



## Odonata of Lanao del Sur, Mindanao, Philippines

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Available online at: [www.isca.in](http://www.isca.in), [www.isca.me](http://www.isca.me)

Received 5<sup>th</sup> September 2013, revised 17<sup>th</sup> October 2013, accepted 15<sup>th</sup> December 2013

### Abstract

*Odonata is a good biological indicator species especially on fluvial ecosystems. Good faunistic data is crucial in order to use Odonata for habitat monitoring and conservation purposes. This research aims to determine the species diversity of the Odonata in selected freshwater systems in Lanao del Sur. Sampling using sweep nets and hand catching was done in nine sampling sites. Sampling was conducted on August 26-31, October 4-6, October 16-17 and December 16, 2012 for a total of 12 sampling days. Forty six species representing the first record for Lanao del Sur Province comprising 27 dragonflies and 19 damselflies were documented. Higher species richness ( $S=27$ ) was found in the upstream of Malaig River. Moderate species richness was found in eight sampling sites while low species richness was recorded in the lakeshore of Lake Dapao in Barangay Tuka.*

**Keywords:** Damselflies, dragonflies, freshwater, Lake Dapao, river.

### Introduction

Odonata (dragonflies and damselflies) is a useful indicator on the health of the ecosystem<sup>1</sup>. It consists of two suborders, the larger dragonflies belonging to the suborder Anisoptera and the more delicate ones, the damselflies, belonging to suborder Zygoptera<sup>2</sup>.

Zooplankton population<sup>3</sup>, phytoplankton communities<sup>4</sup>, and aquatic macroinvertebrates<sup>5</sup> are indicators of water quality. The Odonata is also known to be an excellent biological indicator of environmental conditions due to its sensitivity to changes in the environment. Occurrence of widespread species in stream habitats indicates disturbed environments<sup>6</sup>.

Distribution of Odonata species is determined largely by suitable habitats to maintain source population. In tropical countries like the Philippines, diversity of Odonata is highly dependent on the types of aquatic habitats in different forests<sup>6</sup>. The Philippines is recognized for its high number of endemic Odonata. More than 60% of the named species are endemic<sup>7</sup>. It also shares elements from both the Oriental and the Australasian region<sup>8</sup>. However, many species belong to the red list due to habitat fragmentation<sup>9</sup>.

Recent surveys in the Philippines contributed further to the odonatological data. Thirty-six species were recorded in Zamboanga del Sur<sup>6</sup>, 49 species in Lanuza and San Agustin, Surigao del Sur including two new species which are new Mindanao record,<sup>10</sup> and 22 species in Misamis Occidental<sup>11</sup>.

Despite various studies on Philippine odonata, several areas in the archipelago remain poorly explored. On the island of

Mindanao for instance, Lanao del Sur province does not have any data for Odonata<sup>12</sup>. This is very ironic considering that Lanao del Sur has one of the oldest lakes in the world with its network of extensive fluvial system, a suitable habitat for odonata<sup>13</sup>.

This study determined the species diversity and distribution of Odonata in nine sampling sites in Lanao del Sur, Philippines.

### Material and Methods

**Sampling and Processing of Samples:** Sampling was conducted on August 26-31, October 4-6, 16-17, and December 16, 2012 from 700 hours up to 1700 hours in nine selected sites of the two municipalities of Lanao del Sur province: Wato Balindong (sites 1-4) and Pualas (sites 5-9), Lanao del Sur (figure 1). Dragonflies and damselflies were collected through sweep nets, hand-grabbing and visual encounter surveys. The collection of Odonata was principally based on adult specimens.

Shannon's Diversity Index ( $H'$ ), Relative Abundance (RA), and evenness (E) were computed using Microsoft Excel. Samples collected were identified through published references and confirmed by the fourth author.

**Description of Sampling Sites:** Site 1, the upstream of Malaig river and falls is located in Wato Balindong, Lanao del Sur (7°55'40.0" North and 124°11'28.5" East). The area despite being locally popular can't be easily reached as it is located inside a mossy mountain forest. One has to trek along the stream to reach the falls or climb an almost 1000 feet steep hilly slope then traverse down to the stream entering a very thick

vegetation and forest trees. Very large old bamboo plants also abound the area. Despite the isolation of the place, plastic wastes and trash abound the area, left by excursionists that managed to trek down the falls. The area going up to the site is also lined with reforestation projects by the government. However the trees introduced in the area are non-indigenous species like *Shorea* sp. (Mahogany) and *Acacia* sp. trees which altered the natural ecosystem of the place.

