

## Odonata species in and around Dibru-Saikhowa biosphere reserve of Assam, India

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### Abstract

Situated in the flood plain zone of the Brahmaputra and Lohit rivers in eastern Assam of North East India, Dibru-Saikhowa Biosphere Reserve (DSBR) is witnessing a vibrant wilderness. Among the insect fauna of these biosphere reserve, one of the most alluring but unstudied taxa is the Odonata. Hence, a survey was conducted in and around DSBR from May, 2021 to October, 2023 to document their diversity and conservation status. During the study, 65 species (42 species of Anisoptera and 23 species of Zygoptera) of odonates belonging to 40 genera and 10 families were recorded. Out of these, 61 species were least concern (LC), 3 species were data deficient (DD) and 1 species was included in Not Evaluated (NE) categories of IUCN Red List. The smallest member of Libellulidae family *Nannophya pygmaea* Rambur, 1842 was recorded from the study area which was last reported a century ago from this region of Assam. Habitat destruction due to various human activities is the present major threats for odonates fauna of this biosphere reserve and its surroundings.

**Keywords:** Odonata, Dibru-Saikhowa Biospher Reserve, diversity, conservation status

### Introduction

Odonates are one of the most enticing groups of insects in this living world. Being an amphibian predator and prey, they have been playing an indispensable ecological role in any landscape except the ice cape Antarctica. These insects are belongs to two sub-orders viz., Zygopter (includes damselflies) and Anisoptera (includes dragonflies) under the order Odonata (Dumont *et al.*, 2010)<sup>[6]</sup>. According to World List of Odonata, there about 6,372 species of dragonfly and damselfly across the globe (Paulson *et al.*, 2022)<sup>[18]</sup>, out of which about 500 species are recorded from Indian sub-continent (Joshi *et al.* 2021)<sup>[11]</sup>. History of dragonfly and damselfly study in North Eastern India including Assam was started from “Abor Expedition” during 1911-12 (Das *et al.*, 2022)<sup>[4]</sup>. Many odonatological studies were conducted by different workers in Assam so far; but very limited works are available from the protected areas of the state (e.g. Kalita, 2014; Kalita and Ray, 2015; Baruah *et al.*, 2016; Thakuria, 2020)<sup>[12, 13, 2, 22]</sup>. Especially in and around Dibru-Saikhowa Biosphere Reserve of Assam, India, except butterfly no other members of the class Insecta are systematically studied till date (Nongmaithem *et al.* 2016)<sup>[15]</sup>. Therefore, the present study aims to provide a baseline of odonates diversity and their conservation status in and around the DSBR of Assam, India.

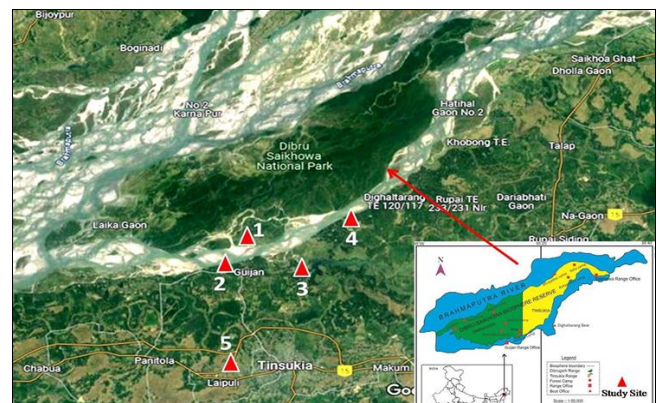
### Materials and Methods

#### Study area

Dibru-Saikhowa Biosphere Reserve (DSBR) is situated in the flood plain zone of the Brahmaputra and Lohit rivers in extreme east of Assam, India. This Biosphere Reserve lies between 27°30'N to 27°45'N latitude and 95°10'E to 95°45' E longitude, at an average elevation of 118 m. The entire biosphere reserve is extended in three districts of Upper Assam, viz. Dhemaji, Dibrugarh and Tinsukia districts. The Brahmaputra and Lohit River are flowing on the north of this biosphere reserve and Dibru River is on the south. Two densely forested areas, viz. Dibru forest and Saikhowa forest, of then North Lakhimpur district were notified as reserve forest by the British Government in 1890 and 1929

respectively. Later, in independent India, both the reserve forests were merged together and declared Dibru-Saikhowa as Wildlife Sanctuary in 1986. After more than a decade, in July 28, 1997, Dibru-Saikhowa was declared as Biosphere Reserve covering a total area of 765 sq. km. including the wildlife sanctuary as well as fringe villages. Subsequently, in 1999, around 350 sq. km. area (mainly the core zone) of the biosphere reserve was upgraded to the status of National Park.

