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Sonnie A Vedra
College of Science and Environment, Mindanao State University at Naawan, 9023 Naawan, Misamis Oriental, Philippines

Ramon Francisco Q Padilla
College of Science and Environment, Mindanao State University at Naawan, 9023 Naawan, Misamis Oriental, Philippines

Rafael J Vicente
College of Science and Environment, Mindanao State University at Naawan, 9023 Naawan, Misamis Oriental, Philippines

Corresponding Author:
Sonnie A Vedra
College of Science and Environment, Mindanao State University at Naawan, 9023 Naawan, Misamis Oriental, Philippines

Indigenous fishes inhabiting the Talabaan river system of Naawan, Misamis Oriental, Northern Mindanao, Philippines

Sonnie A Vedra, Ramon Francisco Q Padilla and Rafael J Vicente

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Abstract
The species composition, abundance, diversity, evenness and similarity of the indigenous fish population inhabiting the upstream, midstream and downstream parts of Talabaan River system in Naawan, Misamis Oriental was determined. Specimens were collected using hand-held siene and cast nets. Total number of individuals of all fish species captured was 150, with 46 (30.66%), 57 (38.00%) and 47 (31.33%), respectively, recorded in the upstream, midstream, and downstream parts of the river. Eleven fish species were recorded in six families namely, *Xiphophorus hellerii (44.67%), Sicyopterus lagocephalus (20.00%), Giuris margaritacea (8.00%), Glossogobius celebius (6.67%), Awaous melanocephalus (5.33%), Rhyacichthys aspro (5.33%), Glossogobius giuris (2.67%), Oreochromis niloticus (2.67%), Anguilla marmorata (2.00%), Gerres limbatus (1.33%),* and *Mesopristes cancellatus (1.33%).* The 11 fish species might indicate that Talabaan River is a good freshwater ecosystem that could support their food and habitat requirements and other ecological needs. It is imperative therefore, that the river must be protected from overexploitation and pollution impacts. This is to sustain the economic and ecological benefits of this fishery resource for the present and future generations of Naawanons and nearby communities as well.

Keywords: Tropical freshwater fishes, species diversity, Talabaan river

1. Introduction
The archipelagic nature of the Philippines harbors higher degree of endemism and biodiversity. In fact, Philippines ranks next to Indonesia in terms of megabio diversity countries in the world. Among freshwater ecosystems like lakes, rivers and streams, they harbor a lot of fish species. Herre (1927) [7] reported fish population diversity comprising no less than 2,117 species. Around the Philippine archipelago, in the freshwater ecosystems of Southern Luzon, numerous diminutive freshwater species were documented (UPLB Limnological Research Station, 2011) [11]. In the Visayas region, total of 89 species of fish were recorded in fresh and brackish waters belonging to 45 families, wherein most species were dominated by Family Gobiidae (13 species) followed by the Family Eleotridae (10 species), Ophichthidae (six species), Cyprinidae (three species), and Poeciliidae (four species), (Bucol and Carumbana, 2010) [4] as well as a comprehensive annotated checklist of eels (Bucol *et al*., 2010) [5]. Moreover, in the freshwater ecosystem of Lakewood in Zamboanga, 11 fish species were recorded belonging to Family Cyprinidae, Channidae, Anabantidae, Anguillidae, Cichlidae, Clariidae, Hemiramphidae, and Osphronemidae (Superales *et al*., 2013) [10]. In Mandulog River in Iligan City, 10 goby species were recorded belonging to three families, namely, Gobiidae, Eleotridae and Rhyacichthyidae (Vedra *et al*., 2013) [12]. Indeed, more scientific inquiry on fish population dynamics is done by the scientific community nowadays. This prompted a study on fish population survey at the Talabaan River in Naawan, Misamis Oriental wherein basic population characteristics and descriptions were conducted.
Talabaan River found in the municipality of Naawan in Misamis Oriental traversed several barangays with Brgy. Lubilan in its topmost and Brgy. Poblacion in its estuarine portion. The River has major activities undertaken and primarily for various agricultural production, that in turn, contribute some concerns on water pollution. Some studies did the use of freshwater

macroinvertebrates as bioindicator of water pollution in Talabaan River (Baclayon *et al*., 2017) [2]. While the study is helpful, it is also imperative to account fish population in said river system. Hence, this study is geared on recording the species composition, abundance, diversity and conservation status of the fish population inhabiting Talabaan River.