Site 2, the midstream of Malaig river is located in Wato Balindong, Lanao del Sur (7°55'06.05" North and 124°12'09.79" East). Two hundred meters from this area are the human settlements of Barangay Salipongan. It has also been observed that small scale quarrying is being operated in this portion of the stream. Operators said that they have been quarrying in the stream for 30 years now.

Site 3, downstream and mouth of the Malaig river is located in Wato Balindong, Lanao del Sur (7°54'50.23" North and

124°12'43.47" East). Anthropogenic disturbances like stream modification and pollution were observed in the area.

Site 4, Lake Lanao lakeshore is located in Barangay Cadayunan and Barangay Bantuga-Wato, Lanao del Sur (7°54'38.71" North and 124°12'35.03" East). Fertilizers and pesticides are commonly used by farmers in the rice farms nearby. The downstream and mouth of the stream are littered with garbage and trash.

Site 5 is located in Barangay Purg, Pualas, Lanao del Sur (04°5'46" North and 124°4'27"). The area is the outflow of Lake Lanao. The stream has moderate flow of water and is surrounded by shrubs. Vehicles cross the stream as it is a way to get to another barangay in the place.

Site 6, the lakeshore of Lake Dapao is located in Barangay. Tuka, Pualas, Lanao del Sur (7°47'40.06" North and 124°03'53.51" East). This is an open area with grassland, cornfield, and marshes but some parts were observed to be muddy.

