

Contribution to the knowledge of Odonata from Vjosa catchment

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The Vjosa River in Albania carries pan-European and global significance. It represents one of the last intact large river systems in Europe, hosting many different types of ecosystems, from the narrow gorges in the upper part, to the wide, braided river sections in the middle part, to the near natural delta in the Adriatic Sea. These ecosystems include aquatic, semi-aquatic and semi-terrestrial habitats, and also include vital terrestrial foraging habitats near the river, in the still predominantly traditionally cultivated landscape. Imagines of Odonata act as ecosystem-connecting faunal elements – a fact which enhances their meaning as bioindicators. Very few studies for the area exist so far, but these few underscore the importance of the river valley as Albania's biodiversity hotspot, providing ideal aquatic habitats for numerous species. Here, we will discuss the Odonata species based on the analysis of existing research data and on the results of our expeditions to the Vjosa habitats during 2015–2017. In total, 22 Odonata species were found, 9 belonging to the Zygoptera and 13 to the Anisoptera. The species were recorded both as imagines and partly as exuviae. 10 species (*Pyrrhosoma nymphula*, *Ceriagrion tenellum*, *Coenagrion ornatum*, *Sympetrum fusca*, *Sympetrum fonscolombii*, *Sympetrum vulgatum*, *Sympetrum striolatum*, *Aeshna mixta*, *Crocothemis erythraea*, *Libellula quadrimaculata*) are reported for the first time in this area. Based also on data reported in the literature, the total checklist now increases to 28 species known for the Vjosa watershed so far; all 28 species belong to Annex II (IUCN, 2010); *Cordulegaster heros* is classified as NT (Near Threatened) according to the IUCN, the EU27 red list and the European red list, and as VU (Vulnerable) according to the Mediterranean red list. *Caliaeschna microstigma* and *Coenagrion ornatum* are classified as very rare and endangered at all current sites (according to Annex II they are considered strictly protected faunal elements, are listed as LC (Least Concern) according to the IUCN, but as NT according to the EU27 red list, European red list, and the Mediterranean red list). *Calopteryx splendens* is classified as VU according to Mediterranean red list and as LC according to the others.

The total number of species recorded for the Vjosa watershed is nearly half of the Odonata species found in Albania (70 species based on our data). The Vjosa floodplain system is therefore one of the richest ecosystems regarding Odonata of Albania and the Balkan region.

SHKËMBI E., GERKEN B., PEPÀ B., KIÇAJ H., MISJA K. & PAPARISTO A., 2018: Beitrag zur Kenntnis der Odonaten-Fauna des Vjosa Fluss-Systems.

Der Vjosa-Strom in Albanien hat eine pan-europäische und globale Bedeutung. Er bildet eines der letzten intakten großen Flusssysteme in Europa, in dem alle auentypischen Ökosysteme in durchweg sehr gutem ökologischen Zustand erhalten sind. Dies gilt für alle Abschnitte des Gewässersystems, und somit von den engen Schluchten im Oberlauf über die breiten verflochtenen Flussabschnitte des Mittellaufs bis zu seinem natürlichen Delta der Mündung in das Adriatische Meer. Bisher wurden diesem herausragenden Ökosystemkomplex nur wenige naturwissenschaftliche Studien gewidmet. Bereits diese wenigen Studien unterstreichen die Bedeutung die Bedeutung des Vjosa-Auensystems in Albanien als europaweit bedeutenden Hotspot der Biodiversität. Dieser bildet ideale aquatische, semi-aquatische und semi-terrestrische Lebensräume und bezieht terrestrische Lebensräume in der Nähe der Flüsse mit der noch überwiegend traditionell kultivierten Landschaft ein, der als natürlicher und notwendiger Komplex an Nahrungshabitat wirkt. Libellen fungieren als Ökosystem-verbindende Faunenelemente, was ihre Bedeutung als Bioindikatoren unterstreicht.

