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Preliminary Assessment of Freshwater Gastropods in the Selected Rivers in Esperanza, Agusan del Sur, Philippines

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Abstract

The present work had been carried out in order to determine the freshwater gastropods in the three rivers of Esperanza, Agusan del Sur, Philippines namely Ojot River, Wawa River and Sabang-ojot River. Collection of gastropods was done from September 30-Ocober 3, 2015 through opportunistic method along 100-m transect line established in accessible area. Physico-chemical parameters of water were obtained using multi-parameter tester. Results of physico-chemical parameters suggest that three sites have freshwater characteristics. Five species of freshwater gastropods were collected and identified in the three sampling sites. Sabang-ojot River has the highest number of freshwater gastropods species recorded because of its muddy to clayish substrate and rich vegetation. *L. caperata* and *P. canaliculata* were the ubiquitous species. Assessment of freshwater gastropods in a longer period of time is highly recommended.

Keywords: Freshwater gastropods, Ojot River, Wawa River, Sabang-ojot River

1. Introduction

Gastropods are soft-bodied and single-valve animals [8] of Phylum Mollusca. According to Abbott [1], it is one of the most diverse taxa having 40,000 species in which 5,000 of these are freshwater snails thriving in freshwater habitats. However, the 1996 IUCN *Red List of Threatened Animals* listed 216 gastropods as extinct and 806 gastropods as threatened mostly of freshwater, terrestrial and marine [11].

Gastropods species are among the most biologically used indicator to assess the quality of any water impoundment. The absence or presence of certain gastropods species can indicate the present condition of an aquatic habitat. Some of gastropods species also provide food for fishes, birds and human beings. Brown [3], stated that some gastropods serves as intermediate host of infectious trematodes and other parasites of animals and human beings, and they need to be scientifically explored and studied for they play significant roles in public and veterinary health [17].

Esperanza is one of the 14 municipalities of Agusan del Sur, Philippines. It is endowed with vast and extensive rivers which are significant resources of the nearby community. Irrigation, waterway in transporting logs, laundry sites and bathing places of human and domesticated animals like pigs and carabaos (water buffalo) are among the functions of these rivers in the community. As climate unpredictably changes, these human activities might have an impact on the organisms particularly on gastropods fauna living on these habitats. Strong *et al.* [15] stated that the unsuitable use of water resources, habitat loss and degradation are the identified threats to the sensitive organisms such as in wetland.

No further studies have been conducted yet in the rivers in the Municipality of Esperanza, Agusan del Sur, Philippines. Thus, had driven the author to study the said area in order to provide baseline data about these rivers and to identify the gastropods species found therein. Other objectives of the study include the determination of the abundance of gastropods species and determine the comparison of the species composition of gastropods in the three selected rivers of the municipality. Results of the study will serve as an important reference also for evaluating future water quality changes, as well as providing insights on how to protect the river and its biodiversity.

This study was limited only in identifying, determining the abundance and comparing the composition of gastropods species that was collected in the three rivers during sampling period. Though, several factors affect these variables, therefore the temporal distribution will not be studied due to limited data-gathering time.

2. Materials and Methods

2.1. Sampling Site

Fig 1: Location of the three main sampling sites and sampling stations in Esperanza, Agusan del Sur.

Sampling sites are the three main rivers found in the Municipality of Esperanza. Three replicated sampling stations were determined per sampling site (Fig. 1). Global Positioning System (GPS) was used in order to determine the exact location (coordinates) of the area.

Fig 2: Three sampling sites showing natural habitat for freshwater gastropods - A. Ojot River; B. Wawa River; C. Sabang-ojot River

Site 1: Ojot River
This river is located in Barangay Remedios. It has shallow and deep waters. Pebbles, sand and gravel are the major components of its bed (Figure 2). Along the bank is a corn field and quarrying of sand and gravel was also observed in the area.

Site 2: Wawa River
Wawa is an extensive river that separates Barangay Poblacion and Barangay Piglawigan. The river bank is rich in vegetation with shrubs, grasses and some fruiting trees. It has muddy to clayish substrate (Figure 2).

Site 3: Sabang-ojot River
This river is found in Barangay Langag. Sampling stations were established near the confluence of the river. Small ponds with muddy to clayish substrate surrounded with shrubs and tall grasses can be found in each site`s stations (Figure 2). This area is also rich in macrophytes.