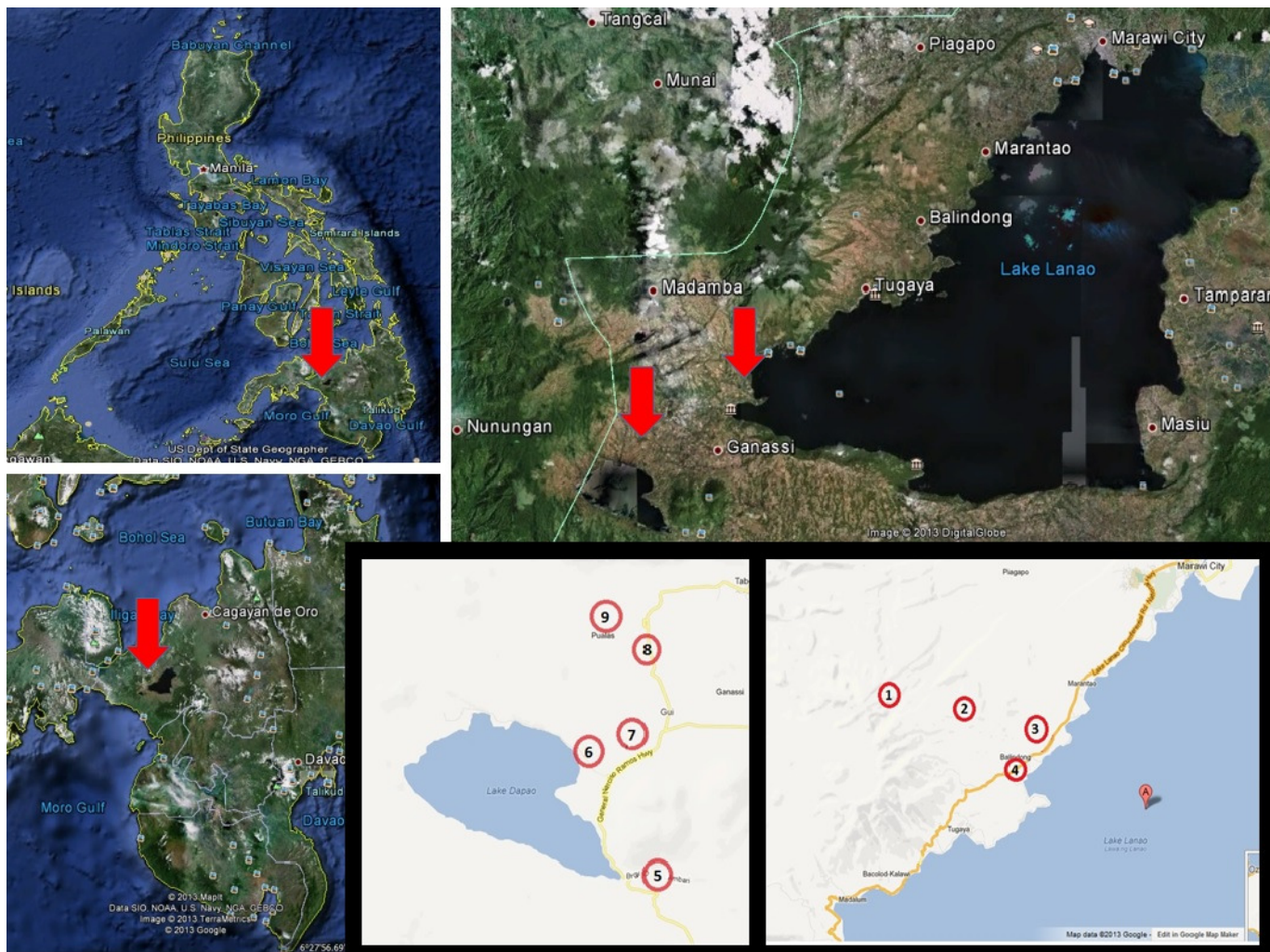


Figure-1  
 Sampling sites in Lanao del Sur<sup>14</sup>

Site 7 is located in Barangay Danugan, Pualas, Lanao del Sur (07°47'24.14" North and 124°4'25.55" East). The spring serves as the only water source for drinking and other usage. The area is covered with forest patches and is well vegetated with trees. Human settlements are far enough from the spring, however, the spring is still well-visited since people come to the place to get water despite the water pipes that were installed from the spring to the houses.

Site 8 is located in Barangay Ingud, Pualas, Lanao del Sur (31°49'7.83" North and 24°04'124.1" East). The area is covered with grassland and is an open field that is partly covered with trees and shrubs. The stream used to be a good source of water in the barangay, but it is currently close to drying up.

Site 9 is located in Barangay Talambu, Pualas, Lanao del Sur (7°47'10.81" North and 124°4'44.64" East). This is an open area with a small stream surrounded by shrubs and ditches.

## Results and Discussion

Forty- six species of Odonata under eleven families and 35 genera were identified (27 Anisoptera and 19 Zygoptera) (table 1). All species represent the first record for the province. Seven out of nine sampling sites (sites 2, 3, 4, 5, 6, 8, and 9) were relatively disturbed areas with low species richness (S=5-13). High species richness was recorded in sites 1 (27 species) and 7 (22 species) which are both observed to be mossy mountain forests and are well-vegetated areas. Odonata has preference for dense forest, undisturbed vegetation, optimum temperature and presence of aquatic habitat<sup>15</sup>.

Mountainous areas like sites 1 and 7 with higher species richness provide greater potential for survival as well as diversity of habitats<sup>7</sup>. The higher species richness in the dipterocarp forest than in modified habitats and agro ecosystem indicates that the Odonata prefers forested and undisturbed areas<sup>10</sup>. Small water bodies are ecologically important because they support specific and important hydrological, chemical and biological processes<sup>9</sup>.

*Orthetrum pruinosum clelia*, *O. Sabina sabina*, and *O. Testaceum testaceum* were observed to be abundant in the study areas. *O. p. clelia* is a very common dragonfly of wells, ponds, ditches, tanks and rivers, and also widely distributed across parts of its range<sup>16,17</sup>. *O. Sabina* is a common and widespread species that is tolerant of disturbed areas<sup>18</sup>. Most of *O. s. Sabina* was found in disturbed areas near human settlements and altered fields, and open fields like those in Barangay Tuka (site 6) and Barangay Ingud (site 8). All the three species above belong to family Libellulidae, which is the most diverse group of Odonata that breeds in a wide variety of aquatic habitats like puddles, ponds, marshes, rivers, domestic storage tanks and aquaria<sup>16</sup>. Odonata appears to have specific habitat features<sup>19</sup>. For instance, Families Gomphidae and Libellulidae are mainly

associated with run habitats and Family Coenagrionidae which occurs mainly in riffles<sup>20</sup>. The highest number (S=22) of species collected in this study was under Family Libellulidae, suborder Anisoptera. Most of the sampling areas were observed to be less turbulent which are the preferred habitat of Family Libellulidae.