Im vorliegenden Beitrag dokumentieren wir den Bestand an Libellen (Insecta: Odonata), wie er aus der Analyse weniger, bereits existierender Forschungsdaten ermittelt, und durch die Ergebnisse unserer Expeditionen der Jahre 2015 bis 2017 erweitert werden konnte. Wir beschreiben den Nachweis von 22 Arten der Odonata, davon sind neun Arten Kleinlibellen (Zygoptera) und 13 Arten Großlibellen (Anisoptera). Die Nachweise liegen sowohl als Funde von Imagines als teilweise auch durch Exuvien vor. Zehn Arten (*Pyrrhosoma nymphula*, *Ceriagrion tenellum*, *Coenagrion ornatum*, *Sympetrum fusca*, *Sympetrum fonscolombii*, *Sympetrum vulgatum*, *Sympetrum striolatum*, *Aeschna mixta*, *Crocothemis saccharopolyspora*, *Libellula quadrimaculata*) werden zum ersten Mal für dieses Stromgebiet gemeldet. Unter Berücksichtigung aller Literatur-Daten werden für das Vjosa-System bisher 28 Arten gemeldet. Alle 28 Arten sind im Anhang II (IUCN, 2010) notiert. *Cordulegaster heros* stuften wir als gefährdet ein, und sie wird in der Roten Liste der IUCN (EU27), der Roten Liste der Libellen Europas für den Mittelmeerraum als vulnerable eingestuft. *Caliaeschna microstigma* und *Coenagrion ornatum* ist europaweit als sehr selten und vermutlich an allen Vorkommen gefährdet (zählt gemäß Anhang II zu den streng geschützten Faunenelementen, Least Concern, laut IUCN NT gem. Rote Liste EU27 sowie Rote Liste Europa und Rote-Liste-Mittelmeer). *Calopteryx splendens* wird gem. Rote Liste Mittelmeer als vulnerable eingestuft. Die Gesamtzahl der für das Vjosa-Auensystem nachgewiesenen Libellenarten beträgt fast die Hälfte der mit bisher 70 für ganz Albanien nachgewiesenen Arten. Das Vjosa-Auensystem ist somit eines der bezüglich Odonaten reichsten Ökosysteme Albaniens und des Balkan-Raumes.

Keywords: Odonata, Albania, Vjosa River, biodiversity, species number, State of vulnerability of species, Odonata Coenoses.

Introduction

The Odonata represent a well-known, widely distributed order of insects. Recently this order has gained the attention of entomologists around the world, not only for its position in biodiversity, but also as an important bioindicator of water quality (CORBET 1999). The Odonata include about 6000 known species worldwide (CORBET & BROOKS 2008), more specifically 5680 species (KALKMAN et al. 2008). About 143 species and subspecies are found in Europe, while 70 species have been identified in Albania based on publications and in our unpublished data (SHKËMBI et al. 2016, 2017).

The Odonata are a group of insects with incomplete metamorphosis, whose development is related to aquatic environments both in the larval stage and in the adult phase. They populate areas with slow flowing waters (BOUCHARD 2004). They need certain environmental parameters such as nutrients and oxygen, which deeply affect their existence and distribution. It is well known that their larvae are sensitive to water quality and waterfront morphology (CHINERY 2004). The effects of chemical pollution on macro-invertebrates (including Odonata) in aquatic systems have been reported by MATAGI (1996). The adults are responsive to habitat structure and are excellent indicators of river disturbance (SAMWAYS & STEYTLER 1996, STEWART & SAMWAYS 1998).

Vjosa is the largest river in southern Albania, with a watershed of 6700 km² (Fig. 1). Its source lies in the Pindus Mountains in Greece. The river valley expands when it enters Albania and occasionally forms numerous narrow gorges. The meandering lower part opens up into a valley with extensive wetlands. The high diversity of ecosystems in the Vjosa River affects the diversity of the order Odonata (QIRIAZI 2001). In Albania, Vjosa enters near Çarshova, passes the cities of Përmeti, Këlcyra, Tepelena, and Memaliaj, and flows into the Adriatic Sea northwest of the Vlora region. In Albania, the Vjosa is supplied by the tributaries Drino and Shushica (QIRIAZI 2001).

