.

Onychogomphus forcipatus (Linnaeus, 1758)

Published records: Dumont 1977; Franković 1998.

New records: 01.08.1984, Golubić village, near Obrovac, River Krupa; 04.08.1984, Golubić village, near Obrovac, River Krupa; 09.07.1998, Golubić village, near Obrovac, River Krupa; 03.05.2010, Nadvoda village, near Kaštel Žegarski, River Zrmanja; 04.05.2010, Berberov Buk, River Zrmanja; 05.05.2010, Ogarov Buk, River Zrmanja; 11.08.2010, Nadvoda village, near Kaštel Žegarski, River Zrmanja.

Family LIBELLULIDAE

Libellula depressa Linnaeus, 1758

Published records: Dumont 1977; Franković 1998.

New records: 01.05.2010, village Begovac, pond near the village; 01.05.2010, Zrmanja village, village spring and Gradina water tank; 01.05.2010, Romići village, pond near the village; 03.07.2010, Jakovljević stan village, pond near the village; 04.07.2010, Jasenice village, pond near the village.

Libellula fulva Müller, 1764

Published records: Franković 1998.

New records: 01.08.1984, Golubić village, near Obrovac, River Krupa; 09.07.1998, Golubić village, near Obrovac, River Krupa; 03.05.2010, Nadvoda village, near Kaštel Žegarski, River Zrmanja; 12.08.2010, Jurice village, pond near the village.

Orthetrum albistylum (Selys, 1848)

New records: 04.05.2010, Berberov Buk, River Zrmanja.

Orthetrum coerulescens (Fabricius, 1798)

Published records: Franković 1998.

New records: 09.07.1998, Golubić village, near Obrovac, River Krupa; 09.07.1998, Nadvoda village, near Kaštel Žegarski, River Zrmanja; 01.07.2010, Zrmanja village, village spring and water tank Gradina; 03.07.2010, Nadvoda village, near Kaštel Žegarski, River Zrmanja; 04.07.2010, Dobarnica stream; 12.08.2010, Nadvoda village, near Kaštel Žegarski, River Zrmanja.

Orthetrum brunneum (Fonscolombe, 1837)

Published records: Dumont 1977; Franković 1998.

New records: 01.08.1989, Town of Obrovac, River Zrmanja.

Sympetrum fonscolombii (Selys, 1840)

New records: 01.05.2010, village Begovac, pond near the village; 04.07.2010, Jasenice village, pond near the village; 11.08.2010, village Begovac, pond near the village; 11.08.2010, Jakovljević stan village, pond near the village; 12.08.2010, Jurice village, pond near the village.

Sympetrum meridionale (Selys, 1841)

New records: 01.08.1989, Kruševo village, near Obrovac; 12.08.2010, Perice village, near Karinsko Ždrilo.

Sympetrum sanguineum (Müller, 1764)

Published records: Franković 1998.

Crocothemis erythraea (Brulle, 1832)

Published records: Franković 1998.

New records: 01.08.1989, Kruševo village, near Obrovac; 03.07.2010, Nadvoda village, near Kaštel Žegarski, River Zrmanja.

The clustering of the six regions showed clear separation between the three northern localities (Turopolje, Banovina and Međimurje) and three karstic rivers (Zrmanja, Krka, Neretva). Inside the karstic rivers, Zrmanja was clustered separately while Neretva and Krka were grouped together (Fig. 3).

from northern Croatia, where habitats of this species are more common, but even there the species is rare and local. The records from southern Croatia are very rare and sporadic, so this additional record fills the existing gap in its distribution in southern Dalmatia (Belančić et al., 2008).

The recorded number of 31 species is probably still not final. In comparison with the lower part of the River Neretva, where 48 dragonfly species have been recorded (Bogdanović et al., 2008), the Zrmanja is still insufficiently surveyed. On the other hand, the area of lower part of Neretva river contain many diverse wetland habitats, including river, streams, canals, different types of ponds as well as brackish habitats – many of which are not present around the River Zrmanja. With that in mind, it is probable that the final number of species will not be as high as in the River Neretva, but additional species may indeed be recorded in the future. To what extent the karstic rivers differ in the number of hitherto recorded species is evident in a comparison between the Cetina, where only 6 published records exist so far (Geelen & Oomen, 1965) and the Krka where 38 species have been recorded so far (Franković & Halapir, 1990; Bogdanović et al., 2013). Each of these rivers represents a hotspot of dragonfly diversity in the karstic Dalmatia region, and is very important in terms of dragonfly conservation.