2.2. Sampling Method and Collection of Gastropods

100-meter transect line was established in accessible area of each sites. Opportunistic method was used in collecting the gastropod species through hand picking in the dry areas and in cases where water was shallow, an improvised D-frame net that measures 1.0 m width with 500 µm opening mesh size was used in collecting gastropods. Sampling period was on September 30-October 3, 2015, between 5:00-9:00 in the morning.

2.3. Identification of Gastropods

All samples of gastropod species collected per sites were placed in a polyethylene bag with proper label for further analysis. The samples were washed, photographed and counted. Identification was done up to family level and species level, if possible, using the key guides of Harold and Guralnick [10], Frest and Johannes [7] and Thompson [18].

2.4. Water Salinity, TDS, Temperature and DO

Water analysis was done prior to the collection of gastropods using multi-parameter tester (Hach HQ40d model). Water salinity, TDS, temperature and DO was obtained by emerging the electrode of the tester into the water. This was done three times in each site.

2.5. Statistical Analysis

Data collected were statistically analyzed using PAST Software to obtain Species Richness index (d′), Evenness, Shannon-Weiner index (H′), and Simpson's Dominance index (D).

Comparison of species composition per site was determined using Sorensen`s Similarity Index (S) based on the presence or absence of species in a particular area, a low index value means a large difference in species composition between the two sites compared [2]. Cluster analysis based on Brav-Curtis similarity index was then used to determine the similarity of the community structure of the three sampling sites.

3. Results

3.1. Water quality parameters measured in three sites

Water quality parameters or physico-chemical parameters is very important for the survival and distribution of certain organisms. According to Garg *et al.* [9], the ecology of gastropods is considered to be affected by environmental factors such as physico-chemical parameters.

Table 1: Mean value of some water quality parameters in each sampling sites

Sampling Sites	Parameters			
	Salinity (ppt)	TDS (mg/L)	DO (mg/L)	Temperature (°C)
Ojot River	0.12	118.1	7.7	29.2
Wawa River	0.20	199.4	7.8	29
Sabang-ojot River	0.12	129	8.1	28.5

The results of some physico-chemical parameters of water are shown in Table 1. Salinity of the three sampling sites were < 1 ppt., highest concentration of Total Dissolved Solids was recorded in Wawa River (199.4 mg/L), followed by Sabang-ojot River (129 mg/L) and Ojot River (118.1 mg/L) has the lowest concentration of TDS. Sabang-ojot River has the highest concentration of Dissolved Oxygen (8.1 mg/L) compare to the two remaining sites having also a temperature of 28.5 °C. Moreover, Wawa River and Ojot River has a DO of 7.8 mg/L and 7.7 mg/L with a temperature of 29 °C and 29.2 °C respectively.

Though not all of the parameters were included during the sampling period, results show that the three rivers are under favorable condition (as recommended by DAO, 1990-34) for the survival of different organisms.

3.2. Identified Gastropods Species

A total of five species belonging to four genus, four families, and two orders under two subclasses (Table 2) that comprises 164 individuals were collected and identified in the three rivers during the sampling period.

Table 2: List of freshwater gastropods identified in each sampling sites

				Sampling Sites		
Subclass and Order	**Family and Genus**	**Species**	**Common Name/Local Name**	**Ojot River**	**Wawa River**	**Sabang-ojot River**
Pulmonata **Order** Basomma tophora	Planorbidae **Genus** *Gyraulus*	*G. ladacensis*		-	+	+
	Lymnaeidae **Genus** *Lymnaea*	*L. accuminata*	Suso	-	+	+
		L. caperata	Kuhol	+	+	+
Prosobranchia **Order** Meso gastropoda	Ampullariidae **Genus** *Pomacea*	*P. canaliculata*	Golden Apple Snail/Kuhol	+	+	+
	Thiaridae **Genus** *Melanoides*	*M. tuberculata*	Punggok	-	-	+

Among the gastropods species collected, *Lymnaea caperata and Pomacea canaliculata* were the ubiquitous, being present in all three sampling sites (Table 2 and Figure 6). However, *Gyraulus ladacensis* have the highest number of individuals next to *Pomacea canaliculata*, though it is present only in Wawa River and Sabang-ojot River and no individual was collected in Ojot River. Moreover, *M. tuberculata* was found only in Sabang-ojot River (Table 2).

