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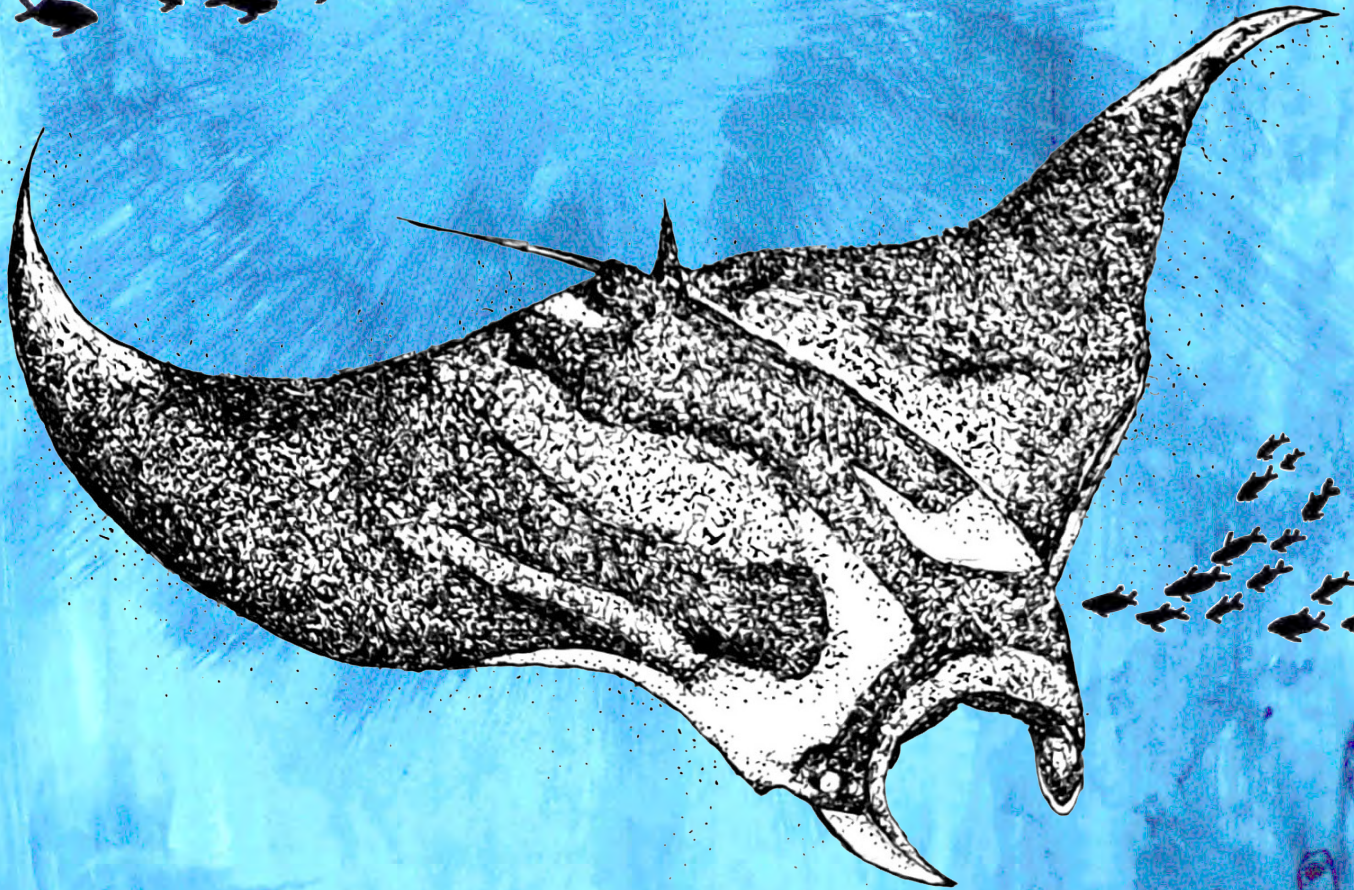
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Cover: Giant Oceanic Manta Ray *Mobula birostris* in ink on acrylic wash by Elakshi Mahika Molur adapted from scientific illustration by Roger Hall.



study other different aspects of the taxa like taxonomy, biology, ecology, behavior and biogeography. So, the present study was conducted to study Odonata fauna of Kashmir, J&K, India.

