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Odonata of Island Garden city of Samal and its Relation to other Small Islands in the Philippines

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Abstract

The first record of odonata fauna in the Island Garden City of Samal is presented with comparison to other small islands in the Philippines. Opportunistic and photo documentation were employed in all fluvial systems surveyed between April 2014 to April 2015. Thirty one (31) species belonging to 7 families and 22 genera was recorded. Twelve species (12) or 39% are zygopterans and 19 species or 61% are anisopterans. A relatively low level of endemism (35%) is recorded which is attributed to the different habitat modifications of its fluvial systems. Kroeber's percentage of similarity revealed Island Garden City of Samal shares similar odonata species with Siargao and Saranggani Islands characterized by karst ecosystem with low lying topography. Creation of local policy to protect the head waters where most of the endemic species found is urgently needed.

Keywords: Odonata, survey, karst, conservation, Samal.

Introduction

Odonata are not only aesthetically pleasing insects inhabiting our rivers and lakes but also serve as bio-indicators of water and habitat qualityand control insect-borne diseases[1,2]. Hämäläinen[3] reported the Philippines as one of the 17 mega diverse countries in the world and a home to 300 odonata species of which 90% are mostly Zygopterans and 40% Anisopterans. Mindanao the second largest island in the country holds 130+ species[3]. Hämäläinen and Muller[4] provided the most comprehensive account of the odonata species in various islands of the country and later Villanueva provided more updated records[5-8]. However many islands remain unexplored including the Island Garden City of Samal (IGACOS).

The Island Garden City of Samal (IGACOS) is one of the small islands belonging to the Mindanao faunal region. It is a 300km^2 with unique geologic position bordered by Davao del Sur and Davao City on the west, Compostela Valley Province on the north, and Davao Oriental on the east where Mount Hamiguitan Range Wildlife Santuarya UNESCO World Heritage is located. It is relatively flat with no defined mountains and its highest elevation is only 410 masl. It has only two major river systems, Tagbaobo River and Binoling River. The island receives fair rainfall all throughout the year with no pronounced dry or wet season[9].

Recently the island is gaining popularity as one of the major tourist destinations in Region XI. With the recent transformation of the island into a tourist destination, much of the island's forested land is transformed into commercial and agricultural purposes. More importantly, its fluvial systems are transformed into commercial tourist destination. Cottages and other amenities were built inside Tagbaobo and Binoling Rivers which may cause disturbance to its Odonata inhabitants which is virtually unknown until the 2014-2015 Odonata expedition in the island. This paper provided the first list of Odonata in Samal Island and comparison to other small islands in the Philippines is also presented.

Material and Methods

Opportunistic and photo documentation were employed in the following fluvial systems, Sampao Falls, Tagbaobo River in Barangay Tagbaobo (7°0'25"N 125°46'43"E), Hagimit Falls, Binoling River in Barangay Cawag (7°3'43.2"N 125°43'44.4"E), Bagsak Lake in Barangay Aumbay (7°3'0"N 125°45'52.2"E) and Bangkalan Lake in Barangay San Agustin the months of April 2014 and April 2015. Species were collected by hand-picking and hand netting for elusive species. Vouchers were soaked for 24 hours in acetone, air dried, and placed in individual paper triangles. Endemicity and conservation status were obtained using the IUCN Red List of Threatened Species.

Results and Discussion

Thirty one (31) species belonging to seven (7) families and twenty two (22) genera were documented. Twelve (12) or thirty nine percent (39%) are zygopterans and nineteen (19) or sixty one percent (61%) are anisopterans. Family Libellulidae comprised majority of the species 17 followed by Coenagrionidae (7 spp.), and Platycnemididae and Gomphidae

with 2 species each and the rest of the families Platystictidae, Protoneuridae and Chlorocyphidae represented by only 1 species (table-1).

High representation of the Oriental species from family Libellulidae like *Orthetrum pruinosum clelia, Diplacodes trivialis, Neurothemis ramburii, N. terminata, Trithemis aurora, Trithemis festiva, Brachydiplax chalybea chalybea* and *Acisoma panorpoides* was observed in fluvial systems which experience various modifications such as establishment of resorts, human habitation, and agricultural use. Family Libellulidae is known as one of the largest families that dominate standing water and have high tolerance to anthropogenic disturbances. They dominate lentic ecosystems of Bangkalan and Bagsak Lakes which are gradually converted into agro-ecosystems.