Vegetation of DSBR is clearly distinguished as woodland, grassland and wetland. Major portion of this biosphere reserve is covered by wetlands of various sizes. Water bodies present inside and surroundings of the biosphere reserve are not only providing a suitable habitat for odonates but also supporting a good biodiversity of aquatic and terrestrial fauna. The climate of the area is tropical monsoon type with hot, wet summer and cool dry winters with infrequent raining. The annual rainfall varies from 2300 mm to 3800 mm and it occurs mainly in June to September. The maximum average temperature of the area is 36° C and minimum is 6° C. This area is falls at the junction of two biodiversity hotspots viz. Indo-Burma and Eastern Himalaya biodiversity hot-spots which make it privilege to harbor a rich diversity of flora and fauna (Dwivedi, 2009)<sup>[5]</sup>.



**Fig 1:** Map of Dibru-Saikhowa Biospher Reserve, Assam (India) with study sites

**Sampling Sites**

This study was mainly confined in that part of DSBR which is falling under Tinsukia district of Assam. It was conducted from May, 2021 to October, 2023. Five distinct habitat types viz. Goramjan, Guijan, Maguri Beel, Dighaltarang Goan and Makum bypass road (Table-1) were selected for the study of odonates in and around DSBR. Checklist

survey method (Royer *et al.*, 1998) [20] was adapted for the study. All the microhabitats were observed for an hour and record the encountered species. All the field visits were made during the sunny days between 9.00 am to 1.00 pm, when adult dragonflies and damselflies were observed to be very active.

**Table 1:** Study sites with their habitats

Site No.	Study sites	Geographical Coordinates		Elevation (in meter)	Habitat type
		Latitude	Longitude		
1	Goramjan	27°59'17" N	95°32'37" E	113 m	Lotic water, sandy river bank and human settlement with cattle farm ( <i>Khuti</i> )
2	Guijan	27°57'83" N	95°32'66" E	122 m	River bank and Tea garden
3	Maguri Beel	27°57'26" N	95°36'90" E	117 m	Large lentic water body ( <i>beel</i> ) with aquatic vegetation.
4	Dighaltarang Goan	27°61'20" N	95°39'86" E	124 m	Seasonal lentic water bodies and woody vegetation
5	Makum bypass road	27°48'47" N	95°31'08" E	125 m	Perennial lentic water bodies (ponds) and paddy field.

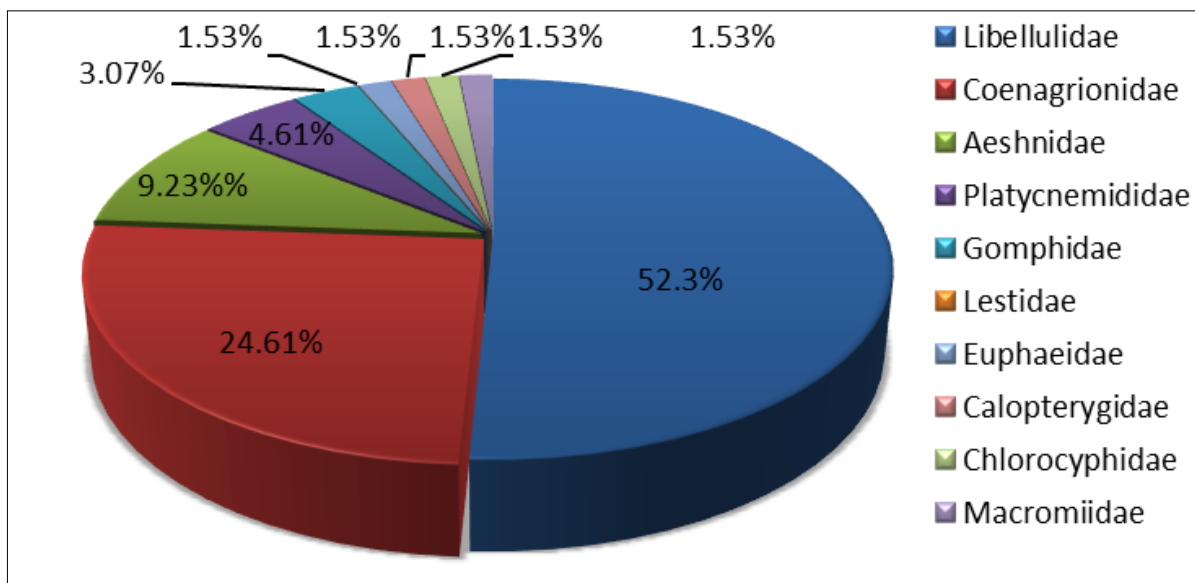
**Specimen Collection and Identification**

Encountered species in the field were photographed with digital camera and identified with standard literature (Fraser 1933, 1934 & 1936) [8, 9, 10] and field guides (Subramanian, 2009 and Nair, 2011) [21, 14]; those species facing difficulties to identify in the field, were caught using a sweeping net and released in the same location after capturing its detail photographs. Taxonomic arrangement of recorded odonete species is made in the checklist according to World List of Odonata (Paulson *et al.*, 2022) [18] and conservation status of the species is mentioned on the basis of IUCN Red List Verson 3.1 [25].