MATERIALS AND METHODS

Study Area

Kashmir, province of Union Territory of Jammu & Kashmir is the northwestern part of Himalaya bounded by Pir Panjal Range from the south-west and Great Himalaya from the north-east. The area of the valley is 15,853 km² and geographically it lies between 33.30–34.40° N and 73.45–75.35° E. The average elevation level is 1,666 m although the surrounding mountains are at 3,000–4,250 m. The climate of the valley is temperate and has four distinct seasons (Winter, Spring, Summer, and Autumn). Kashmir is with vast and variety of aquatic and terrestrial resources manifested in the form of rivers, streams, lakes, ponds, wetlands, forests, and meadows. The present study was conducted across the Kashmir valley and 14 sites were selected on the basis of altitude encompassing different ecosystems like rivers, streams, lakes, ponds, wetlands, paddy fields, agricultural fields, forests, meadows, gardens, and parks (Figure 1).

Methods

The odonates of Kashmir were studied monthly from November 2020 to November 2022. All surveys and samplings were carried out during sunny days using a combination of direct search technique (Sutherland 1996) and opportunistic sighting methods. The photographs of the species were taken using Canon EOS 200D II with 250 mm lens. The identification of species was done using taxonomic literature (Fraser 1933, 1934, 1936) and field guides (Subramanian 2009). For species nomenclature and classification, Kalkman et al. (2020) and Subramanian & Babu (2017) were followed. Based on the frequency of sighting, species were locally categorized as Very Common (VC) when they were sighted during 75–100% of the field outings, Common (CO) when the sighting was between 50–75%, Occasional (OC) when the sighting was only 25–50%, and Rare (RA) when the sighting was below 25% (Adarsh et al. 2014).

RESULTS AND DISCUSSION

A total of 24 species belonging to two suborders under 13 genera and five families were recorded during the present study (Table 1, Image 1). Zygoptera (damselflies) is represented by six species under five genera and three families while Anisoptera (dragonflies)