It is hoped that this study may contribute additional information on the diversity of fishes in the river systems of Mindanao. Further, results can be of good use to the scientific community, resource-users, policy-makers and other stakeholders primarily on formulating initiatives leading to biodiversity conservation and sustainable development.

2. Materials and Methods

2.1 Study area

The specimen collection sites were in the three barangays of Naawan municipality, namely, Barangays Lubilan (upstream), Tagbalogo (midstream) and Patag (downstream), which are traversed by Talabaan River (Figure 1). A hand-held seine, measuring 3 m by 1.5 m with 3.5 mm mesh and a heavy lead line, was used for the collection of fish specimens. Seining was performed by three field assistants: two held each pole, while the other one had disturbed the substrate for fish to be caught into the net. A cast net was used in downstream portion of the river. Collection of specimens was done once on August 2021. Fishing time was done in less than three hours cruising portion of the river within the sampling barangays considered.

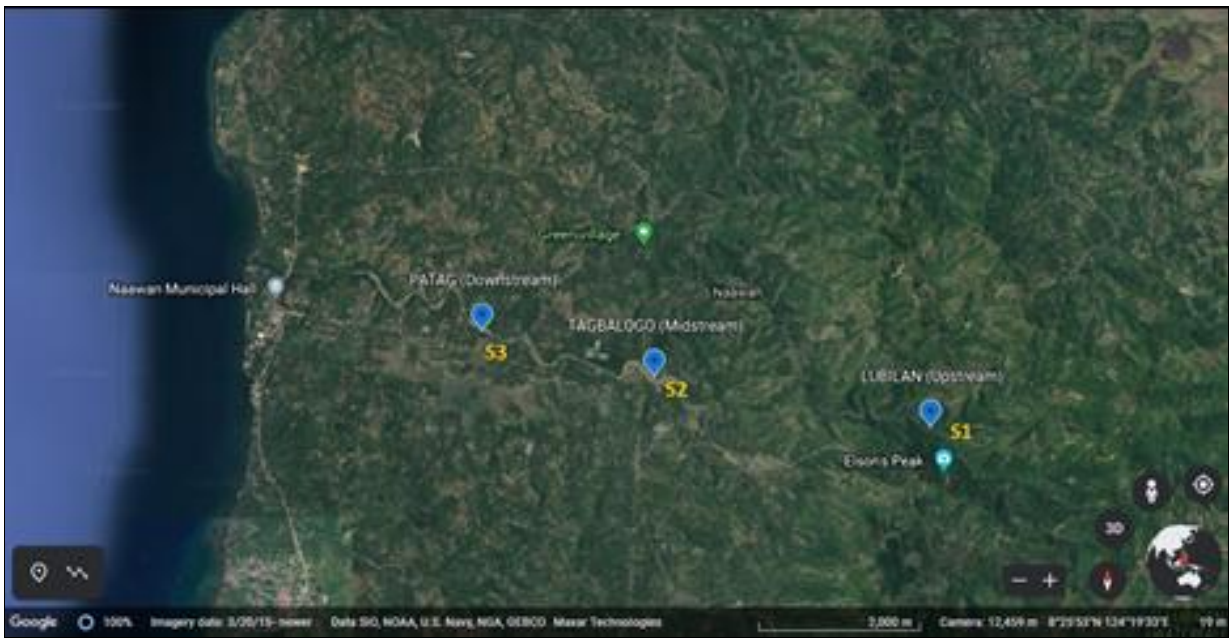

Fig 1: Map showing the collection sites in Barangays Lubilan (S1), Tagbalogo (S2) and Patag (S3) representing the upstream, midstream and downstream of Talabaan River system, Naawan, Misamis Oriental.