**Results and Discussion**

A total number of 65 odonat species belonging to 40 genera under 10 families were recorded in and around DSBR. Out of these, sub-order *Zygoptera* (Damselflies) contributed 23 species under 11 genera and 6 families (Table-2); while sub-order *Anisoptera* (Dragonflies) represented 42 species belonging to 29 genera and 4 families [Table-3]. Family Libellulidae was dominating the odonate fauna of the study area with 34 species under 23 genera, which is 52.3% of total odonate species recorded in the DSBR. Coenagrionidae with 16 species becoming the second largest family;

Aeshnidae contains 6 species, Plactycnemididae contains 3 species, Gomphidae contains 2 species, Lestidae, Euphaeidae, Calopterygidae and Macromiidae are sharing 1 species each (Fig- 2). Most common dragonflies of the study area were *Acisoma panorpoides*, *Aethriamanta brevipennis*, *Brachydiplax chalybea*, *Brachythemis contaminata*, *Crocothemis servilia*, *Diplacodes trivialis*, *Neurothemis fulvia*, *N. intermedia*, *Orthetrum pruinosum*, *O. sabina*, *Pantala flavescens*, *Potamarcha congener*, *Rhyothemis variegata*, *Trithemis aurora* and *T. pallidinervis* were the most common species. Members of Coenagrionidae family such as *Aciagrion pallidum*, *Agriocnemis lacteola*, *A. pygmaea*, *Ceriagrion cerenorubellum*, *C. coromandelianum*, *Ischnura rubilio* and *Pseudagrion rubriceps* were the most common damselflies in and around the DSBR. Two Aeshnidae members' viz. *Gynacantha bainbriggei* and *G. subinterrupta* were frequently encountered during evening time actively flying and sometimes parching near the electric light sources of houses, shops, etc. located in the Site-2 and Site-5 of the study area. Out of 65 recorded species, 61 were least concern (LC), 3 species were data deficient (DD) and 1 species was included in Not Evaluated (NE) categories of IUCN Red List.



**Fig 2:** Pie chart depicting family wise distribution of species in and around Dibru-Saikhowa Biosphere Reserve of Assam, India.

**Records of notable species**

***Nannophya pygmaea* Rambur, 1842 (Fig. 3)**

This species was observed in the month of August, 2023 close to site-5 (i.e. Makum bypass road) in an abandoned paddy field near a small shallow drain. Seven individuals of these species (4 male and 3 females) were sighted in the location. They were not showing too much active, flying slowly in a short distance about one meter and perched on leaves of ferns and small herbs about 30 to 45 cm above the muddy ground.

This small dragonfly body length is measured about 17 mm and wings span is up to 12 mm. Wings base have amber colour which are more prominent in hind wings. Legs are black. Mature males are red or red-brown in colour; eyes red on top and below dark brown. Female have black and brown thorax; while white and brown bands are present on its abdomen. Segment 8 to 10 is having dark black bands separated with thin white bands. Immature male appears yellowish brown.



**Fig 3:** *Nannophya pygmaea* Rambur,1842; A- Mature female; B-Mature male; C-Immature male

***Indothemis carnatica* (Fabricius, 1798)**

(Fig.4) This was an unanticipated record in the campus of Guru Teg Bahadur Academy, Borguri, Tinsukia, Assam; closed to Site-5. An adult male was observed perched on leaves of small shrub about 1m above the dry ground in the

month of August 2023. *I. carnatica* is a dark violaceous small dragonfly having pale yellow anal appendages with black tipped. Hind wings base has very small blackish patch and rest part is clear. It has a black forns. Both thorax and abdomen are uniform royal blue.



**Fig 4:** *Indothemis carnatica* (Fabricius, 1798)

**Table 2:** Checklist of Damselflies (Zygoptera) recorded in and around the Dibru-Saikhowa Biosphere Reserve of Assam, India.