A 50% endemism (23 out of 46 species) was recorded in this study. A higher number of endemic species in Suborder Zygoptera (15 Philippine endemic) was recorded than in Suborder Anisoptera (8 Philippine endemic). Similar findings of higher endemism in Suborder Zygoptera than Suborder Anisoptera were observed in Zamboanga del Sur with 3 Anisoptera and 13 Zygoptera, in Lanuza and San Agustin, Surigao del Sur with 1 Anisoptera and 22 Zygoptera, and in Misamis Occidental Province with two Anisoptera and five Zygoptera<sup>6,10,11</sup>.

Figure 2 shows the evenness and species diversity in nine sampling sites. Site 1, which was observed to be not prone to human disturbance because it is located in a mossy mountain forest showed higher species diversity compared to the other eight sampling sites. Communities with low competitive displacement have high diversity<sup>21</sup>. Species diversity is affected by the type of environment and the characteristics of freshwater systems the organism inhabits, hence, Odonata exhibits a wide range of different habitat preference even between closely related species<sup>22</sup>. Another factor that contributes to the low diversity in some areas is the water quality. The lake's water quality like that of site 6 was disturbed due to human waste released into the lake. Odonata usually has definite habitat preference and territorial behavior<sup>8</sup>. A good quality of aquatic environment is correlated with high species diversity<sup>23</sup>.

Evenness value closer to 1 indicates even distribution while a value closer to 0 means that there is a dominant species<sup>24</sup>. All nine sites appeared to have an even distribution indicating that there is no competition among the species. A decrease in evenness is a result of increased competition<sup>12</sup>. Evenness value is influenced mainly by the competition of species for food and territory within an area.

## Conclusion

High endemism of Odonata (50%) was recorded in Lanao del Sur province which indicates that more Odonata species could be recorded by exploring other relatively undisturbed areas in Lanao del Sur.

## Acknowledgement

The authors would like to acknowledge the Department of Environment and Natural Resources of the Autonomous Region of Muslim Mindanao for the gratuitous permit and the people of Pualas and WatoBalindong for their cooperation and support in the collection of samples.

**Table-1**  
**Species Richness, Endemic species and Distribution of Odonata in nine sampling sites**

Species name	Malaig River, Wato Balindong				Lake Dapao, Pualas					Total
	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	
	Up stream	Mid stream	Down stream/ Mouth of the river	Lake Lanao	Brgy. Purg	Brgy. Tuka	Brgy. Danugan	Brgy. Ingud	Brgy. Talambuu	
<b>Suborder Anisoptera</b>										
<b>Family Corduliidae</b>										
<i>Epophthalmia vittigera vittigera</i> (Rambur, 1842)	-	-	-	2	-	-	-	-	-	2
<i>Hemicordulia mindana mindana</i> * (Needham & Gyger, 1937)	-	-	-	-	-	-	1	-	-	1
<i>Heteronaias heterodoxa</i> * (Selys, 1878)	4	-	-	-	-	-	-	-	-	4
<i>Idionyx Philippa</i> * (Ris, 1912)	1	-	-	-	-	-	3	-	-	4
<b>Family Gomphidae</b>										
<i>Ictinogomphus tenax</i> * (Hagen, 1854)	-	-	-	2	2	1	1	-	-	6
<b>Family Libellulidae</b>										
<i>Acisoma panorpoides panorpoides</i> (Rambur, 1852)	-	-	1	-	-	-	2	-	-	3
<i>Aethriamanta gracilis</i> (Brauer, 1878)	4	2	1	5	-	-	-	-	-	12
<i>Brachydiplax chalybea chalybea</i> (Brauer, 1868)	-	-	-	1	-	-	-	-	-	1
<i>Crocothemis servilia servilia</i>	-	-	-	-	-	2	-	-	-	2
<i>Diplacina bolivari</i> * (Selys 1882)	6	3	-	-	-	-	-	-	-	9
<i>Diplacina braueri</i> * (Selys, 1882)	-	-	-	-	2	-	2	-	-	4
<i>Diplacina nana</i> * (Brauer, 1868)	-	-	-	-	-	-	2	-	-	2
<i>Diplacodes trivialis</i> (Rambur, 1842)	-	-	4	-	-	-	-	-	-	4
<i>Macrodiplax cora</i> (Brauer, 1867)	5	2	1	-	-	-	-	-	-	8
<i>Neurothemis terminate terminate</i> (Ris, 1911)	1	-	-	4	-	-	-	-	-	5
<i>Neurothemis ramburii ramburii</i> (Brauer, 1868)	1	0	-	-	1	-	5	3	2	12
<i>Orthetrum pruinosum clelia</i> (Selys, 1878)	2	-	-	-	3	2	13	13	8	41
<i>Orthetrum Sabina sabina</i>	1	-	-	6	-	11	2	15	2	37
<i>Orthetrum testaceum testaceum</i> (Burmeister, 1839)	-	-	-	1	-	-	4	15	6	26
<i>Pantala flavescens</i> (Fabricius, 1798)	-	-	-	1	-	-	-	-	-	1