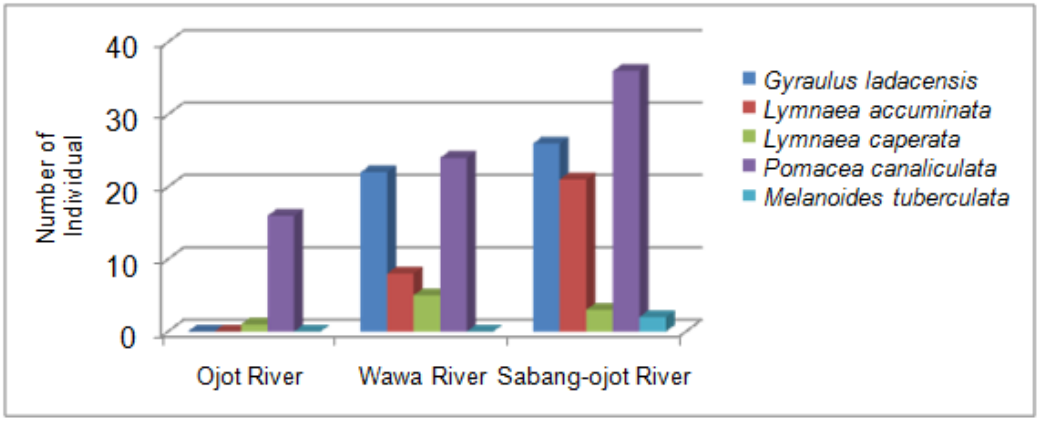

Fig 3: Number of individuals of freshwater gastropods collected in each sampling sites.

Table 3 shows the biodiversity indices of freshwater gastropods collected in three sampling sites. Sabang-ojot River was more diverse compared to the two remaining sites in terms of species richness having five taxa of freshwater gastropods recorded. This species richness was then followed by Wawa River (4 species), and Ojot River having the least taxon recorded with only two species were found, however, Dominance (D) was highest in this site. Simpson diversity index (1-D) and Shannon-Weiner index (H`) was highest in Saban-ojot River, while Evenness (e^ H/S) was highest in Wawa River.

Table 3: Biodiversity indices of collected freshwater gastropods in the three sampling sites.

Sampling Sites			
Biodiversity Indices	**Ojot River**	**Wawa River**	**Sabang-ojot River**
Taxa_S	2	4	5
Individuals	17	59	88
Dominance_D	0.8893	0.3301	0.3133
Simpson_1-D	0.1107	0.6699	0.6867
Shannon_H	0.2237	1.214	1.269
Evenness_e^H/S	0.6254	0.8416	0.7115

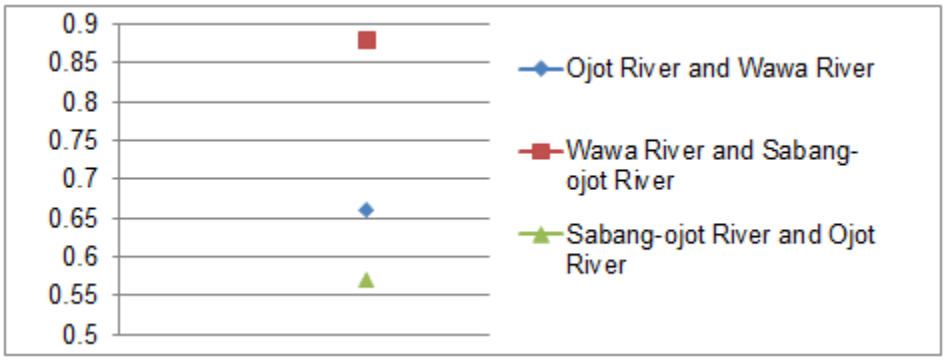

Fig 4: Computed Sorensen`s Similarity Index (S). Low index value means a large difference in species composition between the two sites compared

Similarity of species composition between sites was also computed using Sorensen`s Similarity Index (S) and are shown in Figure 5. Wawa River and Sabang-ojot River obtained the highest similarity index with 0.88 similarity index value, while Sabang-ojot and Ojot River had the lowest similarity index value obtained (0.57). The three sampling sites were clustered into two groups as exhibited by cluster dendogram in Figure 6 using Bray-Curtis Similarity Index. Sabang-ojot and Wawa River are more similar, and this similarity is very distant from Ojot River.

