

Diversity of Freshwater Fish in Sawaga River, Malaybalay City, Bukidnon, Philippines

LESLEY C. LUBOS

ORCID NO. 0000-0002-8761-3680

lesleyclubos@buksu.edu.ph

CARINA JOANE V. BARROSO

ORCID NO. 0000-0002-7418-9390

villcjem@yahoo.com

OMAR A. TANTOY

ORCID No. 0000-0003-0822-9275

omartantoy@buksu.edu.ph

MA. ALGERICA T. CUENCO

ORCID No. 0000-0002-9908-3015

algerica_cuenco@yahoo.com

LALEVIE C. LUBOS

ORCID No. 0000-0002-7853-0023

lalevielubos@buksu.edu.ph

Bukidnon State University
Malaybalay City, Bukidnon, Philippines

ABSTRACT

The Sawaga River (Binukid: Wahig Sawaga) is a river found in Central Bukidnon, on the island of Mindanao, Philippines. A majority of its catchment area is located in Malaybalay City. The study was conducted from July 2018-December 2019 on the basis of the present fish diversity. Three sampling stations were selected. The study revealed the presence of 292 individual freshwater fishes were collected and examined in the three. And only eight species were identified, belonging to seven families and seven genera. The Highest value for richness index was 0.2671 and the lowest 0.0171.

Keywords: fish, river, diversity indices, three stations

INTRODUCTION

Over the last century, riverine ecosystems have suffered from intense human intervention resulting in habitat loss and degradation. Consequently, many fish species have become highly endangered, particularly in rivers where heavy demand is placed on freshwaters (Negi & Mamgain, 2013).

Freshwater fish are the most diverse group of vertebrates and have the greatest proportion of threatened species (Leidy et al., 1998; Duncan & Lockwood, 2001; Arthington et al., 2016; Liu et al., 2017).

Rivers have been very useful to men in all parts of the earth since very early times. They provide water to slake the thirst of men, fertilize their lands, and provide a means of communication for the goods that transport from place to place.

The Philippines is one of the places where the freshwater ecosystem is in danger of dying. In Mindanao alone, five (5) river systems have been declared at present as biologically threatened by the Environmental Management Bureau of the Department of Environment and Natural Resources (DENR).

Although there were numerous studies done worldwide on freshwater fishes, few studies have been conducted in Mindanao, Philippines (Quimpang et al., 2015). The lack of concern for freshwater fish is possibly due to the overall proximity of terrestrial and marine environment around the archipelago, which attracted more attention from scientists and other researchers.

The Sawaga River (Binukid: *Wahig Sawaga*) is a river in Central Bukidnon, Philippines, on the island of Mindanao. A majority of its catchment area is located in Malaybalay City. Its source is from a watershed west of Mt. Tuminungan (Bertomen et al., 2015) (part of the Kitanglad Range) in Barangay Dalwangan. It flows shortly northward and then eastward into Patpat and Kalasungay; the river then flows southward into the Poblacion District, past Casisang, San Jose, and Laguitas. The Lower Sawaga Valley is located in its lower course from Barangay Linabo through Bangcud until it meets with the Manupali River. It ends at Pulangi River in Kahaponan, Valencia City. The Sawaga River has a total length of about 64.5 km and the basin has a total of 42,692 hectares (Paringit et al., 2017).

The Sawaga River is one of the major water sources of the city years ago. However, it had previously gone through some natural catastrophes that caused floods and debris that affected some of the barangays in Malaybalay City. On the other hand, there are also infrastructures in the watershed and manmade activities in the river. It has slaughterhouse, poultries, piggeries, and human

settlements. Some of the residents near the watershed often do their laundry, take their baths, wash their dishes, throw their garbage, urinate and defecate in the river. The wastes that human activities produced may have affected the water quality (Bertomen, 2015) Therefore, the conservation of fish biodiversity has become more important.

Bukidnon State University has focused its research capabilities on studies that directly impact the well-being of the people. It is the social responsibility of the university to utilize research-based knowledge in informing the public of matters concerning their Biodiversity and the environment in formulating schemes as interventions.

The University's activity participates in the government's Rivers Rehabilitation Program by providing a preliminary biological status of the Sawaga River, offering scientific data related to the river's fish.

OBJECTIVES OF THE STUDY

The study aimed to collect, classify, identify, and determine the species diversity index of fishes present in the three stations of the Sawaga River.

MATERIALS AND METHODS

Ethics statement

The study followed the ethical standards of the University. All necessary permits were obtained for the described field studies. The handling of fish was also conducted in accordance with the guidelines on the care and use of animals for scientific purposes set by IACUC.

