Presented at the DLSU Research Congress 2017
De La Salle University, Manila, Philippines
June 20-22, 2017

The Arthropod Diversity in Aquatic Ecosystem in Biñan City, Laguna, Philippines

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Abstract: The arthropod diversity in the aquatic ecosystem in De La Salle University – Science and Technology Center, Binan City, Laguna, Philippines was determined to provide additional information on the aquatic macroinvertebrates that can aid in the preservation and monitoring of aquatic habitats. In the study, a total of 711 different arthropods were collected, of which 452 (63.57%) came from river ecosystem and 259 (36.43%) came from river banks. Of the total collection, 702 (98.73%) were insects and 9 (1.27%) were spiders. The diversity index revealed that there is a low arthropod diversity with a range of H^1= 1.28-2.47 in the aquatic ecosystem. The river ecosystem has H^1=1.28 and the river banks has H^1=2.47. The index of dominance (D) in the river is 0.38 and in the river banks is 0.12 and the index of equitability (E) in the river is 0.06 and in the river banks is 0.03. The Sorensen's Index of Similarity (IS) indicated a low 21.62% (4 families) of taxa commonly shared between the river ecosystem and river banks. The relative densities of each family of arthropods showed the dominance of the species belonging to Gerridae, Veliidae and Culicidae.

Key Words: diversity; dominance; Gerridae; Veliidae; Culicidae

1. INTRODUCTION

Observing biodiversity at the ecosystem level is a general approach of appreciating and evaluating the natural richness of the Philippines, taking in concern the active ecological roles and relationships of both the biotic and the abiotic parts of the biosphere within a given location, as well as the influences of natural occurrences and environmental changes caused by humans. Rivers and streams, lakes and reservoirs, and artificial fishponds are examples that fall into the three respective categories (Carpenter and Springer, 2004). All of these are determined by low-salinity water that flow from the natural rainwater catch basins shaped by forests. This type of ecosystem commonly serves the purposes and benefits of fisheries and agriculture (Sinha and Heany, 2006).

One of those river systems is the Biñan River which is located south of Metro Manila and is one of the tributary rivers of Laguna de Bay, the largest and most important freshwater resource in the Philippines (Laguna Lake Development Authority, 1995; Laguna Lake Development Authority 2005).

The most diverse and abundant group of multicellular life found in various ecosystems, more generally on Earth, is represented by arthropods. Habitat patches alongside river systems are often extremely isolated and categorized by high degree of heterogeneity at various spatio-temporal scales (Martin et al., 2015).

The interrelationship among the populations of river bank arthropod directly connecting the river channel is often significantly distressed due to river regulation. While flight-active arthropods effortlessly scatter upstream, less mobile species are most likely to show predominant downstream dispersal unless specific upward movements are dominant (Lambeets et al., 2009). New studies revealed that there are less arthropods and they are smaller and less varied in the areas that were occupied by reed plants (Martin et al., 2015; Veiga, 2016).

These changes are caused by multiple direct and indirect grounds like the occurrence of compounds which make the reed into a not very nutritious and palatable food (Veiga, 2016). The biodiversity of aquatic arthropods is an imperative indicator of the ecosystem's function. These

bioindicators have the benefit of monitoring anthropogenic stress of an ecosystem over a long period of time (Rosenberg and Resh, 1993). This study aims to determine the diversity of arthropods in an aquatic environment found in DLSU – Science and Technology Campus, Biñan City, Laguna using diversity indices. Understanding the habitat preferences of aquatic macroinvertebrates can aid in the preservation and monitoring of aquatic habitats.

2. METHODOLOGY

2.1 Study Site

The study was conducted in Biñan River (14° 26' 38" North, 121° 04' 02" East), located in Biñan City, Laguna, Philippines on July 30, 2016. The two sampling sites include the river and riverbanks. The dominant flora surrounding the riverbanks are grasses and shrubs.

2.2 Sampling Method

Fifteen (15) randomly selected 1m x 1m plots were measured on riverbanks. Ten (10) double stroke sweeps using the standard folding sweep net were taken in collecting arthropods inside the 15 plots of the riverbanks. River arthropod samples were collected from surface water near rocks using sweep nets. This was done in fifteen (15) replicates. Each sweep net sample was emptied in a 15.24cm x 15.24cm ziplock plastic bag with 70% ethanol and appropriate labels (location [R vs RB]), and replication [R1, R2… R15] (Barrion et al., 2016).

2.3 Sorting and Counting of Samples

The alcohol preserved arthropods in ziplock bags were all taken to the laboratory in DLSU-STC for sorting and counting by the graduate students of DLSU.

2.4 Sorting and Counting of Samples

All arthropods were identified using Brownstone dissecting microscope and locally available literature CSIRO (1979) and arthropod identification websites as a reference for classification. These literatures were marked with asterisk in the literature cited section.

2.5 Diversity Indices

Arthropod species diversity in river and riverbanks were measured using Shannon's Index of diversity ($H' = \sum(Pi \times LnPi)$) and Simpson's Index of Dominance ($D = \sum Pi2$). Also, Shannon's Index of Evenness ($J = (\sum(Pi \times LnPi))/LnS$), Simpson's Index of Diversity ($SID = 1 - \sum Pi2$), and Simpson's Index of Equitability ($E = (1 - \sum Pi2)/S$) were determined. Sorensen's Index of Similarity (SI) [2 (Number of shared species in A & B environments) / (A+B) x 100] was used to determine the commonly shared taxa between the river ecosystem and river banks. A = total species in river (R) and B = total species in riverbank (RB), and results were expressed in percentage (%). Also, relative density (RD) [(Number of individuals / Total number of individual species) x 100] was measured (Barrion et al., 2016).

