

OCCURRENCE AND SPECIES COMPOSITION OF MACROINVERTEBRATES FAUNA FROM UPSTREAM AND DOWNSTREAM OF MIN YE DAM, ZAWGI RIVER SEGMENT, KYAUKSE TOWNSHIP, MANDALAY REGION

Mie Mie Myint¹, Myo Thandar Thone² and Thant Zin³

Abstract

A total of 24 macroinvertebrate species, 24 genera belonging to 20 families, ten orders and three phyla were also collected and identified in four study sites of upstream and downstream of Min Ye Dam, Zawgi River Segment during the study period from August to December 2019. During the study period, the highest number of species composition was observed in Hemiptera (25.00%), followed by Mesogastropoda (16.66%), Coleoptera (16.66%), Odonata (12.50%), Araneae (8.33%), Haplotaxida, Veneroida, Decapoda, Ephemeroptera and Diptera (4.17%) respectively. In the present study, macroinvertebrates fauna was the highest at upstream of dam (site I and II) and the lowest at downstream of dam (site III and IV). In upstream, tall grasses predominated and the bed composed of silt. The downstream was found washing and bathing, activities of human and sand and gravels occupied the bed of stream. The macroinvertebrates fauna were higher in upstream than downstream of Min Ye Dam from Zawgi River, and is allocated to the habitat compatibility.

Keywords: Hemiptera, Mesogastropoda, Coleoptera, Odonata, Araneae

Introduction

Aquatic macroinvertebrates are organisms that live in the water (aquatic), are visible with the naked eye without the use of a microscope (macro), and lack an internal skeleton (invertebrate). Examples of aquatic macroinvertebrates include insects, worms, snails, mollusks and crustacean. Aquatic macroinvertebrates are typically found living under rocks or logs or living in congregated leaf packs. Aquatic macroinvertebrates are an integral part of the food chain. Many macroinvertebrates feed on organic material such as leaves and algae. Other higher order organisms such as birds, fish and larger insects then feed on aquatic macroinvertebrates. Macroinvertebrates are widely recognized as the best biological indicators for stream health. Because of their short life cycles (generally one year of which most is spent in the water) and relative immobility. Aquatic macroinvertebrates are good indicators of stream health. Their survival is directly linked to their habitat. Aquatic macroinvertebrates cannot quickly move to another stream if the one they are currently living in becomes polluted (Carmen *et al.*, 2015).

Macroinvertebrates that live in rivers include worms, snails, beetles, dragonflies, mayflies, stoneflies and yabbies. Pollution and other changes caused by human activities in and around a river will determine what types of macroinvertebrates live there. For this reason, river macroinvertebrates are widely used to indicate the biological health of a river. Healthy rivers are typically unpolluted and have many different macroinvertebrates habitats, so in a healthy river one would expect to find many different types of macroinvertebrates including species that are sensitive to water pollution. Unhealthy rivers may be highly polluted or may have lost most types of macroinvertebrate habitats. Such river may have only few types of hardy, pollution tolerant macroinvertebrate species (New South Wales (NSW) government, 2000).

Although, Zawgi River is permanent with the water body throughout the year and the river is inhabited with form and different kinds of macroinvertebrates, no information was available

¹ Lecturer, Department of Zoology, Kyaukse University

² Dr, Lecturer, Department of Zoology, University of Mandalay

³ Dr, Professor (Head), Department of Zoology, University of Mandalay

about the occurrence of macroinvertebrates in this area. Therefore, the present study was carried out with the following objectives:

- to identify and record the benthic macroinvertebrates fauna in the allocated segment of Zawgi River
- to determine the species composition and occurrence based on the monthly collected species

Materials and Methods

Study area and sites

The study area is the upstream and downstream of Min Ye Dam, Zawgi River Segment, Kyaukse Township, Mandalay Region. It lies at 21° 35' 49.04" N and 96° 08' 38.08" E. It is 1.8 km long.

Four study sites were selected in Zawgi River Segment, two in upstream and two in downstream of Min Ye Dam. Site I is located at upstream of Min Ye Dam of Zawgi River (21° 35' 47.0" N and 96° 08' 24.0" E). Site II is located at upstream of Min Ye Dam of Zawgi River (21° 35' 56.0" N and 96° 08' 24.0" E). Site III is located at downstream of Min Ye Dam of Zawgi River (21° 35' 56.0" N and 96° 08' 24.0" E). Site IV is located at downstream of Min Ye Dam of Zawgi River (21° 35' 56 " N and 96° 08' 15.0" E).