Few endemic species *Drepanosticta flavomaculata, Risiocnemis tendipes, Risiocnemis atripes, Gomphidia kirschii, Diplacina bolivari, Diplacina braueri* were recorded from near water sources with few vegetated parts of Sampao Falls, Tagbaobo and Binoling River. The presence of endemic species at the water sources in the island calls for an alarming imbalance ecosystems. These water sources served as the remaining haven of these endemic species[10] that urgently needs protection. Continuous modification up to the water sources of each fluvial system would lead to site extinction of endemic species which is crucial to the future of IGACOS ecosystem.

Among of the fluvial systems surveyed Sampao Falls and Tagbaobo River host most number of endemic species. This can be attributed to the remaining thick vegetation fragments to some parts of Sampao Falls and Tagbaobo River. The high endemism level in Sampao Falls and Tagbabo River showed that zygopteran species mostly endemic prefer shaded fluvial systems[11]. The low number of endemic species found in Binoling River implies the detrimental effect of anthropogenic disturbances like the commercialization of the falls into resort and human habitation. Likewise with Bagsak and Bangkalan lakes which are now converted into agricultural uses.

Eleven out of 31 species or thirty five percent (35%) are endemic of which 8 are found distributed in the Philippines and 3 species are confined to Mindanao. This is relatively lower compared to other islands in the Philippines which have a comparable size to IGACOS like Babuyan Group and Siargao Islands as recorded by Villanueva[5,8] with endemism levels of 45% and 38% respectively. However, its species richness does not lag behind other islands except for Siargao Island which has 47 recorded species. Among of the small islands with relatively low level of endemism compared to IGACOS are Batanes Group of islands and Saranggani with 13% and 18% endemism[5,6]. Villanueva[6] attributed the low endemism of Saranggani to the low topography of the island which is not favorable for surface flowing water and various anthropogenic disturbances the island experiences which is very similar with Island Garden City of Samal.