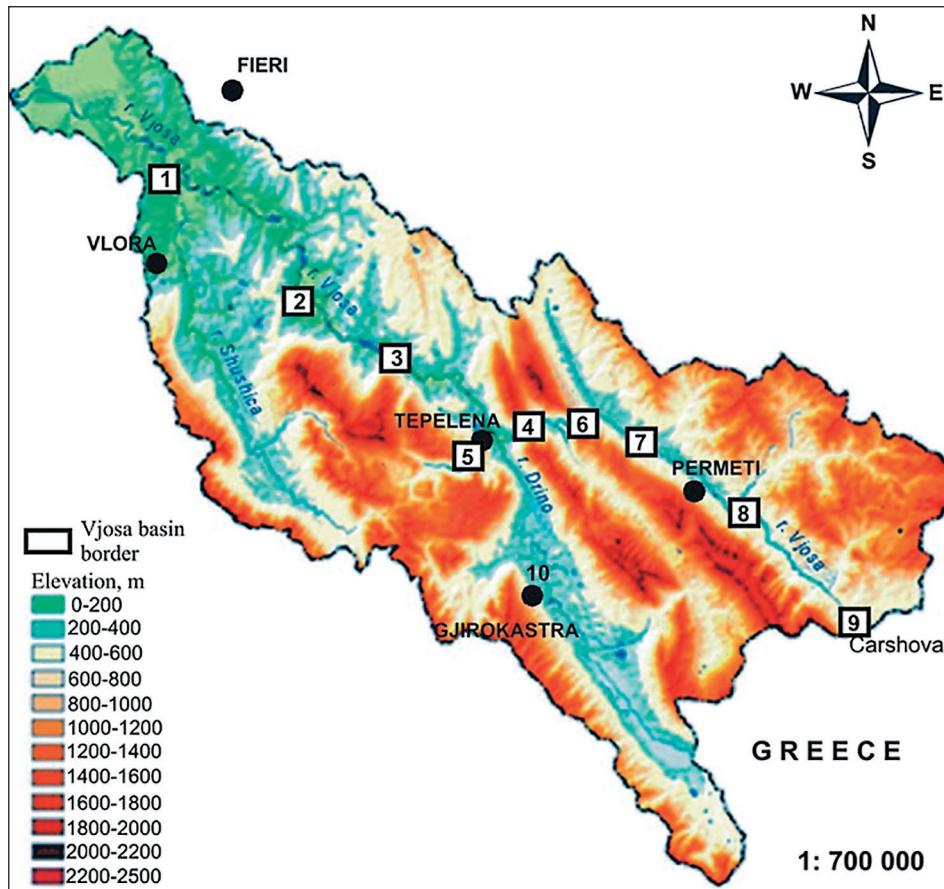


Fig.1: Vjosa catchment area with the visited places of investigation: 1, Novosela, Vlora, 15.08.2015; 2, Poçemi & Kuta, Mallakastra, 9.10.2016; 24–26.04.2017; 3, Ilirasi, Tepeleena, 15.08.2015/9.10.2016; 4, Dragoti, Tepelena, 21.08.2015; 5, Bënça, 9.10.2016/ 28.04.2017; 6, Peshtani, Tepelena, 21.08.2015; 7, Grabova, Përmeti, 21.08.2015; 8, Petrani, Përmet, 21.08.2015; 9, Çarshova, Përmet, 21.08.2015; 10, Viroi, Gjirokastra, 15.08.2015 & 28.04.2017. – Abb.1: Das Einzugsgebiet der Vjosa und die Untersuchungsgebiete: 1, Novosela, Vlora, 15.08.2015; 2, Poçemi & Kuta, Mallakastra, 9.10.2016; 24–26.04.2017; 3, Ilirasi, Tepeleena, 15.08.2015/9.10.2016; 4, Dragoti, Tepelena, 21.08.2015; 5, Bënça, 9.10.2016/ 28.04.2017; 6, Peshtani, Tepelena, 21.08.2015; 7, Grabova, Përmeti, 21.08.2015; 8, Petrani, Përmet, 21.08.2015; 9, Çarshova, Përmet, 21.08.2015; 10, Viroi, Gjirokastra, 15.08.2015 & 28.04.2017.

Material and methods

The study area on the Vjosa River and its branches extends from the western to the eastern side of the country. Four trips have been undertaken, in August 2015, August 2016, October 2016 and April 2017. All visited sites in the Vjosa catchment area and the data of those visits are provided in Figure 1. Odonata specimens were collected with entomological aerial nets. The suborder Anisoptera is difficult to capture in flight. They have delicate bodies and can be damaged by the movement of the entomological net in the opposite direction

of their movement. In this case, the specimens were caught when they were at rest, during the process of copulation, or when they were depositing eggs. As for the suborder Zygoptera, the capture is simpler because they fly more slowly and have a smaller radius of activity (CORBET 1962). The insects were placed in entomological envelopes labelled with date, place of capture, and special notes regarding collection time. The collected material underwent careful treatment in the laboratory, first being placed in an exicator for a maximum of 24 hours, and then being carefully analyzed in a Stereo-Microscope ZEISS Stemi 2000-C. The material is preserved in the scientific collection of the Faculty of Natural Science in Tirana. Taxonomy and nomenclature used in this paper are based on the identification keys and field guides available for the Mediterranean region (DIJKSTRA & LEWINGTON 2006, DIJKSTRA & KALKMAN 2012). Determination of exuviae follows GERKEN & STERNBERG (1999). *The conservation status was assessed according to IUCN (2010) criteria and categories, and the spatial data using the Geospatial Conservation Assessment Tool prepared by GeoCAT with Kew Gardens, ViBRANT, and IUCN.*

Results

So far, no detailed studies have been carried out for Odonata in Albania. DUMONT et al. (1993) collected and determined 8 Odonata species within the Vjosa area: *Calopteryx splendens*, *Ischnura elegans*, *Platycnemis pennipes*, *Aeshna isoceles*, *Anax imperator*, *Gomphus vulgatissimus*, *Orthetrum brunneum*, and *Orthetrum coerulescens*. MURANYI (2007) reports 4 species from the Vjosa catchment: *Calopteryx virgo*, *Caliaeschna microstigma*, *Onychogomphus forcipatus*, and *Cordulegaster heros*.