Study period

The present investigation for macroinvertebrate was carried out from August to December 2019.

Specimen collection and preservation

Macroinvertebrates were collected once per month and between 7:00 am and 8:00 am in four study sites. They were collected using nylon dip net (or) pond net for 15 minutes at each site. They were preserved in 70% alcohol solution for further study. They were sorted, counted, identified under a stereo microscope and photographic records were made in the laboratory of Zoology Department at University of Mandalay.

Identification of the specimens

Identification of the collected macroinvertebrate species were made according to Edmondson (1959), Koh (1989), Gerber and Gabriel (2002), Perez *et al.* (2004), Wade *et al.* (2004), Mekong River Commission (2006), Wegner (2011) and Umar *et al.* (2013). The classification of macroinvertebrate was followed after Mekong River Commission (2006).



Sources: Google Earth (2019)

Plate 1 Map of study area showing the study sites

Results

A total of 24 species of macroinvertebrates fauna belonging to three phyla, six classes, ten orders and 20 families were recorded in study areas (Table 1).

Species occurrence and composition of recorded macroinvertebrates

A total of 24 macroinvertebrates species, 24 genera belonging to 20 families and ten orders were collected during the study period. The ten orders are Haplotaxida, Mesogastropoda, Veneroida, Araneae, Decapoda, Ephemeroptera, Odonata, Hemiptera, Coleoptera and Diptera (Plate 2). Among these orders, Haplotaxida, Veneroida, Decapoda, Ephemeroptera and Diptera were represented by a single species, genus and family each. Under Araneae two species, two genera and two families were recorded and three species, three genera and three families of Odonata were found. Mesogastropoda was found four species, four genera and two families. Coleoptera was found four species, four genera and four families. Hemiptera was found six species, six genera and four families.

In site I, the highest number of species was found in September (seven species) and the lowest in October (two species). In site II, the highest number of species was found in October (nine species), followed by August and September (eight species) and the lowest in December (four species). In site III, the highest number of species was found in September, October and December (five species) and the lowest in November (four species). In site IV, the highest number of species was found in December (eight species) and the lowest in November (one specie). The total numbers of macroinvertebrate species were different at four study sites. The highest number of species in upstream of dam (site I and II) and the lowest number of species in downstream of dam (site III and IV) were recorded. (Table 2, Fig. 1)

Among the ten orders, the percentage species composition of recorded macroinvertebrate fauna was found to be highest (25.00%) under the order Hemiptera, followed by (16.66%) in Mesogastropoda and Coleoptera, (12.50%) in Odonata, (8.33%) in Araneae, and Haplotaxida, Veneroida, Decapoda, Ephemeroptera and Diptera in each of (4.17%) respectively. (Table 3, Fig. 2)

Table 1 List of macroinvertebrate species recorded in the study area (August to December, 2019)

Phylum	Class	Order	Family	Genus	Species	Common name
Annelida	Clitellata	Opisthopora	Megascolecidae	<i>Pheretima</i>	1. <i>Pheretima posthuma</i>	Earthworm
Mollusca	Gastropoda	Mesogastropoda	Ampullariidae	<i>Pila</i>	2. <i>Pila globosa</i>	Apple snail
				<i>Thiara</i>	3. <i>Thiara scabra</i>	Pagoda snail
				<i>Tarebia</i>	4. <i>Tarebia granifera</i>	Quilted melania snail
Arthropoda	Bivalvia Arachnida	Veneroidea Araneae	Corbiculidae Salticidae Tetragnathidae	<i>Melanoidea</i>	5. <i>Melanoidea tuberculata</i>	Red-rimmed melania snail
				<i>Corbicula</i>	6. <i>Corbicula fluminea</i>	Asian clam
				<i>Phidippus</i>	7. <i>Phidippus audax</i>	Jumping spider
				<i>Tetragnatha</i>	8. <i>Tetragnatha montana</i>	Shadow stretch-spider
				<i>Macrobrahium</i>	9. <i>Macrobrahium</i>	Grass shrimp
				<i>Thalerosphyrus</i>	10. <i>Thalerosphyrus</i> sp.	Flat-headed mayfly
				<i>Coenagrion</i>	11. <i>Coenagrion puella</i>	Damselfly larvae
				<i>Gomphus</i>	12. <i>Gomphus adelphus</i>	Dragonfly larvae
				<i>Pachydiplax</i>	13. <i>Pachydiplax</i> sp.	Dragonfly or blue dasher
Insecta	Crustacea Ephemeroptera Odonata Hemiptera Coleoptera Diptera	Decapoda Ephemeroptera Odonata Hemiptera Coleoptera Diptera	Palaemonidae Heptageniidae Coenagrionidae Gomphidae Libellulidae Nepidae Notonectidae Pleidae Gerridae Dytiscidae Noteridae Curculionidae Psephenidae Culicidae	<i>Macrobrahium</i>	14. <i>Ranatra linearis</i>	Water scorpions
				<i>Notonecta</i>	15. <i>Notonecta</i> sp.	Back swimmer
				<i>Paraplea</i>	16. <i>Paraplea</i> sp.	Pygmy backswimmer
				<i>Gerris</i>	17. <i>Gerris lacustris</i>	Water strider
				<i>Ventidius</i>	18. <i>Ventidius distanti</i>	Water strider
				<i>Ptilomera</i>	19. <i>Ptilomera</i> sp.	Water strider
				<i>Eretes</i>	20. <i>Eretes sticticus</i>	Predaceous diving beetle
				<i>Hydrocanthus</i>	21. <i>Hydrocanthus</i> sp.	Burrowing water beetle
				<i>Listronotus</i>	22. <i>Listronotus</i> sp.	Under water weevil
				<i>Psephenus</i>	23. <i>Psephenus</i> sp.	Water-penny beetle
				Unidentified pupae	24. Unidentified pupae	Mosquito