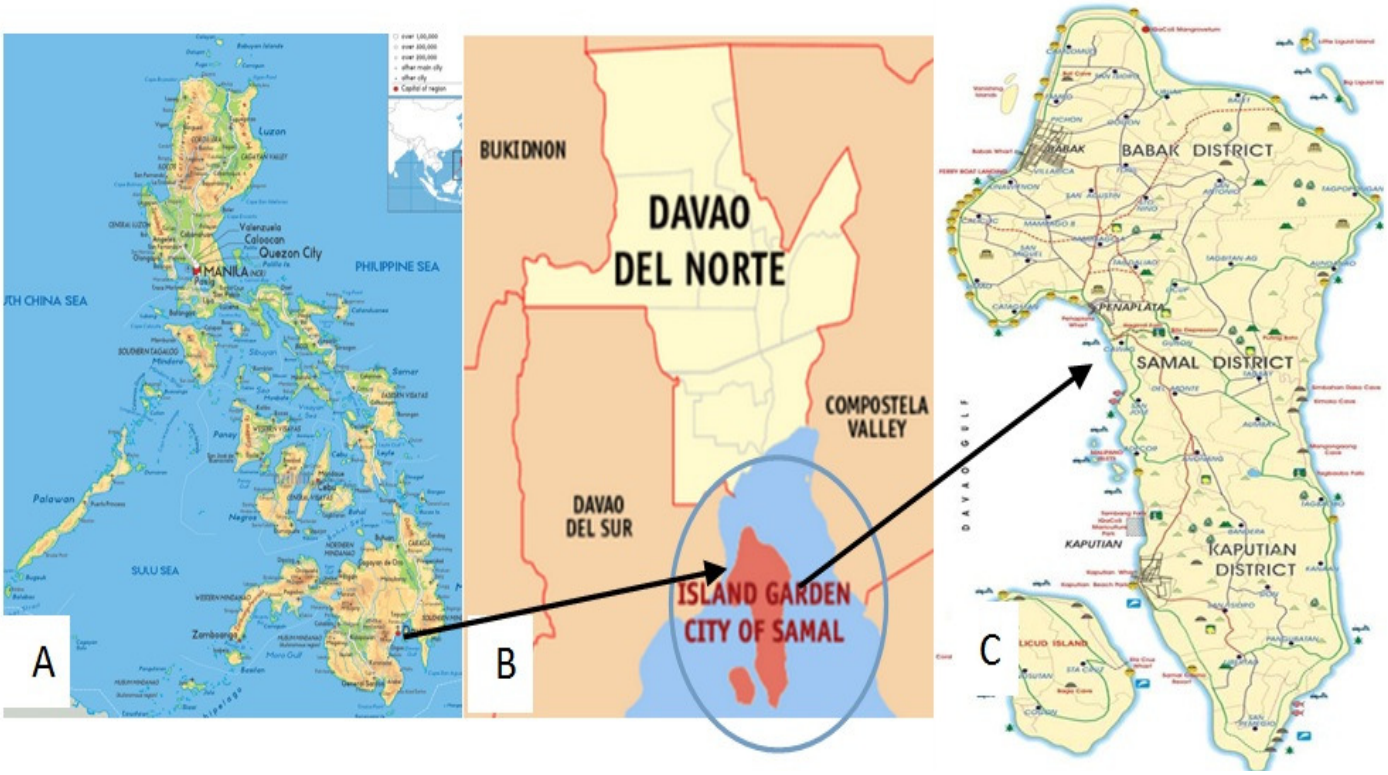

Figure-1
Map of the A. Philippines, B. IGACOS location in Mindanao and C. IGACOS

Table-1
List of Odonata Species in IGACOS with their Geographical Distribution

Family	Species	Geographic Distribution
Chlorocyphidae	*Rhinocypha colorata* (Hagen *in* Selys, 1869)	Philippine Endemic
Coenagrionidae	*Agriocnemis f. femina* (Braeur, 1868)	Oriental
	Argiocnemis rubescens intermedia	Oriental
	Coeriagrion lieftincki (Asahina 1967)	Philippine endemic
	Ishnura senegalensis (Rambur 1842)	Oriental
	Pseudagrion pilidorsum (Brauer, 1868)	Oriental
	Pseudagrion microcephalum (Rambur 1842)	Oriental
	Teinobasis samaritis (Ris 1915)	Philippine Endemic
Platycnemididae	*Risiocnemis appendiculata* (Brauer, 1868)	Mindanao Endemic
	Risiocnemis atripes (Needham & Gyger, 1941)	Mindanao Endemic
Platystictidae	*Drepanosticta flavomaculata* van (Tol 2005)	Mindanao Endemic
Protoneuridae	*Prodasineura integra* (Selys, 1882)	Philippine Endemic
Gomphidae	*Gomphidia kirschii* (Selys, 1878)	Philippine Endemic
	Heliogomphusbakeri (Laidlaw, 1925)	Philippine Endemic
Libellulidae	*Acisoma p. panorpoides*(Rambur, 1842)	Oriental
	Agrionoptera insignis (Rambur, 1842)	Oriental
	Brachydiplax chalybeachalybea (Brauer, 1868)	Oriental
	Crocothemis s. servilia (Dury, 1770)	Oriental
	Diplacina bolivari (Selys, 1882)	Philippine Endemic
	Diplacina braueri (Selys, 1882)	Philippine Endemic
	Diplacodes trivialis (Rambur, 1842)	Oriental
	Neurothemis ramburii (Brauer, 1866)	Oriental
	Neurothemis terminate (Ris, 1911)	Oriental
	Orthethrum pruinosum clelia (Selys, 1878)	Oriental
	Orthethrum Sabina Sabina (Drury, 1770)	Oriental
	Pantala flavescens (Fabricius, 1798)	Oriental
	Potamarcha congener (Rambur, 1842)	Oriental
	Ryothemis Phyllis subphylas (Sulzer, 1776)	Oriental
	Tetrathemi sirregularis irregularis (Brauer 1868)	Oriental
	Trithemis aurora (Burmeister, 1839)	Oriental
	Trithemis festiva (Rambur, 1842)	Oriental
TOTAL	31	