Scientific Name with Family	English Names	IUCN Status
Family: Lestidae		
1. <i>Lestes praemorsus</i> Hagen in Selys,1862	Sapphire-eyed Spreadwing	LC
Family: Euphaeidae		
2. <i>Euphaea ochracea</i> Selys,1859		LC
Family: Calopterygidae		
3. <i>Neurobasis chinensis</i> (Linnaeus,1758)	Stream Glory	LC
Family: Chlorocyphidae		
4. <i>Libellago lineata</i> (Burmeister,1839)	River Heliodor	LC
Family: Platycnemididae		
5. <i>Copera marginipes</i> (Rambur, 1842)	Yellow Bush Dart	LC
6. <i>Copera vittata</i> (Selys,1863)	Blue Bush Dart	LC
7. <i>Onychargia atrocyana</i> Selys,1865	Black Marsh Dart	LC

Family: Coenagrionidae		
8. <i>Aciagrion pallidum</i> Selys, 1891	Pale Slender Dartlet	LC
9. <i>Agriocnemis femina</i> (Brauer, 1868)	Pruinosed Dartlet	LC
10. <i>Agriocnemis kalinga</i> Nair & Subramanian, 2014	Indian Hooded Dartlet	LC
11. <i>Agriocnemis lacteola</i> Selys, 1877	Milky Dartlet	LC
12. <i>Agriocnemis pieris</i> Laidlaw, 1919	White Dartlet	LC
13. <i>Agriocnemis pygmaea</i> (Rambur, 1842)	Pigmy Dartlet	LC
14. <i>Agriocnemis splendidissima</i> Laidlaw, 1919	Splendid Dartlet	LC
15. <i>Ceriagrion cerinorubellum</i> (Brauer, 1865)	Orange-tailed Marsh Dart	LC
16. <i>Ceriagrion coromandelianum</i> (Fabricius, 1798)	Coromandel Marsh Dart	LC
17. <i>Ceriagrion olivaceum</i> Laidlaw, 1914	Rusty Marsh Dart	LC
18. <i>Ceriagrion rubiae</i> Laidlaw, 1916	Orange Marsh Dart	LC
19. <i>Ischnura rubilio</i> Selys, 1876	Western Golden Dartlet	NE
20. <i>Ischnura rufostigma</i> Selys, 1876		LC
21. <i>Pseudagrion decorum</i> (Rambur, 1842)	Three-lined Dartlet	LC
22. <i>Pseudagrion malabaricum</i> Fraser, 1922	Malabar Sprite	LC
23. <i>Pseudagrion rubriceps</i> Selys, 1876	Saffron-faced Blue Dart	LC

**Table 3:** Checklist of Dragonflies (Anisoptera) recorded in and around the Dibru-Saikhowa Biosphere Reserve of Assam, India.