Sampling collection

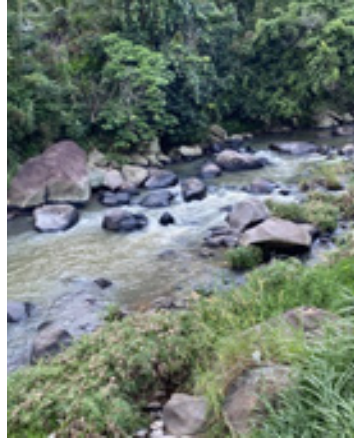
Sampling involved collection from various stations with the help of fishermen using indigenous fishing methods and using different types of nets, namely gill nets, cast nets, and dragnets. Fishes were also purchased from the fishermen on the spot.

Sampling Sites

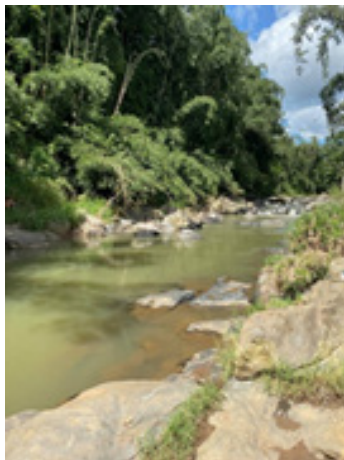
A total of three sampling stations were selected in Sawaga River: Station 1- near the bridge of the diversion road at Barangay Sumpong (Latitude 8.1616 Longitude 125.1180); Station 2- near BuKSU Main Campus at Fortich Street (Latitude 8.1558 Longitude 125.1229); Station 3- City Slaughterhouse at Barangay 9 (Latitude 8.1426 Longitude 125.1294).



STATION 1



STATION 2



STATION 3

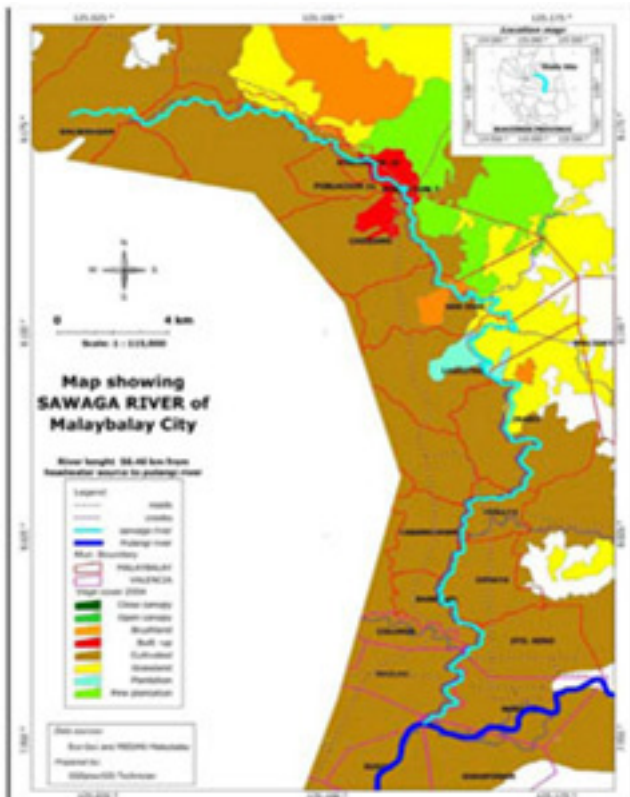


Figure 1. Map of Sawaga River. (source: Opiso, Einstine M., and Jim Loui R. Alburoa. "Hydro-Geochemical Characteristics of Sawaga River, Malaybalay City, Bukidnon. Liceo Journal of Higher Education Research, vol. 10, no. 1, 2014, p. 56+.).

Sampling for fish

Fishes were sampled using gill nets, gill nets, cast nets, and dragnets, each measuring 100 m long and 2 m wide. Fishes were also purchased from the fishermen on the spot. Professional fishermen were hired to capture fish with multiple mesh-sized gillnets. One gill net was set in each sampling station and was left in the water for at least 12 hours, that is, from about 6:00 p.m. to about 6:00 a.m. the following morning. The fish catch was sorted out into species, counted, and measured for standard length in millimeter (mm). The data on standard length were used to determine mortality rate, exploitation rate, and recruitment/

spawning patterns with the use of FISAT software. Other indigenous fishing gears used by the local fishers were adopted, and the fish catch was identified, counted, and then measured. Identification of fish specimens was based on available taxonomic references and online databases (e.g., FishBase by Froese & Pauly, 2019). (Fish standard length alone cannot determine mortality rate, exploitation rate, and recruitment /spawning patterns. Other fish reproductive parameters were inputted into FISAT. Fish species were counted and weighed in the field, and Live fish were released at the sampling sites.