Table-2
Odonata fauna of IGACOS and other small islands in the Philippines

	IGACOS (300km^2)	**Babuyan Group (50-196km^2)**	**Balut Island (80km^2)**	**Batanes Group (203 km$^{2)}$**	**Bucas Grande (130km^2)**	**Siargao Island (436km^2)**	**Saranggani Island (70km^2)**
Total Species Recorded	31	29	23	30	24	47	17
% of Endemism	35%	45%	26%	13%	38%	38%	18%
# of Species Shared	-	17	15	10	14	23	13
# of Species Not Shared	-	12	8	20	10	24	4
Kroeber's % of Similarity	-	56.73%	56.8%	32.79%	51.75%	61.65%	59.2%

Kroeber's percentage of similarity shows odonata of IGACOS is most similar to Siargao and Saranggani Islands which are also karst ecosystems and have almost the same topographic description mainly low lying and no considerable high elevation. Among of the taxa shared by the different islands compared are the Oriental species from the family Libellulidae indicating high distribution of this family to the different parts of the archipelago (table-3). For Zygoptera *Rhinocypha colorata* and *Agriocnemis femina* are abundantly distributed in all islands compared (table-3). Most of the taxa not shared are the endemic zygopterans like *Euphaea refulgens, Amphicnemis dentifier, Neurobasis sp. (luzonensis)* and possible island endemic *Drepanostica sp., Risiocnemis atripes* which are confined to specific islands. Siargao hosts the most unique species not found in other islands like *Pseudagrion schieli, Teinobasis filamentum, Lestes p. praemorsus and Gynacantha bayadera.*

The unique species found in IGACOS not shared with other islands include the endemic species *Risiocnemis atripes,* and *Gomphidia kirschii* of which the latter is rare in most islands in the Philippines except Polillo[7]. No island endemic species is recorded in IGACOS.

Conclusion

The endemic species observed in the semi-forested area of Sampao Falls and Tagbaobo River is a good indication that the island still hosts a few endemic species. However, the dominance of Oriental species mainly from Libellulidae in almost all fluvial systems surveyed indicates detrimental effect of various habitat modifications like resorts, human habitation, and clearing of forest for agricultural use. An immediate conservation effort such as the creation of a policy to protect the head water sources where most of the endemic species were found is urgent.

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Table-3
Species comparison in different small islands in the Philippines

Species	**Samal Island**	**Babuyan Group**	**Balut Island**	**Batanes Island**	**Bucas Grande**	**Siargao**	**Saranggani Island**
Zygoptera							
Rhinocypha colorata (Hagen *in* Selys, 1869) PE	√	√	√	√	√	√	-
Agriocnemis f. femina (Braeur, 1868) O	√	√	√	√	√	√	√
Agriocnemis pygmea (Rambur,1842) O	-	√	-	√	√	√	-
Agriocnemis rubescens intermedia (Selys, 1877) O	√	√	-	-	√	√	-
Coegriagrion lieftincki (Asahina, 1967) PE	√	-	-	-	√	√	-
Ishnura senegalensis (Rambur,1842) O	√	√	-	√	-	-	-
Pseudagrion pilidorsum (Brauer, 1868) O	√	√	√	√	-	√	-
Pseudagrion microcephalum O	√	-	-	√	-	√	-
Pseudagrion schieli ME	-	-	-	-	-	√	-
Teinobasis samaritis PE	√	√	√		-	-	√
Teinobasis sp. (cf. samaritis) PE	-	√		√	-	-	-
T. filamentum PE	-	-	-	-	-	√	-
T. sp.cf. filamentum PE	-	-	-	-			√
T. olivaceous	-	-	-	-	√	√	-
Xiphiagrion cyanomelas	-	-	-	-		√	-
Risiocnemis appendiculata (Brauer, 1868) ME	√	-	-	-	√	√	-
R. eryhtrura ME	-	-	-	-	-	√	-
R. flammea ME	-	-	-	-	-	√	-
R. fuligifrons ME	-	-	-	-	-	√	-
R.atripes (Needham & Gyger, 1941) ME	√	-	-	-	-	-	-
Drepanosticta flavomaculata ME	√	-	-	-	-	-	√
D. schorri ME	-	-	-	-	√	√	-
Drepanosticta sp.nov. 1	-	√	-	√	-	-	-
Drepanosticta sp. nov. 2	-	-		√	-	-	-
Prodasineura integra (Selys, 1882) PE	√	-	√	-	-	√	-