In this paper, we report 22 Odonata species collected during 2016–2017 (suborder Zygoptera is represented with 4 families, 8 genera and 9 species, suborder Anisoptera is represented with 3 families, 10 genera and 13 species). Here below is the list of collected species:

Suborder Zygoptera

Family Calopterygidae: genus *Calopteryx* (*C. splendens* and *C. virgo*).

Family Lestidae: genus *Sympetrum* (*S. fusca*), genus *Lestes* (*L. sponsa*).

Family Coenagrionidae: genus *Ischnura* (*I. elegans*), genus *Ceriagrion* (*C. tenellum*), genus *Coenagrion* (*C. ornatum*), genus *Pyrrhosoma* (*P. nymphula*).

Family Platycnemididae: genus *Platycnemis* (*P. pennipes*).

Suborder Anisoptera

Family Gomphidae: genus *Gomphus* (*G. vulgatissimus*), genus *Onychogomphus* (*O. forcipatus*).

Family Aeshnidae: genus *Caliaeschna* (*C. microstigma*), genus *Aeshna* (*A. mixta*), genus *Anax* (*A. imperator*), genus *Brachytron* (*B. pratense*).

Family Libellulidae: genus *Sympetrum* (*S. vulgatum*, *S. striolatum* and *S. fonscolombii*); genus *Orthetrum* (*O. brunneum*, *O. coerulescens*), genus *Crocothemis* (*C. erythraea*), and genus *Libellula* (*L. quadrimaculata*).

The table 1 provides an overview of the frequencies of species and genera for 7 families reported by us for Vjosa catchment area.

Tab. 1: The frequencies of species and genera for each family in Vjosa catchment area. – Tab. 1. Die Häufigkeit der Arten und Gattungen für jede Odonaten-Familie im Einzugsgebiet der Vjosa.

Families	Number of species	Frequency of species	Number of genera	Frequency of genera
Suborder Zygoptera				
Calopterygidae	2	9	1	5.5
Lestidae	2	9	2	11
Coenagrionidae	4	18	4	22
Platycnemididae	1	4.5	1	5.5
Suborder Anisoptera				
Gomphidae	2	9	2	11
Aeshnidae	4	18	4	22
Libellulidae	7	32	4	22
Total	22	100 %	18	100 %

The most represented is the Libellulidae family, with 7 species (32 %) and 4 genera (22 %) and Platycnemididae is the less represented family, with 1 genus (5.5 %) and 1 species (4.5 %).

Based on literature and data collected during this study, below, we present the total list of 28 recorded species known so far for the Vjosa catchment area.

1. *Calopteryx virgo* (LINNAEUS, 1758) – Collected individuals 3; station 9 (21.08.2015; 1 ♂, 1 ♀); station 2. (04.2017; 1 exuviae). This species was also reported by HASANI et al. (2007) for Viroi Lake and by MURÁNYI et al. (2013) for Erseka.

2. *Calopteryx splendens* (HARRIS, 1780) – Collected individuals 2; station 4 (21.08.2015; 2 ♂). It was reported by DUMONT et al. (1993) for Kélcrya and Viroi Lake, and by HASANI et al. (2007) for Viroi Lake.

3. *Sympetrum fusca* (VAN DER LINDEN, 1820) – Some imagines at station 2 (04.2017); small pond near border of cultivated land, not recently inundated.

4. *Ischnura elegans* (VAN DER LINDEN, 1820) – Collected individuals 29; station 1 (15.08.2015; 3 ♂, 1 ♀); station 2 (9.10.2016; 04.2017; 6 ♂, 3 ♀); station 3 (3.08.2015, 3 ♂, 3 ♀); station 6 (21.08.2015, 3 ♂, 1 ♀); station 10 (15.08.2015, 4 ♂, 2 ♀). This species is reported by DUMONT et al. (1993) for Kélcrya and Viroi Lake.

5. *Pyrrhosoma nymphula* (SULZER, 1776) – Some imagines at station 2 (04.2017); small pond near border of cultivated land, not recently inundated.

6. *Ceriagrion tenellum* (DE VILLERS 1789) – Collected individuals 7; station 2 (9.10.2016; 4 ♂, 3 ♀); it is found in habitats dominated by *Phragmites* sp.