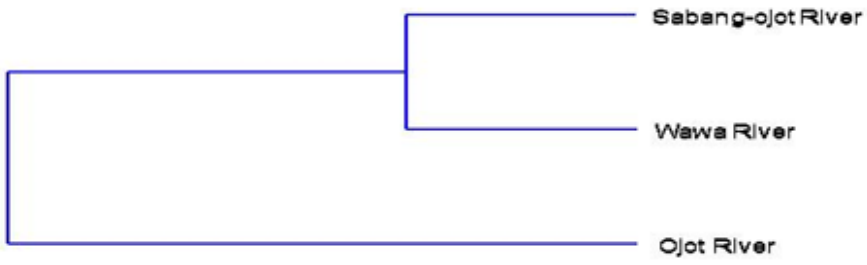

Fig 5: Dendogram of cluster analysis based on Bray-Curtis similarity index showing the similarity of the community structure of the three sampling sites.

Figure 6 shows the graph analysis of the occurrence of freshwater gastropods in the three sampling sites. *L caperata* and *P. canaliculata* were found to be present in the three sampling sites. No presence of *G. ladacensis* and *L. accuminata* were recorded in Ojot River and *M. tuberculata* was present only in Saban-ojot River. Furthermore, the representative species of

freshwater gastropods collected and identified in the three sampling sites are shown in Figure 7.

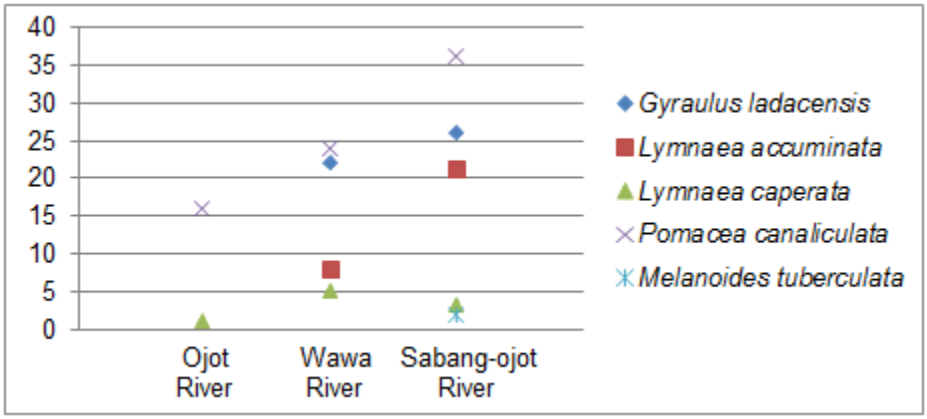

Fig 6: Graph analysis showing occurrence of freshwater gastropods in three sampling sites.

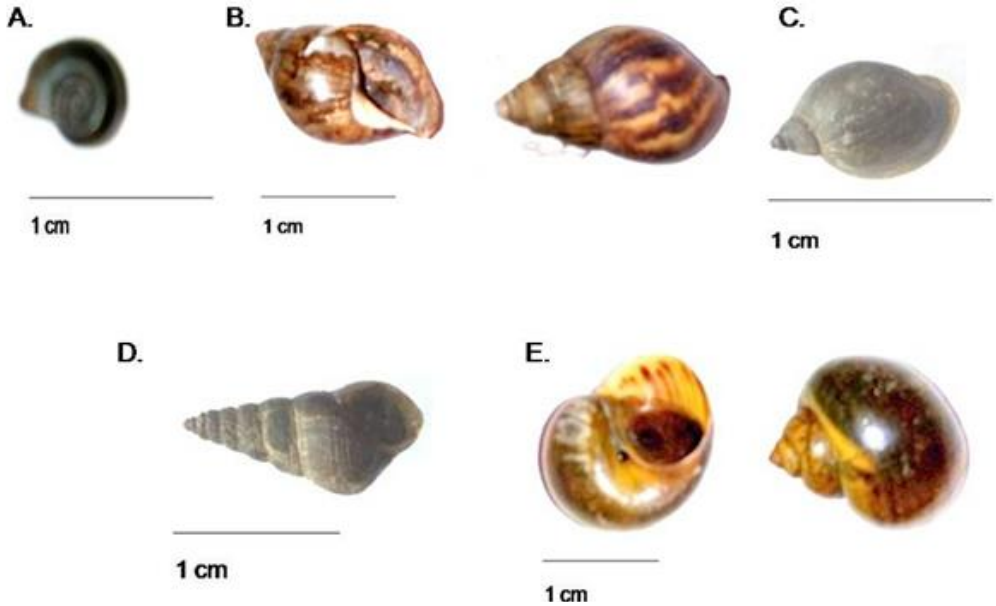

Fig 7: Representative species of freshwater gastropods collected in three sampling sites. A. *Gayraulus ladecensis*; B. *Lymnaea caperata*; C. *Lymnaea accuminata*; D. *Melanoides tuberculata*; E. *Pomacea canaliculata.*