Euphaea refulgens PE	-	√	-	-	-	-	-
Neurobasis sp. (luzonensis) PE	-	√			-	-	-
Amphicnemis dentifier	-	-	-	-	-	√	-
Amphicnemis sp.	-	√	-	-	-	√	-
A.lestoides	-		-	-	√	√	-
Lestes p. praemorsus	-		-	-	-	√	-
Anisoptera							
Anaxguttatus	-	-	√	-	-	-	-
Gynacantha sp.	-	-	√	-	-	-	-
G. bayadera O	-	-	-	-	-	√	-
Gomphidia kirschii (Selys, 1878) PE	√	-	-	-	-	-	-
Heteronias heterodoxa PE	-	√	√	-	-	-	-
Idionyxy olanda	-	-	√	-	-	-	-
Idionyx salva	-	√	-	-	-	-	-
Heliogomphus bakeri (Laidlaw, 1925) PE	√	-	-	-	-	√	-
Acisoma p. panorpoides (Rambur, 1842) O	√	-	-	-	√	√	-
Agrionoptera Insignis (Rambur, 1842) O	√	√	√	√	√	√	√
Brachydiplax chalybea O	√	-	-	-	-	√	-
Camacinia gigantea	-	-	-	-	-	√	-
Cratillalinea taassidua O	-	-	-	-	-	√	-
Crocothemis s. servilia (Dury, 1770) O	√	-	-	-	-	√	-
Diplacina bolivari (Selys, 1882) PE	√	√	√	-	-	√	√
Diplacina braueri (Selys, 1882) PE	√	√	-	-	√	√	-
D. lisa PE	-	√	-	-	-	-	-
D. nana PE	-		-	-	√	√	-
Diplacodes trivialis (Rambur, 1842) O	√	√	√	√	√	√	√
Hydrobasileus croceus	-	-	-	-	√	-	-
Lathrecista a. asiatica (Fabricius, 1798) O	-	-	√	-	√	-	√

*Lyriothemis*sp. cf. *hirundo* Ris, 1913	-	-	√	-	-	-	-
Nannophyapygmea	-	-	-	-	√	-	-
Neurothemisramburii (Brauer, 1866) O	√	√	√	√	-	√	√
Neurothemis terminata (Ris, 1911) O	√	√	√	-	√	√	√
Onychothemis abnormis	-	√	-	-	-	-	-
Orthethrum pruinosum clelia (Selys, 1878) O	√	√	√	√	√	-	√
Orthethrum Sabina Sabina (Drury, 1770) O	√	√	√	√	-	√	√
Orthetrum t. testaceum (Burmeister, 1839) O	-	√	√	-	√	√	√
Pantala flavescens (Fabricius, 1798) O	√	√	√	√	√	√	√
Potamarcha congener (Rambur, 1842) O	√	-	√	-	√	√	√
Ryothemis Phyllis subphylis O	√	-	-	-	-	√	-
Ryothemisregia O	-	√	-	-	-	-	-
Tholymis tillarga O	-	-	-	-	-	√	-
Tetrathemis irregularis irregularis(Brauer, 1868) PE	√	√	-	-	-	√	-
Trithemis aurora (Burmeister, 1839) O	√	-	-	-	-	-	-
Trithemis adelpha O	-	-	-	-	-	√	-
Trithemis festiva (Rambur, 1842) O	√	-	√	-	√	√	√
Tramea transmarinaeuryale O	-	√	-	√	-	-	-
Tramea virginia O	-	-	-	√	-	-	-
Zyxommaobtusum Albarda, 1881O	-	-	√	-	-	√	√
Zyxomma petiolatum Rambur, 1842 O	-	-	-	-	-	√	-
Total Species	31	29	23	30	24	47	17