Scientific Name with Family	English Names	IUCN Status
Family: Aeshnidae		
1. <i>Anaciaeschna jaspidea</i> (Burmeister, 1839)	Rusty Darner	LC
2. <i>Anax guttatus</i> (Burmeister, 1839)	Blue-tailed Green Darner	LC
3. <i>Gynacantha bainbriggei</i> Fraser, 1922		DD
4. <i>Gynacantha dravida</i> Liefinck, 1960	Brown Darner	DD
5. <i>Gynacantha khasiaca</i> MacLachlan, 1896		DD
6. <i>Gynacantha subinterrupta</i> Rambur, 1842		LC
Family: Gomphidae		
7. <i>Ictinogomphus rapax</i> (Rambur, 1842)	Common Clubtail	LC
8. <i>Paragomphus lineatus</i> (Selys, 1850)	Common Hooktail	LC
Family: Libellulidae		
9. <i>Acisoma panorpoides</i> Rambur, 1842	Trumpet Tail	LC
10. <i>Aethriamanta brevipennis</i> (Rambur, 1842)	Scarlet Marsh Hawk	LC
11. <i>Brachydiplax chalybea</i> Brauer, 1868	Rufous-backed Marsh Hawk	LC
12. <i>Brachydiplax farinosa</i> Kruger, 1902	Blue-tailed Dasher	LC
13. <i>Brachydiplax sobrina</i> (Rambur, 1842)	Little Blue Marsh Hawk	LC
14. <i>Brachythemis contaminata</i> (Fabricius, 1793)	Ditch Jewel	LC
15. <i>Bradinopyga geminata</i> (Rambur, 1842)	Granite Ghost	LC
16. <i>Crocothemis servilia</i> (Drury, 1773)	Ruddy Marsh Skimmer	LC
17. <i>Diplacodes nebulosa</i> (Fabricius, 1793)	Black-tipped Ground Skimmer	LC
18. <i>Diplacodes trivialis</i> (Rambur, 1842)	Ground Skimmer	LC
19. <i>Indothemis carnatica</i> (Fabricius, 1798)	Light-tipped Demon	LC
20. <i>Lathrecista asiatica</i> (Fabricius, 1798)	Asiatic Bloodtail	LC
21. <i>Nannophya pygmaea</i> Rambur, 1842	Scarlet Dwarf	LC
22. <i>Neurothemis fulvia</i> (Drury, 1773)	Fulvous Forest Skimmer	LC
23. <i>Neurothemis intermedia</i> (Rambur, 1842)	Ruddy Meadow Skimmer	LC
24. <i>Neurothemis tullia</i> (Drury, 1773)	Pied Paddy Skimmer	LC
25. <i>Orthetrum chrysis</i> (Selys, 1891)	Brown-backed Red Marsh Hawk	LC
26. <i>Orthetrum luzonicum</i> (Brauer, 1868)	Tri-coloured Marsh Hawk	LC
27. <i>Orthetrum pruinosum</i> (Burmeister, 1839)	Crimson-tailed Marsh Hawk	LC
28. <i>Orthetrum sabina</i> (Drury, 1773)	Green Marsh Hawk	LC
29. <i>Orthetrum triangulare</i> (Selys, 1878)	Blue-tailed Forest Hawk	LC
30. <i>Palpopleura sexmaculata</i> (Fabricius, 1787)	Blue-tailed Yellow Skimmer	LC
31. <i>Pantala flavescens</i> (Fabricius, 1798)	Wandering Glider	LC
32. <i>Potamarcha congener</i> (Rambur, 1842)	Yellow-tailed Ashy Skimmer	LC
33. <i>Rhodothemis rufa</i> (Rambur, 1842)	Rufous Marsh Glider	LC
34. <i>Rhyothemis variegata</i> (Linnaeus, 1763)	Common Picture Wing	LC
35. <i>Tetrathemis platyptera</i> Selys, 1878	Pigmy Skimmer	LC
36. <i>Tholymis tillarga</i> (Fabricius, 1798)	Coral-tailed Cloud Wing	LC
37. <i>Tramea basilaris</i> (Palisot de Beauvois, 1817)	Red Marsh Trotter	LC
38. <i>Trithemis aurora</i> (Burmeister, 1839)	Crimson Marsh Glider	LC
39. <i>Trithemis pallidinervis</i> (Kirby, 1889)	Long-legged Marsh Glider	LC
40. <i>Urothemis signata</i> (Rambur, 1842)	Great Crimson Glider	LC
41. <i>Zyxomma petiolatum</i> Rambur, 1842	Brown Dusk Hawk	LC
Family: Macromiidae		
42. <i>Eupophthalmia vittata</i> Burmeister, 1839	Common Torrent Hawk	LC

Finding 65 odonate species only in a part of Dibru-Saikhowa Biospher Reserve of Assam (especially in the buffer zone) and its surroundings manifest a healthy ecological condition with immense potentiality to support a good biodiversity. (Kalita, *et al.* 2014) <sup>[12]</sup>. Common occurrence of species mainly from Gomphidae family also signifies the undisturbed and good quality of water as well as forest in the study area (Das *et al.*, 2012) <sup>[3]</sup>.

In 1911-12, during “Abar Expedition”, Laidlow first described the smallest dragonfly *Nannophya pygmaea* from North Lakhimpur area (presently divided into Lakhimpur, Dhemaji, Dibrugarh and Tinsukia districts) of upper Assam (Fraser, 1921) <sup>[7]</sup>. More than one century later, re-recording of *N. pygmaea* from the study area infers that odonate diversity in this region is still maintaining its reputation up to some extent, in spite of many changes have been taking place in last hundred years. *N. pygmaea* is

generally found in open grassy and weedy vegetation along with forest edges where there is water bodies like river, stream, pond or drains nearby. A previous study shows that marshes with lots of sedge plants like most by this species and often seen perching at the tip of these plants. (Nurfahana, 2018) <sup>[16]</sup>. In this study *N. pygmaea* was found near an abandoned paddy field inside the Vivekananda Kendra Vidyalaya, Laipuli, Tinsukia campus which is close to Site-5. That area has not been using for cultivation since more than a decade. Yoon *et al.* (2010) <sup>[23]</sup> also observed that this species is adapted better in abandoned paddy fields which is in the early seral stage of plant succession; but, *N. pygmaea* disappears in that habitat where succession proceeds to its next level. Rapid vanishing of abandoned paddy fields from the study area due to high population pressure is an alarming threat for the conservation of this smallest dragonfly.