Analysis of Data

Shannon's and Simpson's community indices were obtained from the data on fish used to characterize the landscape of the Sawaga River. Because the two indices have different considerations (Shannon's will be on the proportion while Simpson's will be purely on the number), both were used to check if a similar trend was observed. Similarity indices were also obtained and used to compare plant communities between the two stations included in the study.

Shannon's Diversity Index was obtained using the following formula (Begon, Harper, & Townsend, 1990):

$$H^1 = -\sum p_i \log p_i$$

H^1 = Shannon's index

p_i = proportion of species (i.e., number of individuals for species relative to the total number of individuals for all species)

Simpson's Index of Diversity was obtained as:

$$N_2 = \frac{N(N-1)}{\sum n(n-1)}$$

Where:

N_2 = diversity index

N = total number of individuals of all species

n = number of individuals of a species

RESULTS AND DISCUSSION

Table 1

Number of Fish Species collected per family and Genus

FAMILY/GENUS	STATION			TOTAL	pi	pi*ln(pi)
	1	2	3			
1 Family Cichlidae						
1 Genus Amatitlania						
1 <i>Amatitlania nigrofasciata</i>						
Günther	21	11	19	51	0.1747	
(Convict Cichlid black stripes)						-0.394765
2 <i>Amatitlania nigrofasciata</i>						
Günther (Convict Cichlid variant the yellowish)	11	8	12	31	0.1662	-0.138102
2 Family Poeciliidae						
2 Genus Poecilia						
3 <i>Poecilia reticulata</i> Peters						
	23	34	21	78	0.2671	-0.352615
3 Genus Xiphophorus						
4 <i>Xiphophorus helleri</i> Heckel						
	12	6	9	27		0.0925
(Swordtail fish)						-0.220153
4 Family Osphronemidae						
(Gouramies):						
4 Genus Trichopodus						
5 <i>Trichopodus trichopterus</i> Pallas						
	18	11	14	43	0.1473	-0.282085
5 Family Zenarchopteridae:						
5 Genus Nomorhamphus						
6 <i>Nomorhamphus cf. pectoralis</i>						
Fowler	12	16	11	39	0.1336	-0.288885
6 Family Loricariidae						
6 Genus Pterygoplichthys						
7 <i>Pterygoplichthys pardalis</i>						
Castelnau	3	1	1	5		0.0171
(Sailfin Catfish)						-0.069646
7 Family Cyprinidae (Carp)						
7 Genus Cyprinus						
8 <i>Cyprinus carpio</i> Linnaeus						
(Carp)	8	4	6	18	0.0616	-0.171763

Table 1 continued.

FAMILY/GENUS	STATION			TOTAL	pi	pi*ln(pi)
	1	2	3			
7 FAMILIES						
7 GENUS						
TOTAL	108	91	93	292		
Shannon's index - H¹						1.908014

Fish species composition

A total of 292 fish specimens were sampled in the three stations of Sawaga River that were identified into eight species, seven genera, and seven families (Table 1).

The number of *Poecilia reticulata* was the greatest, accounted for 78 of the total, followed by *Amatitlania nigrofasciata* (Convict Cichlid black stripes) accounting for 51, *Trichopodus trichopterus* (43), *Nomorhamphus pectoralis* (39), *Amatitlania nigrofasciata* (Convict Cichlid variant the yellowish) (31), *Xiphophorous hellerii* (Swordtail fish) (27), *Cyprinus carpio* (Carp) (18), and *Pterygoplichthys pardalis* (Sailfin Catfish) (5).

Diversity Index

The highest fish diversity was recorded at station 1, followed by stations 3 and 2. Typical values are generally between 1.5 and 3.5 in most ecological studies. The index is rarely greater than 4 - the Shannon index increases as both the richness and the evenness of the community increase. As shown in Table 1, the Shannon Index of Diversity is 1.91, which is considered a typical diversity based on the range. This implies that the three different sampling stations in Sawaga River indicated a strong relationship with overall species richness and showed variation.

CONCLUSIONS

The river plays a significant role in maintaining and replenishing the fish resources in Sawaga River. The results have further shown that fish composition and diversity have a significant bearing on the biodiversity status of the Sawaga River. At the same time, it would also have potential impacts on fish diversity in

the Sawaga River. Thus, the conservation of fishes has become urgent, and an integrated management plan should be developed and effectively implemented.

RECOMMENDATIONS

The conservation status of the fishes found in the Sawaga river must be identified. Determine the anthropogenic activities and their subsequent environmental disturbances that could possibly affect the distribution of fishes in the River and conduct seasonal collection to determine the distribution pattern of fishes.

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