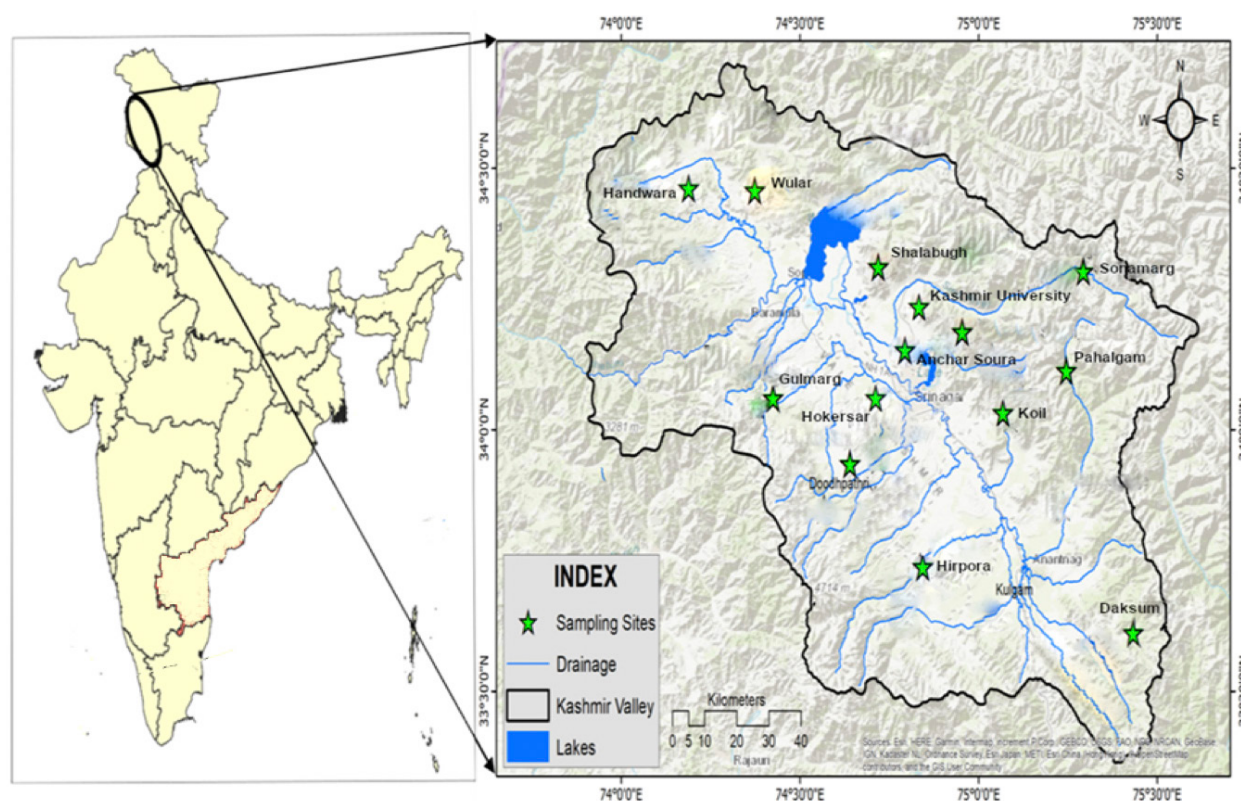


Figure 1. Study area with sampling sites.



Image 1. A—*Megalestes major* | B—*Sympetma paedisca* | C—*Ischnura inarmata* | D—*Lestes barbarus* | E—*Ischnura forcipata* | F—*Enallagma cyathigerum* | G—*Crocothemis servilia* | H—*Orthetrum brunneum* | I—*Orthetrum triangulare* | J—*Orthetrum luzonicum* | K—*Orthetrum glaucum* | L—*Orthetrum internum* | M—*Orthetrum sabina* | N—*Sympetrum commixtum* | O—*Sympetrum fonscolombii* | P—*Sympetrum striolatum* | Q—*Libellula quadrimaculata* | R—*Pantala flavescens* | S—*Aeshna mixta* | T—*Trithemis aurora* | U—*Aeshna petalura* | V—*Anax parthenope* | W—*Anax guttatus* | X—*Aeshna juncea*.

by 18 species under eight genera and two families. The Libellulidae was the most dominant family with 12 species followed by Aeshnidae with six species among the Anisoptera. Coenagrionidae represented the most prevalent family of Zygoptera constituting three species followed by Lestidae and Synlestidae each with two and one species respectively. Among these 24 species, 20 are

already reported while four species *Orthetrum sabina* (Drury, 1770), *Orthetrum internum* McLachlan, 1894, *Anax guttatus* (Burmeister, 1839), and *Aeshna petalura* Martin, 1906 are reported first time from Kashmir, India.

On the basis of occurrence of 24 species, six were found to be Very Common; seven species were Common, nine species to be Occasional while two species were

Table 1. Species recorded during the present study.