7. *Coenagrion ornatum* (SELYS, 1850) – Collected individuals 4; station 2 (04.2017, 2 emerging imagines and 2 adults) (Fig. 3/1); clearwater rivulet behind dam and near cultivated land, not recently inundated.

8. *Platycnemis pennipes* (PALLAS, 1771) – Collected individuals more than 30; station 1 (15.08.2015; 3 ♂, 3 ♀); station 2 (04.2017; 2 ♂); station 5 (9.10.2016; 4 ♂, 3 ♀); station 7 (21.08.2015; 2 ♂, 3 ♀); station 10 (1.08.2015; 3 ♂, 1 ♀); feeding habitat near main channels of Vjosa River and in the mountainous vicinity. It was also reported for Viroi Lake by DUMONT et al. (1993).



Fig. 2: 1. *Coenagrion ornatum* (SELYS), freshly emerged (left); 2. *Orthetrum brunneum* (FONSCOLOMBE), freshly emerged (right). – Abb. 2: 1. *Coenagrion ornatum* (SELYS), frisch geschlüpft (links), 2. *Orthetrum brunneum* (FONSCOLOMBE), frisch geschlüpft (rechts).

9. *Lestes sponsa* (HANSEMANN, 1823) – Some imagines at station 2 (04.2017); also reported by HASANI et al. (2007) for Viroi Lake.

10. *Caliaeschna microstigma* (SCHNEIDER, 1845) – Collected individuals 3; station 4 (21.08.2015; 1 ♂); station 9 (21.08.2015; 2 ♂). It was also reported by MURÁNYI et al. (2013) for Tepelena and Erseka.

11. *Aeshna isoceles* (MÜLLER, 1767) – Reported by DUMONT et al. (1993) for Viroi Lake.

12. *Aeshna mixta* (LATREILLE, 1805) – Collected individuals 1; station 5 (9.10.2016; 1 ♂).

13. *Anax imperator* (LEACH, 1815) – Collected individuals 3; station 10 (15.08.2015; 3 ♂). It was also reported by DUMONT et al. (1993) and HASANI et al. (2007) for Viroi Lake.

14. *Brachytron pratense* (MÜLLER, 1764) – Collected individuals 2; station 2 (9.10.2016; 2 ♂). It was also reported by HASANI et al. (2007) for Viroi Lake.

15. *Gomphus vulgatissimus* (LINNAEUS, 1758) – Some imagines at station 2 (04.2017). Also reported by DUMONT et al. (1993) for Viroi Lake.

16. *Onychogomphus forcipatus* (LINNAEUS, 1758) – Exuviae and freshly emerged imagines at station 2 (04.2017). Also reported by MURÁNYI et al. (2013) for Mallakastra.

17. *Cordulegaster heros* (THESCHINGER, 1979) – Reported by MURÁNYI et al. (2013) for Erseka.

18. *Somatochlora metallica* (VAN DER LINDEN, 1825) – Reported by HASANI et al. (2007) for Viroi Lake.

19. *Libellula quadrimaculata* (LINNAEUS, 1758) – Some imagines at station 2 (04.2017).

20. *Libellula depressa* (LINNAEUS, 1758) – Reported by HASANI et al. (2007) for Viroi Lake.

21. *Orthetrum brunneum* (Fonscolombe, 1837) – Collected individuals 4; station 3 (15.08.2015; 9.10.2016; 2 ♂; 2 ♀). Station 2 (04.2017; 2 exuviae and 1 immature imago at the same habitat with *Coenagrion ornatum*) (Fig. 3/2). This species was also reported by DUMONT et al. (1993) for Viroi Lake.

22. *Orthetrum cancellatum* (Linnaeus, 1758) – Reported by HASANI et al. (2007) for Viroi Lake.

23. *Orthetrum coerulescens* (FABRICIUS, 1798) – Collected individuals 8; station 1 (3.08.2015; 1 ♂); station 3 (3.08.2015; 2 ♂, 1 ♀); station 8 (21.08.2015; 2 ♂, 2 ♀). ***Orthetrum coerulescens* ssp. *anceps*** (SCHNEIDER, 1845), reported as ***O. anceps*** by DUMONT et al. (1993) for Viroi Lake.

24. *Crocothemis erythraea* (BRULLE, 1832) – Imagines at station 2 (04.2017; 2 adults at the beginning of flight period).

25. *Sympetrum fonscolombii* (SELYS, 1840) – Collected individuals 9; station 1 (3.08.2015; 1 ♂, 1 ♀); station 3 (15.08.2015; 2 ♂, 2 ♀); station 10 (15.08.2015; 2 ♂, 1 ♀).

26. *Sympetrum vulgatum* (LINNAEUS, 1758) – Collected individuals 3; station 2 (9.10.2016; 3 ♂).