Table 2 Monthly recorded macroinvertebrate species in four study sites

Sr. No.	Species	Site I				Site II				Site III				Site IV			
		Aug	Sep	Oct	Nov	Dec	Aug	Sep	Oct	Nov	Dec	Aug	Sep	Oct	Nov	Dec	
1	<i>Pheretima posthuma</i>	+	+	-	+	-	+	+	+	+	-	-	-	-	-	-	
2	<i>Pila globosa</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
3	<i>Thiara scabra</i>	-	+	-	-	+	+	-	-	+	-	-	-	-	-	+	
4	<i>Tarebia granifera</i>	-	-	-	-	-	+	-	-	-	-	-	-	-	-	+	
5	<i>Melanooides tuberculata</i>	+	+	-	+	+	+	+	+	+	-	-	-	-	-	+	
6	<i>Corbicula fluminea</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	
7	<i>Phidippus audax</i>	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	
8	<i>Tetragonatha montana</i>	-	-	-	-	+	-	+	+	-	-	-	-	-	-	-	
9	<i>Macrobrachium lamarrei</i>	+	+	-	-	+	+	-	-	-	+	+	-	-	+	+	
10	<i>Thalerosphyrus</i> sp.	-	+	-	-	-	-	+	+	-	-	-	-	-	-	-	
11	<i>Coenagrion puella</i>	-	-	-	-	-	+	+	+	-	-	-	-	-	-	-	
12	<i>Gomphus adelphus</i>	+	-	-	-	-	+	-	-	-	-	-	-	-	-	-	
13	<i>Pachydiplax</i> sp.	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	
14	<i>Ranatra linearis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
15	<i>Notonecta</i> sp.	-	-	-	-	-	-	-	-	-	-	+	+	-	-	+	
16	<i>Paraplea</i> sp.	-	-	-	-	-	-	-	-	-	-	+	+	-	-	-	
17	<i>Gerris lacustris</i>	-	-	-	-	+	-	-	-	-	-	+	+	-	-	-	
18	<i>Ventidius distantii</i>	-	+	-	-	-	+	-	-	-	-	-	-	+	-	+	
19	<i>Ptilomera</i> sp.	-	+	+	+	-	+	-	-	-	-	-	-	-	+	+	
20	<i>Eretes sticticus</i>	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	
21	<i>Hydrocanthus</i> sp.	-	-	-	-	-	-	+	-	-	+	-	-	-	-	-	
22	<i>Listronotus</i> sp.	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	
23	<i>Psephenus</i> sp.	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	
24	<i>Diptera pupae</i>	-	-	-	-	-	-	-	-	-	+	+	+	+	+	+	
Total species		4	7	2	3	5	8	8	9	5	4	2	5	5	5	8	

+ = observed, - = not observed

Table 3 Percent species composition of macroinvertebrate in different orders during the study period