<i>Potamarcha congener</i> (Rambur, 1842)	-	-	-	1	-	-	-	-	-	1
<i>Tetrathemis irregularis irregularis*</i> (Brauer, 1868)	1	-	-	-	-	-	-	-	-	1
<i>Tholymis tillarga</i> (Fabricius, 1798)	1	-	1	-	-	-	-	-	-	2
<i>Trithemis aurora aurora</i> (Burmeister, 1839)	-	-	-	-	-	-	2	-	-	2
<i>Trithemis festiva</i> (Rambur, 1842)	2	-	-	-	-	-	-	1	-	3
<i>Urothemis signata bisignata</i> (Brauer, 1868)	1	-	-	-	-	-	-	-	-	1
<i>Zyxomma obtusum</i> (Albarda, 1881)	1	-	-	7	-	-	-	-	-	8
<b>Suborder Zygoptera</b>										
<b>Family Calopterygidae</b>										
<i>Vestalis melania*</i> (Selys, 1873)	7	4	-	-	4	-	6	-	-	21
<b>Family Chlorocyphidae</b>										
<i>Cyrano angustior*</i> (Hämäläinen, 1989)	3	1	-	-	-	-	-	-	-	9
<i>Rhinocypha colorata*</i> (Hagen in Selys, 1869)	3	4	3	-	2	1	8	1	2	24
<i>Rhinocypha turconii*</i> (Selys, 1891)	15	9	-	-	-	-	-	-	-	24
<b>Family Euphaeidae</b>										
<i>Euphaea amphicyana*</i> (Ris, 1930)	3	-	-	-	-	-	-	-	-	3
<b>Family Coenagrionidae</b>										
<i>Agriocnemis femina femina</i> (Brauer, 1868)	3	-	-	-	-	-	-	-	-	3
<i>Agriocnemis rubescens intermedia</i>	4	-	-	-	-	-	2	-	-	6
<i>Ceriagrion lieftincki*</i> (Asahina, 1967)	4	-	1	2	-	-	16	-	-	23
<i>Pericnemis spn*</i>	-	-	-	-	-	-	1	-	-	1
<i>Pseudagrion microcephalum</i> (Rambur, 1842)	-	-	1	1	-	-	-	-	-	2
<i>Pseudagrion pilidorsumpilidorsum</i> (Brauer, 1868)	3	2	2	3	2	-	2	3	6	23
<i>Teinobasis annamaijiae*</i> (Hämäläinen & Muller, 1989)	1	-	-	-	-	-	-	-	-	1
<i>Teinobasis filamentum*</i> (Needham & Gyger, 1939)	-	-	-	-	-	-	1	-	-	1
<b>Family Platycnemididae</b>										
<i>Coeliccia exoleta*</i> (Lieftinck, 1961)	1	-	-	-	-	-	-	-	-	1
<i>Risioecnemis flammea*</i> (Selys, 1882)	-	-	-	-	-	-	6	-	-	6
<i>Risioecnemis tendipes*</i>	-	-	-	-	-	-	7	-	-	7

(Needham & Gyger, 1941)										
<b>Family Platystictidae</b>										
<i>Drepanosticta lestoides</i> * (Brauer, 1868)	-	-	-	-	-	-	1	-	-	1
<b>Family Protoneuridae</b>										
<i>Prodasineura integra</i> * (Selys, 1882)	2	-	-	-	1	-	2	-	3	8
<b>Family Megapodagrionidae</b>										
<i>Rhinagrion reinhardi</i> * (Kalkman & Villanueva, 2011)	1	-	-	-	-	-	-	-	-	1
<b>Total number of individuals</b>	81	27	15	36	17	17	89	51	34	367
<b>Total number of species</b>	27	8	9	13	8	5	22	7	8	46
<b>Total number of endemic species</b>	14	4	2	2	5	2	14	1	3	23