3. RESULTS AND DISCUSSION

A total of 711 specimens of arthropods were collected along the river 452 (63.57%) and river banks 259 (36.43%). Of the total, 98.73% (702) were insects and 1.27% (9) were spiders.

The diversity indices revealed that river banks (H^1=2.47246) has mid-average diversity while the river has low arthropod diversity (H^1=1.2977). However, these values fall under low diversity (H^1= 0-2.49). It is confirmed by the evenness (J) wherein, riverbanks (J=0.75018) has higher value than the river (J=0.56358). Simpson's indices showed that as a combination of all the collections from river and riverbanks, there is low diversity of arthropods (0=low; 1=high) (Table 1) (Gevaña et al., 2013).

Based on the computed value of Sorensen's Index of Similarity (SI), it indicated a low 21.62% (4 families) of arthropod taxa commonly shared between the river ecosystem and river banks. Of the 4 families present in both habitats, Culicidae showed dominance with 67 individual species whereas, Formicidae (50 individuals) > Coenagrionidae (18 individuals) > Libellulidae (14 individuals). Low SI-value indicates that these communities have less similarity.

Table 1. The comparison between the diversity indices of the arthropod collections from river and river banks of De La Salle University – STC Campus, Binan, Laguna, Philippines on July 30, 2016.

Indices of Diversity	Arthropods	
	River	*River banks*
Shannon		
Diversity (H^1)	1.2977	2.47246
Evenness (J)	0.56358	0.75018
Simpson		
Dominance (D)	0.38476	0.12384
Diversity (SID)	0.61524	0.87616
Equitability (E)	0.06152	0.03245

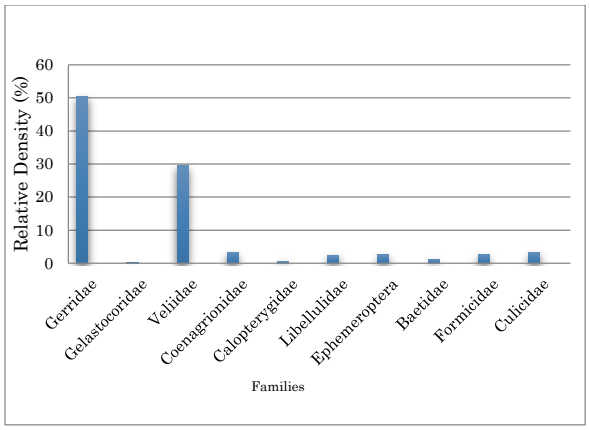

Figure 1. The relative density of each arthropod family present in river of De La Salle University – STC Campus, Binan City, Laguna, Philippines on July 30, 2016.

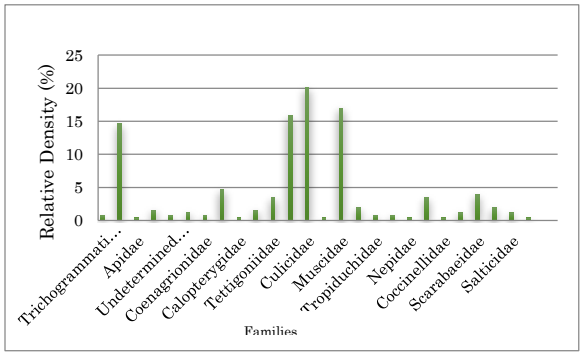

Figure 2. The relative density of each arthropod family present in river banks of De La Salle University – STC Campus, Binan City, Laguna, Philippines on July 30, 2016.

Figures 1-2 show the relative density of each arthropod family in river ecosystem and river banks. Gerridae (54.20%) has the highest relative density among all the other families thus, it implicates the dominance of the species under this family in the aquatic ecosystem. It is followed by Veliidae (29.42%) and Culicidae (20.07%). The dominance of these families confirmed the low diversity of arthropods in river and river banks as what Shannon's index of diversity denoted (Table 1).

4. CONCLUSION

The diversity of the arthropods in the aquatic ecosystem particularly along the river and river banks in De La Salle University –STC Campus in Binan, Laguna Philippines on July 30, 2016 was determined. A total of 711 different arthropods were collected, of which 452 (63.57%) came from river ecosystem and 259 (36.43%) came from river banks. Of the total, 98.73% (702) were insects and 1.27% (9) were spiders.

In total, the indices of diversity (Shannon and Simpson) revealed a low arthropod diversity in the aquatic environment. However, the river banks showed higher diversity (H^1=2.47246) than the river (H^1=1.2977). The relative density of the collected arthropods confirmed the low diversity wherein, species representing Gerridae (54.20%), Veliidae (29.42%) and Culicidae (20.07%) showed dominance among all other families. The Sorensen's Index of Similarity (IS) indicated a low 21.62% (4 families) of taxa commonly shared between the river ecosystem and river banks thus, less overlap of arthropod taxa is present.

5. ACKNOWLEDGEMENTS

This study was originally part of our Master's academic requirements in Advanced Ecology. I thank all my co-members who wholeheartedly worked in all the fieldworks and Dr. Alberto T. Barrion for sharing his expertise and advises in order to better this paper.

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