Fig 4: Odonate’s habitats in the study area

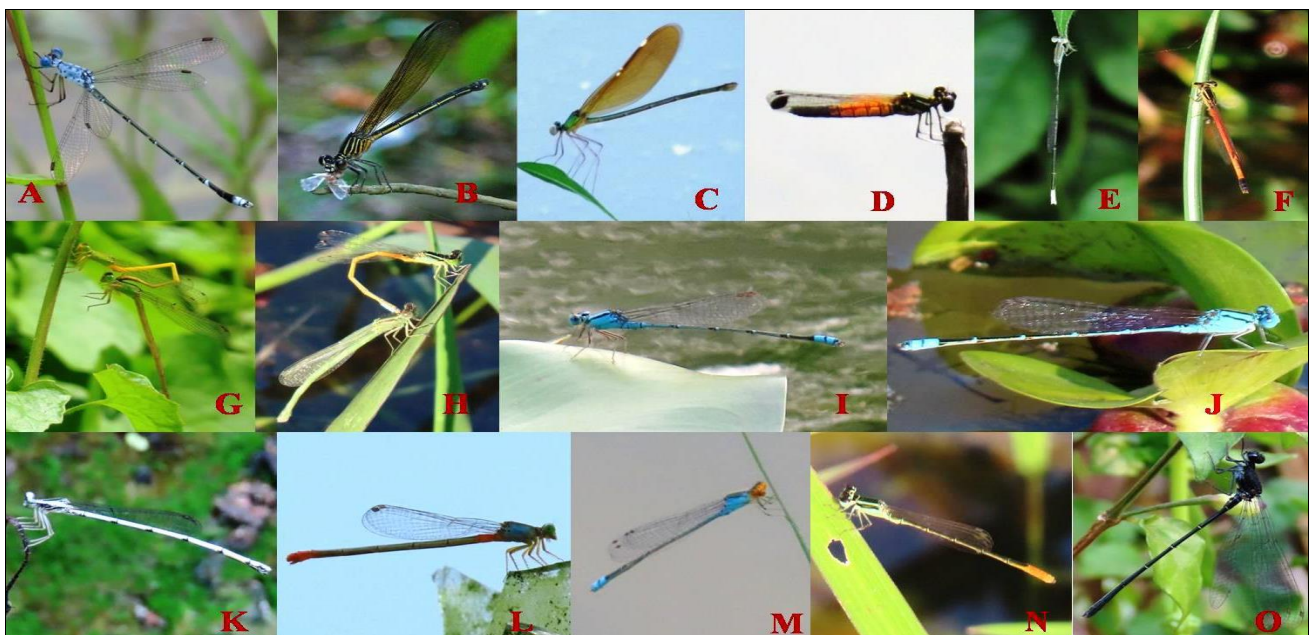
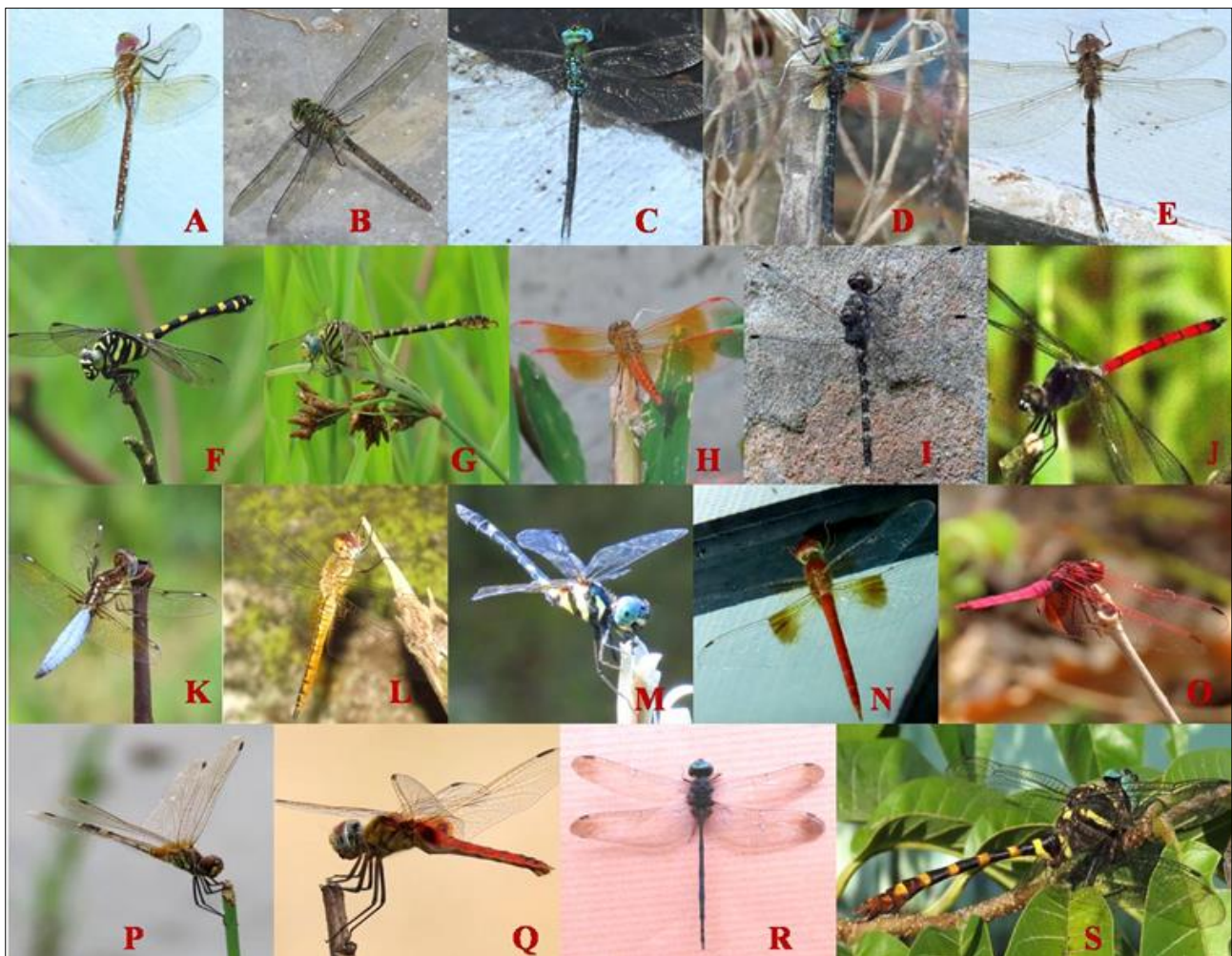