Legend: \* - Philippine endemic

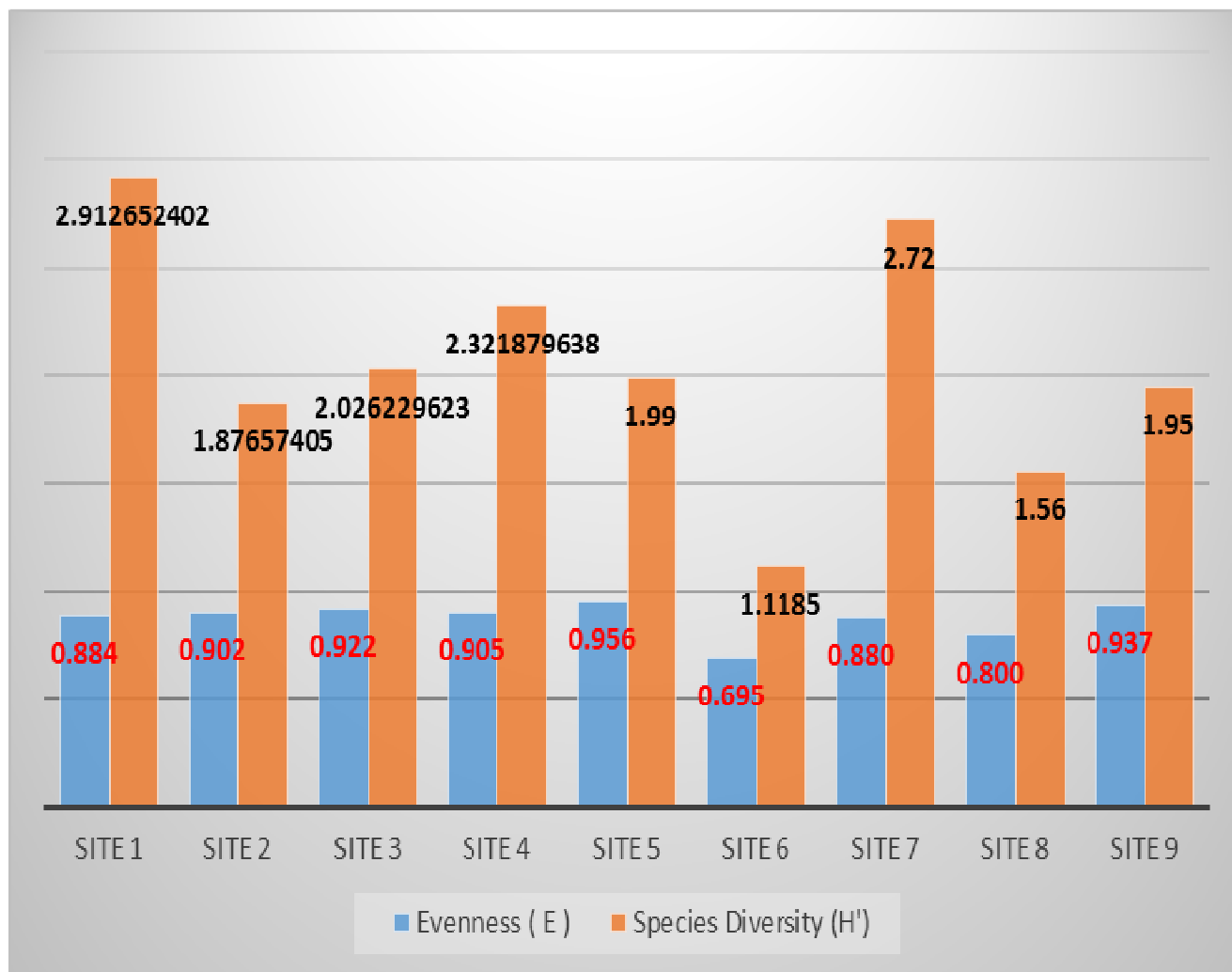


Figure-2  
 Graph showing the Evenness (E) and Species Diversity (H') of Odonata in each site

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