	Family /Scientific name	Observed frequency class	IUCN Red List status
	Lestidae		
01	<i>Lestes barbarus</i> (Fabricius, 1798)	OC	LC
02	<i>Sympecma paedisca</i> (Brauer, 1877)	C	LC
	Synlestidae		
03	<i>Megalestes major</i> Selys, 1862	OC	LC
	Coenagrionidae		
04	<i>Ischnura inarmata</i> Calvert, 1898	VC	DD
05	<i>Ischnura forcipata</i> Morton, 1907	OC	LC
06	<i>Enallagma cyathigerum</i> (Charpentier, 1840)	OC	LC
	Libellulidae		
07	<i>Orthetrum sabina</i> (Drury, 1770)	OC	LC
08	<i>Orthetrum triangulare</i> (Selys, 1878)	C	LC
09	<i>Orthetrum glaucum</i> (Brauer, 1865)	C	LC
10	<i>Orthetrum luzonicum</i> (Brauer, 1868)	OC	LC
11	<i>Orthetrum internum</i> McLachlan, 1894	R	Unknown
12	<i>Orthetrum brunneum</i> (Fonscolombe, 1837)	C	LC
13	<i>Crocothemis servilia</i> (Drury, 1770)	VC	LC
14	<i>Libellula quadrimaculata</i> Linnaeus, 1758	OC	LC
15	<i>Sympetrum commixtum</i> Selys, 1884	VC	LC
16	<i>Sympetrum striolatum</i> (Charpentier, 1840)	VC	LC
17	<i>Sympetrum fonscolombii</i> (Selys, 1840)	VC	LC
18	<i>Pantala flavescens</i> (Fabricius, 1798)	VC	LC
	Aeshnidae		
19	<i>Anax parthenope</i> (Selys, 1839)	OC	LC
20	<i>Anax guttatus</i> (Burmeister, 1839)	C	LC
21	<i>Trithemis aurora</i> (Burmeister, 1839)	R	LC
22	<i>Aeshna petalura</i> Martin, 1906	OC	LC
23	<i>Aeshna mixta</i> Latreille, 1805	C	LC
24	<i>Aeshna juncea</i> (Linnaeus, 1758)	C	LC

LS—Least Concern | DD—Data Deficient | VC—Very Common | C—Common | OC—Occasional | R—Rare.

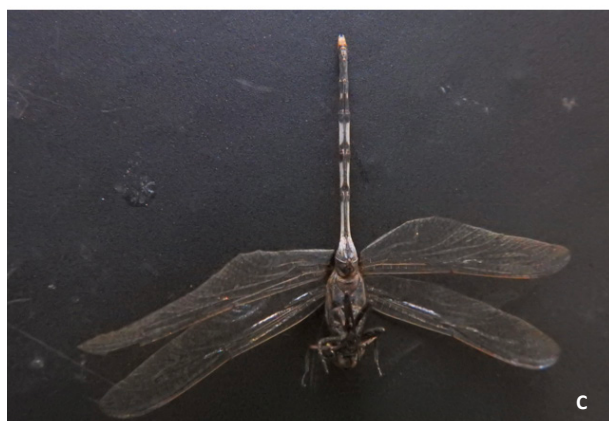
Rare. Among Zygoptera, *Ischnura inarmata* Calvert, 1898 was found to be the most common species. Among the dragonflies *Pantala flavescens* (Fabricius, 1798), *Crocothemis servilia* (Drury, 1770), *Sympetrum commixtum* Selys, 1884, *Sympetrum fonscolombii* (Selys, 1840), and *Sympetrum striolatum* (Charpentier, 1840) were the most common species and *Trithemis aurora* (Burmeister, 1839) and *Orthetrum internum* McLachlan, 1894 were recorded as rare species.

Odonates are an ecologically significant insect

group, hence their conservation is critical. Aquatic ecosystems in Kashmir are at high risk of vulnerability due to anthropogenic pressures such as deforestation, encroachment, pollution, and changes in land use patterns. It is critical to raise public awareness and reduce anthropogenic pressures in order to conserve the habitats of these important insects (Sánchez-Bayo & Wyckhuys 2019). As this is a preliminary survey of odonate fauna of Kashmir, we hence recommend more studies to be taken to assess this important group in all aspects like taxonomy, biology, ecology and behavior and biogeography.

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Supplementary data (*Ortherum Sabina*): A—forewing and hindwing | B—dorsal side | C—ventral side | D—abdomen. © Nisar Paray.

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