Conclusions

The area around the Zrmanja is one of the few areas in Croatia, with the exception of the mountainous areas, which is still not under any strong anthropogenic influence. This is mostly due to the fact that the area was a war zone only 20 years ago, and some parts of the area are still infested with minefields. Almost no industries or larger cities are present in the area. Extensive livestock management is still present and presents an important source of income for the local people. This is especially beneficial for grasslands, as they remain open, and represent important habitats for grassland species, including dragonflies which feed on them. Another positive impact of livestock is the presence of the ponds, which are the only source of drinking water in the area, besides the rivers. Permanent ponds are very important habitats for larvae and adult dragonflies, and the survival of some species in the area is greatly dependent of them. The dragonfly fauna of the Zrmanja now counts 31 species, which makes it one of the best surveyed rivers in southern Croatia. As other Dalmatian rivers have higher numbers of recorded species (e.g. Krka and Neretva), new species records are to be expected here as well.

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Appendix I. Systematic list of all dragonfly species recorded for the area of the River Zrmanja and its surroundings.

Dodatak I. Popis svih vrsta vretenaca zabilježenih na području rijeke Zrmanje i okolice.

	Species	Dumont 1977	Franković 1998 ¹	Pongrac 2000 ²	CNHM ³	This survey ⁴	Belančić et al. 2008 ⁵
	Calopterygidae						
1.	<i>Calopteryx splendens</i> (Harris, 1782)		+	+		+	/
2.	<i>Calopteryx virgo</i> (Linnaeus, 1758)	+	+			+	/
	Lestidae						
3.	<i>Lestes barbarus</i> (Fabricius, 1798)*					+	NT
4.	<i>Sympecma fusca</i> (Vander Linden, 1820)*					+	/
	Coenagrionidae						
5.	<i>Ischnura elegans</i> (Vander Linden, 1820)	+	+			+	/
6.	<i>Ischnura pumilio</i> (Charpentier, 1825)*		+			+	/
7.	<i>Enallagma cyathigerum</i> (Charpentier, 1840)	+	+			+	/
8.	<i>Coenagrion puella</i> (Linnaeus, 1758)*					+	/
9.	<i>Coenagrion ornatum</i> (Selys, 1850)*					+	NT
10.	<i>Coenagrion scitulum</i> (Rambur, 1842)*		+			+	/
11.	<i>Erythromma viridulum</i> (Charpentier, 1840)*					+	/
12.	<i>Erythromma lindenii</i> (Selys, 1840)	+	+			+	/
13.	<i>Pyrrhosoma nymphula</i> (Sulzer, 1776)		+			+	/
	Platycnemididae						
14.	<i>Platycnemis pennipes</i> (Pallas, 1771)		+		+	+	/
	Aeshnidae						
15.	<i>Aeshna mixta</i> Latreille, 1805		+			+	/
16.	<i>Aeshna isocetes</i> (Müller, 1767)		+				NT
17.	<i>Aeshna cyanea</i> (Müller, 1764)*					+	/
18.	<i>Anax imperator</i> Leach, 1815*		+			+	/
	Cordulegastridae						
19.	<i>Cordulegaster bidentata</i> Selys, 1843	+	+			+	/
	Corduliidae						
20.	<i>Somatoclora meridionalis</i> Nielsen, 1935		+			+	/
	Gomphidae						
21.	<i>Gomphus vulgatissimus</i> (Linnaeus, 1758)		+			+	/
22.	<i>Onychogomphus forcipatus</i> (Linnaeus, 1758)	+	+			+	/
	Libellulidae						
23.	<i>Libellula depressa</i> Linnaeus, 1758	+	+			+	/
24.	<i>Libellula fulva</i> Müller, 1764		+			+	/
25.	<i>Orthetrum albistylum</i> (Selys, 1848)*					+	/

26.	<i>Orthetrum coerulescens</i> (Fabricius, 1798) ⁶		+			+	NT
27.	<i>Orthetrum brunneum</i> (Fonscolombe, 1837)	+	+			+	/
28.	<i>Sympetrum sanguineum</i> (Müller, 1764)		+				/
29.	<i>Sympetrum fonscolombii</i> (Selys, 1840)*					+	NT
30.	<i>Sympetrum meridionale</i> (Selys, 1841)*		+			+	NT
31.	<i>Crocothemis erythraea</i> (Brulle, 1832)		+			+	/

* Species recorded for the first time on the surveyed area

¹ Species recorded at the area of the River Krupa

² Species recorded in Golubić village, near Obrovac, River Krupa

³ Specimen from Croatian Natural History Museum found in 1931 in Obrovac

⁴ 1984-2010: Franković, personal communication and personal collection; Seidenbusch personal communication; field survey in 2010

⁵ Status in the Red Data Book of the Dragonflies of Croatia: NT – near threatened.

⁶ In the Croatian Red Book of Dragonflies (Belančić et al. 2008) the subspecies *Orthetrum coerulescens anceps* (Schneider, 1845) is raised to the level of species *Orthetrum ramburii* (Selys, 1848). It should be noted that in this work we consider *O. ramburii* as a subspecies of *O. coerulescens*.