Tab. 2: Analysis of Odonata species in Vjosa catchment area according to IUCN, Red list EU27, Red List Europe and Red List Mediterranean. – Tab. 2: Analyse der Odonata-Arten im Vjosa-Einzugsgebiet gemäß Regelungen der IUCN, der Roten Liste EU27, der Roten Liste Europa und der Roten Liste für den Mittelmeer-Raum.

Nr.	Species	Family	IUCN	Red List EU27	Red List Euro	Red List M- diter.	Trend Europe
1	<i>Calopteryx splendens</i> (Harris)	Calopterygidae	LC	LC	LC	VU	stable
2	<i>Calopteryx virgo</i> (Brulle)	Calopterygidae	LC	LC	LC	LC	stable
3	<i>Ischnura elegans</i> (Vander Linden)	Coenagrionidae	LC	LC	LC	LC	stable
4	<i>Ceriagrion tenellum</i> (De Villers)	Coenagrionidae	LC	LC	LC	LC	stable
5	<i>Sympetrum fusca</i> (Vander Linden)	Coenagrionidae	LC	LC	LC	LC	increasing
6	<i>Coenagrion ornatum</i> (Selys)	Coenagrionidae	LC	NT	NT	NT	decreasing
7	<i>Pyrrhosoma nymphula</i> (Sulzer)	Coenagrionidae	LC	LC	LC	LC	stable
8	<i>Platycnemis pennipes</i> (Pallas)	Platycnemididae	LC	LC	LC	LC	stable
9	<i>Lestes sponsa</i> (Hansemann)	Lestidae	LC	LC	LC	LC	stable
10	<i>Caliaeschna microstigma</i> (Schneider)	Aeshnidae	LC	NT	NT	NT	decreasing
11	<i>Aeschna isosceles</i> (Müller)	Aeshnidae	LC	LC	LC	LC	stable
12	<i>Aeschna mixta</i> (Latreille)	Aeshnidae	LC	LC	LC	LC	increasing
13	<i>Anax imperator</i> (Leach)	Aeshnidae	LC	LC	LC	NT	increasing
14	<i>Brachytron pratense</i> (Müller)	Aeshnidae	LC	LC	LC	NT	stable
15	<i>Gomphus vulgatissimus</i> (Linnaeus)	Gomphidae	LC	LC	LC	LC	stable
16	<i>Onychogomphus forcipatus</i> (Linnaeus)	Gomphidae	LC	LC	LC	LC	stable
17	<i>Cordulegaster heros</i> (Theschinger)	Cordulegastridae	NT	NT	NT	VU	stable
18	<i>Somatochlora metallica</i> (Vander Linden)	Corduliidae	LC	LC	LC	NT	stable
19	<i>Libellula depressa</i> (Linnaeus)	Libellulidae	LC	LC	LC	LC	stable
20	<i>Orthetrum brunneum</i> (Fonscolombe)	Libellulidae	LC	LC	LC	LC	increasing
21	<i>Orthetrum cancellatum</i> (Linnaeus)	Libellulidae	LC	LC	LC	LC	stable
22	<i>Orthetrum coerulescens</i> (Fabricius)	Libellulidae	LC	LC	LC	LC	stable
23	<i>Sympetrum fonscolombii</i> (Selys)	Libellulidae	LC	LC	LC	LC	increasing
24	<i>Sympetrum vulgatum</i> (Linnaeus)	Libellulidae	LC	LC	LC	NT	stable
25	<i>Sympetrum sanguineum</i> (Müller)	Libellulidae	LC	LC	LC	LC	stable
26	<i>Sympetrum striolatum</i> (Charpentier)	Libellulidae	LC	LC	LC	LC	stable
27	<i>Libellula quadrimaculata</i> (Linnaeus)	Libellulidae	LC	LC	LC	LC	stable
28	<i>Crocothemis erythraea</i> (Brullé)	Libellulidae	LC	LC	LC	LC	increasing

Tab. 3: Data on population size, area of occupancy (AOO), extent of occurrence (EOO) and number of localities for *C. microstigma*, *C. splendens*, *C. ornatum* and *C. heros* in Albania. – Tab. 3: Daten zur Populationsgröße, AOO, EOO, (Fläche der Vorkommen (AOO) und Bestandsdichte(EOO) und die Anzahl der Gebiete für *C. microstigma*, *C. splendens*, *C. ornatum* und *C. heros* in Albanien.

Nr	Species name	Population size	AOO (km ²)	EOO (km ²)	Nr. of localities
1	<i>Caliaeschna microstigma</i>	< 300	76	17,180	19
2	<i>Calopteryx splendens</i>	400-500	56	19,137	14
3	<i>Coenagrion ornatum</i>	< 350	40	17,937	10
4	<i>Cordulegaster heros</i>	< 100	12	1,665	3

27. *Sympetrum sanguineum* (MÜLLER, 1764) – Reported by HASANI et al. (2007) for Viroi Lake.