Sr. No	Order	Number of Family	Number of genus	Number of species	Species composition (%)
1.	Haplotaxida	1	1	1	4.17
2.	Mesogastropoda	2	4	4	16.66
3.	Veneroida	1	1	1	4.17
4.	Araneae	2	2	2	8.33
5.	Decapoda	1	1	1	4.17
6.	Ephemeroptera	1	1	1	4.17
7.	Odonata	3	3	3	12.50
8.	Hemiptera	4	6	6	25.00
9.	Coleoptera	4	4	4	16.66
10.	Diptera	1	1	1	4.17
		20	24	24	100

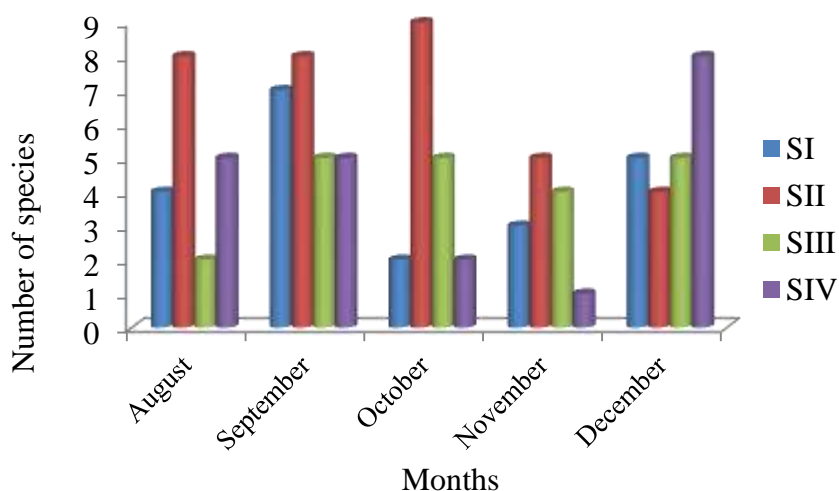


Figure 1 Occurrence of macroinvertebrate species in four study sites from August to December 2019

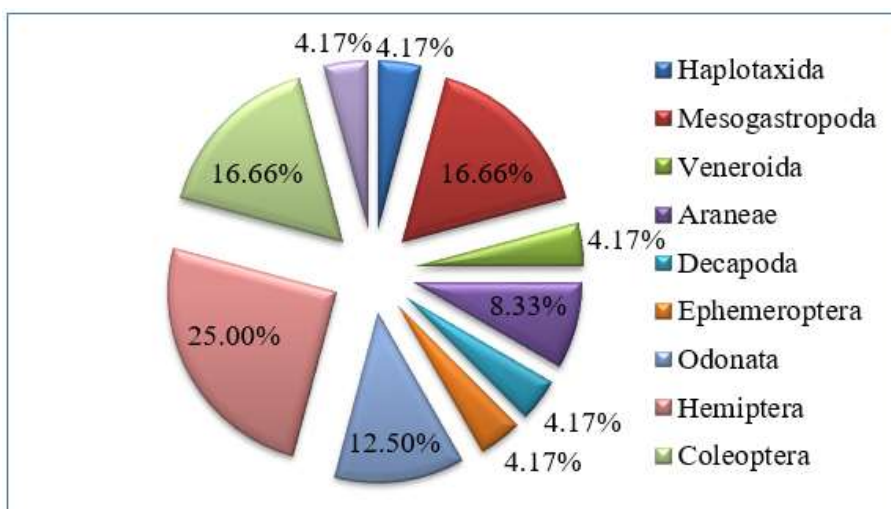


Figure 2 Percent species composition of macroinvertebrate in different orders during study period