Fig 5: Some representative photographs of damselflies. A- *Lestes praemorsus*, B- *Euphaea ochracea*, C- *Neurobasis chinensis*, D- *Libellago lineate*, E- *Aciagrion pallidum*, F- *Ischnura rufostigma*, G- *Ceriagrion coromandelianum*, H- *Agriocnemis kalinga*, I- *Pseudagrion decorum*, J- *P. malabaricum*, K- *Copera marginipes*, L- *Ceriagrion cerinorubellum*, M- *Pseudagrion rubriceps*, N- *Agriocnemis femina*, O- *Onychargia atrociana* (Photographs by S. M. Das)



**Fig 6:** Some representative photographs of dragonflies. A- *Anaciaeschna jaspidea*, B- *Anax guttatus*, C- *Gynacantha bainbriggei*, D- *Gynacantha khasiaca*, E- *Gynacantha subinterrupta*, F- *Ictinogomphus rapax*, G- *Paragomphus lineatus*, H- *Brachythemis contaminata*, I- *Bradinopyga geminata*, J- *Lathrecista asiatica*, K- *Palpopleura sexmaculata*, L- *Pantala flavescens*, M- *Tetrathemis platyptera*, N- *Tholymis tillarga*, O- *Trithemis aurora*, P- *Trithemis pallidinervis*, Q- *Urothemis signata*, R- *Zygomma petiolatum*, S- *Eupophthalmia vittata* (Photographs by S. M. D)

## Conclusion

Being a predatory insect, odonates are helping to control many vector born diseases by eating those harmful insects. On the other hand, they are also a good source of food for other animals like birds, lizards, spiders, fishes etc. Dibru-Saikhowa Biosphere Reserve of Assam is already famous for its unique diversity for avifauna, especially for migratory birds (Dwivedi, 2009) [5]. Rich diversity with good population of odonate species in this biosphere reserve is probably an influencing factor for the local and migratory birds of this reserve. But, more scientific study is waiting to prove such relationship. It is worth mentioning that indiscriminate use of pesticide in the crop fields as well as in illegal fishing practices and habitat destruction for various construction and industrial activities is the major threats for odonates of this biosphere reserve. However, recently the importance and appropriateness of using invertebrate group for prediction of other taxa to be present in an ecosystem was well recognized (Oliver & Betti, 1993; Pearson, 1994) [17,19]. Hence, determining the level of diversity of invertebrate indicator groups like odonates in conservation and management of biodiversity in and around Dibru-Saikhowa Biosphere Reserve of Assam (India) should be a matter of prime concern.