28. *Sympetrum striolatum* (CHARPENTIER, 1840) – Collected individuals 6; station 5 (9.10.2016; 4 ♂, 2 ♀).

Table 2 shows the conservation status of 28 species recorded for the Vjosa watershed based on the IUCN, the EU 27 red list, European red List, and Mediterranean red list. According to the data for four species regarding population size, area of occupancy (AOO), extent of occurrence (EOO), number of localities (Tab. 3) and distribution in Albania (Fig. 2) we made an assessment of the present conservation status of these four species for Albania. *Cordulegaster heros* is assessed as NT based on the IUCN, the EU27 red list, and European red list; *Caliaeschna microstigma* and *Coenagrion ornatum* are assessed as NT according to the EU27 red list, the European red list, and the Mediterranean red list; *Calopteryx splendens* is assessed as VU according to Mediterranean red list.

***Cordulegaster heros*.** According to BOUDOT (2014), this species is assessed as NT for Europe (BOUDOT 2010, KALKMAN et al. 2010), but not assessed for Albania (MoE 2013). It has a narrow distribution area in central to southeastern Europe; in Albania it is only recorded in 3 localities so far, mainly in the eastern part of the country (KNIJF et al. 2015) (Fig. 3). The population size of the species is expected to be less than 100 mature individuals, distributed in an AOO of 12 km² and EOO of approx. 1665 km². In Albania, this species is threatened by habitat reduction and drying of tributaries from deviation of water for hydropower construction. It is considered Endangered (EN B2ab (ii,iii,v)) due to the species' fragmentation in only 3 localities, its small population size, and the threat from habitat destruction.

Caliaeschna microstigma and ***Coenagrion ornatum*** are assessed as LC by the IUCN as they are not close to meeting the thresholds for a threatened category in Europe and have not been evaluated so far for the Red List of the Wild Flora and Fauna of Albania (MoE 2013). On the other hand, they have been assessed as NT in the EU27 red list, European red list, and Mediterranean red list (BOUDOT 2015). *Caliaeschna microstigma* was observed in 19 localities distributed throughout Albania from sea level up to 1500 m a.s.l. (Fig. 3). The AOO is 76 km² and EOO approx. 17180 km², but the population size of this species is very small, calculated to be between 200 and 300 mature individuals, so it is assessed as VU D1 for Albania.