A. *Pheretima posthuma*



Apertural view of the shell



Abapertural view of the shell

B. *Pila globosa*



Apertural view of the shell



Abapertural view of the shell

C. *Thiara scabra*

Plate 2 Recorded macroinvertebrate species



Apertural view of the shell



Abapertural view of the shell

D. Tarebia granifera



Apertural view of the shell



Abapertural view of the shell

E. Melanoides tuberculata



Apertural view of the shell



Abapertural view of the shell

F. Corbicula fluminea

Plate 2 Continued



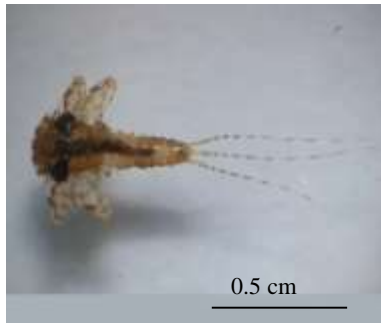
G. *Phidippus audax*



H. *Tetragnatha montana*



I. *Macrobrachium lamarrei*



J. *Thalerosphyrus* sp.



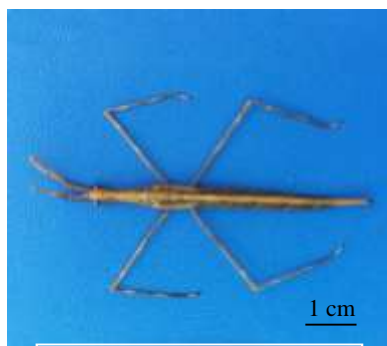
K. *Coenagrion puella*



L. *Gomphus adelphus*



M. *Pachydiplax* sp.



N. *Ranatra linearis*



O. *Notonecta* sp.



P. *Paraplea* sp.



Q. *Gerris lacustris*



R. *Ventidius distanti*

S. *Ptilomera* sp.T. *Eretes sticticus*U. *Hydrocanthus* sp.V. *Listronotus* sp.W. *Psephenus* sp.

X. Unidentified pupae (mosquito)

Discussion

A total of 24 species belonging to three phyla, six classes, ten orders, 20 families and 24 genera were recorded in four study sites of upstream and downstream of Min Ye Dam, Zawgi River Segment, Kyaukse Township, Mandalay Region from August to December 2019.

The highest species composition were recorded in Order Hemiptera with six species and lowest in Order Haplontaxida, Veneroida, Decapoda, Ephemeroptera and Diptera with only one species respectively.

Ei Ei Khaing Nyein (2015) reported that order Hemiptera revealed the highest species composition. The order Coleoptera and Diptera were the least species composition in Meiktila Lake, Meiktila Township. In present study, Order Hemiptera found to be highest and Diptera was least species composition.

Khin Lay Yee (2016) stated that the highest number of species and individual was occurred in order Hemiptera and lowest in order Ophisthoptera from Paleik In, Sintkaing Township. In present study showed that the highest number of species was recorded in Order Hemiptera.

Dosi, *et al.* (2018) revealed that in total 3,257 individual macroinvertebrates were collected. These specimens represented 37 species from 20 families and eight orders. More than 50% of the macroinvertebrates captured were aquatic beetles (Order Coleoptera), Aquatic bugs (Hemiptera) represented 26% of captures. Ten percent of the macroinvertebrates specimens were dragon/damselflies (Odonata). Flies (Diptera), mayflies (Ephemeroptera), shrimps (Decapoda) and aquatic moths (Lepidoptera) were less commonly found in Maludam National Park, Sarawak.

Akindele and Liadi (2014) reported that nineteen taxa of macroinvertebrates were recorded comprising three phyla, four classes and 17 families in Aiba Stream, Iwo and Southwestern Nigeria. Shah, *et al.* (2011) stated that in total, 50 taxa, belonging to 15 orders were recorded for littoral zone of the reservoir. The recorded higher number of taxa (family level) belonged to order Heteroptera (water bugs), Diptera (flies), and class Mollusca in Jagadishpur Reservoir, Taulihawa

country. Barman and Gupta (2015) reported that the study revealed presence of 21 species of aquatic insects belonging to 14 families and 7 orders. The order Hemiptera was found most diverse and relatively abundant in Bakuamari stream, Chakrashila Wildlife Sanctuary, Assam, North East India. In present study, a total of 24 species of three phyla, six classes, ten orders and 20 families were recorded. The highest species composition were recorded Order Hemiptera.

In the present study, macroinvertebrates fauna highest in upstream of dam (site I and II) and lowest in downstream of dam (site III and IV) were recorded. The substrate of upstream was mainly composed on stones pebbles, rocks, clay, sand and organic matter. It was the desirable habitat for macroinvertebrates. In addition, there are many trees and tall grasses on the river bank. Bank vegetation is also evaluated in terms of provision of stream shading and refuge for fish and macroinvertebrates. Downstream habitat and water condition were degraded due to human settlement, disposal of domestic and agricultural wastes, surrounding land use and local geology which contributed to poor species diversity. Therefore, reducing number of macroinvertebrates were recorded in site III and IV.

Conclusion

A total number of 24 macroinvertebrate species of 24 genera, 20 families, ten orders, six classes belonging to three phyla were recorded in four study sites of upstream and downstream of Min Ye Dam, Zawgi river segment in Kyaukse Township. Study sites of upstream showed high species richness of aquatic macroinvertebrates than downstream sites due to local geology, stream habitat condition, human settlement and surrounding land use. Therefore, this study show that the needs to protect the water resources included the habitats of the Zawgi river segment.

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