4. Discussion

The physico-chemical parameters of the three sampling sites (Table 1) did not show much difference except for TDS which is relatively high in Wawa River (199.4 mg/L) that can be attributed to murky water during sampling period. The Dissolved Oxygen of the three sampling sites with its respective temperature (ranges from 7.7 – 8.1 mg/L and 28.5 – 29.2°C) are normal for freshwater bodies as suggested by Colt (1984), freshwater having a temperature of 25-30°C supposed to have a 7.5-8.2 mg/L saturated DO concentration. Generally, the features exhibited by the three sampling sites in terms of Salinity, TDS, DO and temperature have freshwater characteristics [18].

Among the freshwater gastropods species collected and identified in the three sampling sites, *P. canaliculata* was the most dominant and ubiquitous (Table 2, Figures 3 and 6). *Pomacea canaliculata* [4] commonly known as "golden apple snail" or "Kuhol" in the Phiippines, is basically distributed in tropical and subtropical South America, and the most record of this species in the world is in Paso de la Piedras reservoir, Buenos Aires, Argentina [14]. They were introduced in South-east Asian Countries including Philippines because they were seen as an opportunity for financial success (Cowie, in press), but currently considered as major pest in agricultural field. They are widely distributed among sampling sites because of its invasive nature[8]. However, some species of

freshwater gastropods were absent in some site (Table 2 and Figure 6). For instance, no presence of *Gyraulus ladacensis* and *Lymnaea acuminata* are found in Ojot River, on the other hand *Melanoides tuberculata* are absent both in Ojot and Wawa River, though all sampling sites exhibited almost the same physico-chemical parameters of water. According to Strzelec and Krolczyk [16], many gastropod species are tolerant to most physico-chemical parameters and their occurrence is affected by the quality of bottom sediments and abundance of vegetation. They also added that the most suitable substrate for snails in rivers is a sandy bottom covered with thin layer of organic silt. This might be the reasons of the absence of some species in Ojot River, given that the water bed and bank of this river is primarily composed of pebbles, sand and gravel compared to Wawa and Sabang-ojot River with muddy to clayish substrate. Sabang-ojot River and Wawa River are more diverse compared to the Ojot River in terms of species richness having five taxa and four taxa respectively of freshwater gastropods recorded (Table 3). This can be attributed to the substrate type (Strzelec and Krolczyk [16]), and the rich vegetation particularly of shrubs, grasses and macrophytes of the two rivers which serves as food for various organisms. Jurkiewicz-Karnkowska [12] stated that low food quality, especially in many semi-permanent habitats, could constrain the development of molluscan communities. Dominance (D) was highest in Wawa River since there is only one species dominating the area, the *P. canaliculata*. Simpson diversity index (1-D) and Shannon-Weiner index (H`) was highest in Sabang-ojot River (Table 3).

Flores and Zafaralla [6], stated that Shannon-Weiner diversity index (H`) lesser than 2.5 is relatively low, thus, the three sites have low diversity index since none of them obtained a value higher than 2.5. Nonetheless, this low diversity index value of the three sites would make sense if the sampling was done in a longer period of time, noting that in this present work sampling was done for only four days. According to the Sorensen`s Similarity Index (S) and Bray-Curtis Cluster Analysis, Wawa River and Sabang-0jot River are found to be more similar since both sites have almost the same number of species collected when compared to Ojot River.

5. Recommendations

Though, sampling was done in a short period of time, five gastropod species were collected and identified in the three rivers of Esperanza, Agusan del Sur namely Ojot River, Wawa River and Sabang-ojot River. It is therefore recommended that longer period of assessment should be done in the sampling sites and even in other freshwater habitats found in this municipality in order to give baseline data and information about the distribution and abundance of freshwater gastropods in this municipality.

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