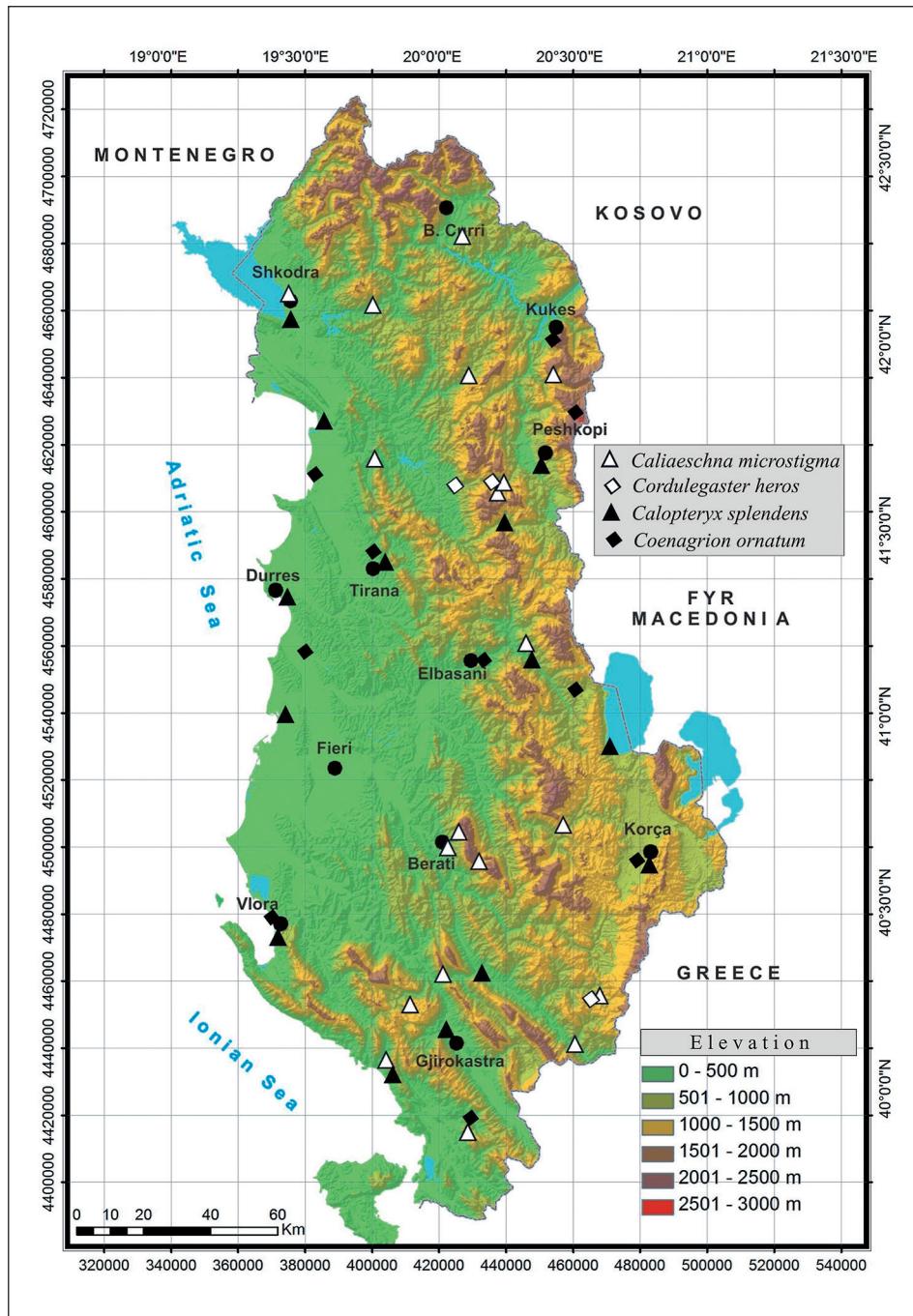


Fig. 3: Distribution map of species *Caliaeschna microstigma*, *Cordulegaster heros*, *Calopteryx splendens* and *Coenagrion ornatum* for all Albanian territory. – Abb. 3: Verbreitungskarte der Arten *Caliaeschna microstigma*, *Cordulegaster heros*, *Calopteryx splendens* und *Coenagrion ornatum* für Albanien.

Coenagrion ornatum was observed in 10 localities with an AOO of 40 km² and EOO of 17,937 km². The population size of mature individuals is also very small, calculated to be less than 350 mature individuals. Based on AOO, EOO, and population size, and since habitat in this species' range is reduced and the quality of waters is worsened due to agriculture development, the national conservation status of the species is assessed as Endangered (EN B1B2ab (i,ii,iii,v)).

Calopteryx splendens was observed in 14 localities with an AOO of 56 km² and EOO of 19,137 km². The species' population size is calculated to be less than 500 mature individuals and appears to be stable, so the national conservation status of *C. splendens* is assessed as VU D1.

Discussion

Based on the results of this study, a total of 28 species are recorded in the Vjosa watershed, 22 of which were observed and collected by us. 10 species (*Pyrrhosoma nymphula*, *Ceriagrion tenellum*, *Coenagrion ornatum*, *Sympetrum fusca*, *Sympetrum fonscolombii*, *Sympetrum vulgatum*, *Sympetrum striolatum*, *Aeshna mixta*, *Crocothemis erythraea*, and *Libellula quadrimaculata*) are reported for the first time in this area.

Coenagrion ornatum is classified with the status LC according to the IUCN, but is listed as Near Threatened/NT based on the European Red List of Dragonflies, and belongs to the group of Strictly Protected Fauna Species according to Appendix II of the Convention on the Conservation of European Wildlife and Natural Habitats. Throughout Europe, *C. ornatum* has become extremely rare and is one of the most characteristic species of small clearwater-floodplain-rivulets rich in *Eleocharis*, *Juncus* and *Sium* genera.

The total number of known species in the Vjosa region accounts for nearly half of the Odonata species in Albania, making this area one of the richest parts of the country. It shows exceedingly high diversity and reinforces the need to conserve the Vjosa watershed. The stations of Novosela, Poçemi, Kuta, and Viroi were the sites with the highest number of observed species (up to 4 species were collected at each locality). Two stations had the smallest number of collected species – Peshtani and Petrani – with 1 species each.

Increasing agricultural activity, deforestation, and urbanization near the river are leading to a degradation of water quality in the Vjosa watershed (MALO & SHUKA 2008). Changes to the favored riverine habitats of Odonata species, particularly with blady grass (*Imperata cylindrica*), reeds (*Typha* spp.), and willows (*Salix* spp.), increase the threats for this insect group. Protecting the habitat diversity and biodiversity in the Vjosa basin would help directly in conserving the diversity of Odonata in this region.

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