## References

1. Adarsh CK, Aneesh KS, Nameer POI. A preliminary checklist of odonates in Kerala Agricultural University (KAU) Campus, Thrissur, Kerala, South India. *J Threat Taxa*,2014;6(8):6127-6137.
2. Baruah B, Gogoi MJ, Payra A, Das GN, Bartamuli M, Sharma R, *et al.* Diversity and habitat preference of Odonate Fauna (Insecta) in Kaziranga – Karbi Hills, Central Assam, North East India. *Ambient Sci*,2016;03(2):64-68.
3. Das SK, Ahmed AR, Sajan SK, Dash N, Sahoo P, Mohanta P, *et al.* Diversity, Distribution and Species Composition of Odonates in Buffer Areas of Similipal Tiger Reserve, Eastern Ghat, India. *Acad J Entomol*,2012;5(1):54-61.
4. Das SM, Gogoi T, Phukan M, *et al.* A checklist of Odonata (Insecta) of Dibrugarh district of Assam, India. *J Entomol Zool Stud*,2022;10(4):155-164.
5. Dwivedi KK (ed.). *Incredible Dibru-Saikhowa National Park*. Tinsukia, Assam: Dibru Saikhowa Conservation Society, 2009.
6. Dumont HJ, Vierstrate A, Vanfleteren JR, *et al.* A Molecular Phylogeny of Odonata (Insecta). *Syst Entomol*,2010;35:6-18.

7. Fraser FC. Indian dragonflies. *J Bombay Nat Hist Soc.*1921:27:492-498.
8. Fraser FC. Fauna of British India (Odonata), Ceylon and Burma. London: Tayler & Francis,1933:1:423.
9. Fraser FC. Fauna of British India (Odonata), Ceylon and Burma. London: Tayler & Francis,1934:2:398.
10. Fraser FC. Fauna of British India (Odonata), Ceylon and Burma. London: Tayler & Francis,1936:3:461.
11. Joshi S, Gassah R, Ismavel VA, *et al.* Dragonflies and Damselflies (Insecta: Odonata) of Karimganja District, Assam, India with four additions to the Indian Checklist. *Oriental Insects*, 2021. DOI:10.1080/00305316.2021.1982787.
12. Kalita GJ. A Survey for Odonates in Manas National Park. Technical Report No.9. Tinsukia, Assam: Field Director, Tiger Project, Manas, Govt. of Assam, 2014.
13. Kalita GJ, Ray SD, *et al.* Studies on the Diversity and Habitat Preference of Odonates in Deepor Beel Bird Sanctuary, Kamrup, Assam. *J Entomol Zool Stud*,2015:3(2):278-285.
14. Nair MV. Dragonflies and Damselflies of Orissa and Eastern India. Bhubaneswar: Wildlife Organisation, Forest and Environment Department, Government of Orissa, 2011.
15. Nongmaithem R, Lodhi MS, Samal PK, Dhyani PP, Sharma S, *et al.* Faunal Diversity and Threats of the Dibru-Saikhowa Biosphere Reserve: A study from Assam, India. *Int J Conserv Sci*,2016:7(2):523-532.
16. Nurfarhana HBH. *Nannophya pygmaea* Rambur, 1842 (Scarlet Dwarf). Malaysia Biodiversity Information System (MyBIS), 2018. Retrieved from <https://www.mybis.gov.my/art/219> on November 30, 2023.
17. Oliver I, Beattie A. A possible method for the rapid assessment of biodiversity. *Conserv Biol*. 1993:7:562-568.
18. Paulson D, Schorr M, Deliry C. World List of Odonata, 2022. Available from:<http://www.pugetsound.edu>. Accessed January 16, 2024.
19. Pearson DL. Selection of Indicator taxa for the quantitative assessment of biodiversity. *Phil Trans R Soc Lond*. 1994:345:74-79.
20. Royer RA, Jane AE, Newton WE, *et al.* Checklist and “Pollard Walk” butterfly survey methods on public lands. *Am Midl Nat*. 1998:140:358-371.
21. Subramonian KA. Dragonflies of India – A Field Guide. New Delhi: Vigyan Prasar, Department of Science and Technology, 2009.
22. Thakuria D. Diversity and Distribution of Odonates in Rani-Deepor Beel Landscape, Assam with special reference to the Life History of certain species. PhD thesis. Guwahati University, Assam, India, 2020.
23. Yoon J, Nam JM, Kim H, Bae YJ, Kim JG. *Nannophya pygmaea* (Odonata: Libellulidae), an Endangered Dragonfly in Korea, Prefers Abandoned Paddy Fields in the Early Seral Stage. *Environ Entomol*,2010:39(2):278-285. <https://doi.org/10.1603/EN09103>.
24. Websites assessed <http://www.indianodonata.org>. 20 November, 2023
25. <https://www.iucnredlist.org>. 3 December, 2023