2.2 Fish diversity

Species composition and richness were determined by counting all species found per collection period per site. Relative abundance was based on the number of individuals in a species divided by the total number of individuals in all species. Shannon's diversity index was used to measure the species diversity and evenness of the different fish species using the formula: $H'=-\sum pi \log pi$, where: *pi* is the proportion of a species relative to all the species of fishes found. Evenness on the distribution of fishes in the river system was determined using the formula: $E= H'/H\ max$, where H' is the Shannon's diversity index and H max = log *S*, where *S* is the total number of goby species. Species similarity among the collection sites was analyzed using Jaccard's similarity coefficient: CCj= c/s; where, *c* is the number of species common to both collection sites and *s* is the total number of species found in each collection site. PAST version 9.2 was the software used in the statistical treatment of the study.

3. Results and Discussion

3.1 Fish Abundance and distribution

A total of 150 individuals of all fish species were captured during specimen collection (Table 1). To this, 11 fish species were found belonging to seven families namely: Eleotridae (i.e. *Giuris margaritacea)*, Rhyacichthyidae (i.e. *Rhyacichthys aspro)*, Gobiidae (i.e. *Awaous melanocephalus, Glossogobius giuris, Glossogobius celebius,* and *Sicyopterus lagocephalus*), Anguillidae (i.e. *Anguilla marmorata*), Gerreidae (i.e. *Gerres limbatus*), Cichlidae (i.e. *Oreochromis niloticus*), Poeciliidae (i.e. *Xiphophorus hellerii*) and Teraponidae (i.e. *Mesopristes cancellatus*) (Figure 2).

In terms of species abundance, majority of the species was dominated by *X. hellerii* (44.67%), followed by *S. lagocephalus* (20.00%), and *G. margaritacea* (8.00%). The rest of the species were captured in smaller quantities. These fish species were distinctly distributed in some geographic areas of the stretch of Talabaan River. For instance, *R. aspro. A. marmorata* and *S. lagocephalus* were mostly found in the upper reaches of the river. *R. aspro* is particular on inhabiting rapid portion of the river where enough oxygen is present (Vedra and Ocampo, 2013) [13]. Boulders and relatively deeper pools of water were observed in the upper reaches of Talabaan River in Brgy. Lubilan that in turn, could provide a favorable habitat of these said species. In fact, *S. lagocephalus* is known *ipon*-fishery in the 1950s in Cagayan de Oro River as per study of Manacop (1953) [8]. Meanwhile, a stretch of the river in the portion of Brgy. Tagbalogo, smaller stones with a few relatively deeper pools of water could provide a distinct habitat for *X. hellerii, S. lagocephalus*, and *G. margaritacea*. In the lower reaches of

Talabaan River in Brgy. Patag, sandy substrates with relatively shallower waters were mostly observed. Since this portion is relatively nearer to the estuary, some species were expected to thrive such as the *G. limbatus, O. niloticus, M. cancellatus, A. melanocephalus, G. giuris, G. celebius* (Table 2). Similar fish species were also observed and recorded in the fresh and brackishwaters of Siqujor and Negros in the Visayan region (Bucol and Carumbana, 2010; Bucol *et al*., 2010) [4, 5].

Table 1: Total number of individuals of fish species recorded in all sampling stations of Talabaan River

Taxa	Lubilan	Tagbalogo	Patag	Total Density	Relative Density
R. aspro	8	0	0	8	5.33
S. lagocephalus	23	7	0	30	20.00
A. marmorata	3	0	0	3	2.00
G. margaritacea	0	2	10	12	8.00
G. giuris	0	0	4	4	2.67
G. celebius	0	0	10	10	6.67
X. hellerii	12	48	7	67	44.67
O. niloticus	0	0	4	4	2.67
G. limbatus	0	0	2	2	1.33
A. melanocephalus	0	0	8	8	5.33
M. cancellatus	0	0	2	2	1.33
Total No. of Ind.	46	57	47	150	100
Mean	4.18	5.18	4.27	13.64	9.09
SD	7.44	14.36	3.90	19.40	12.93
Total No. of Taxa	4	3	8		

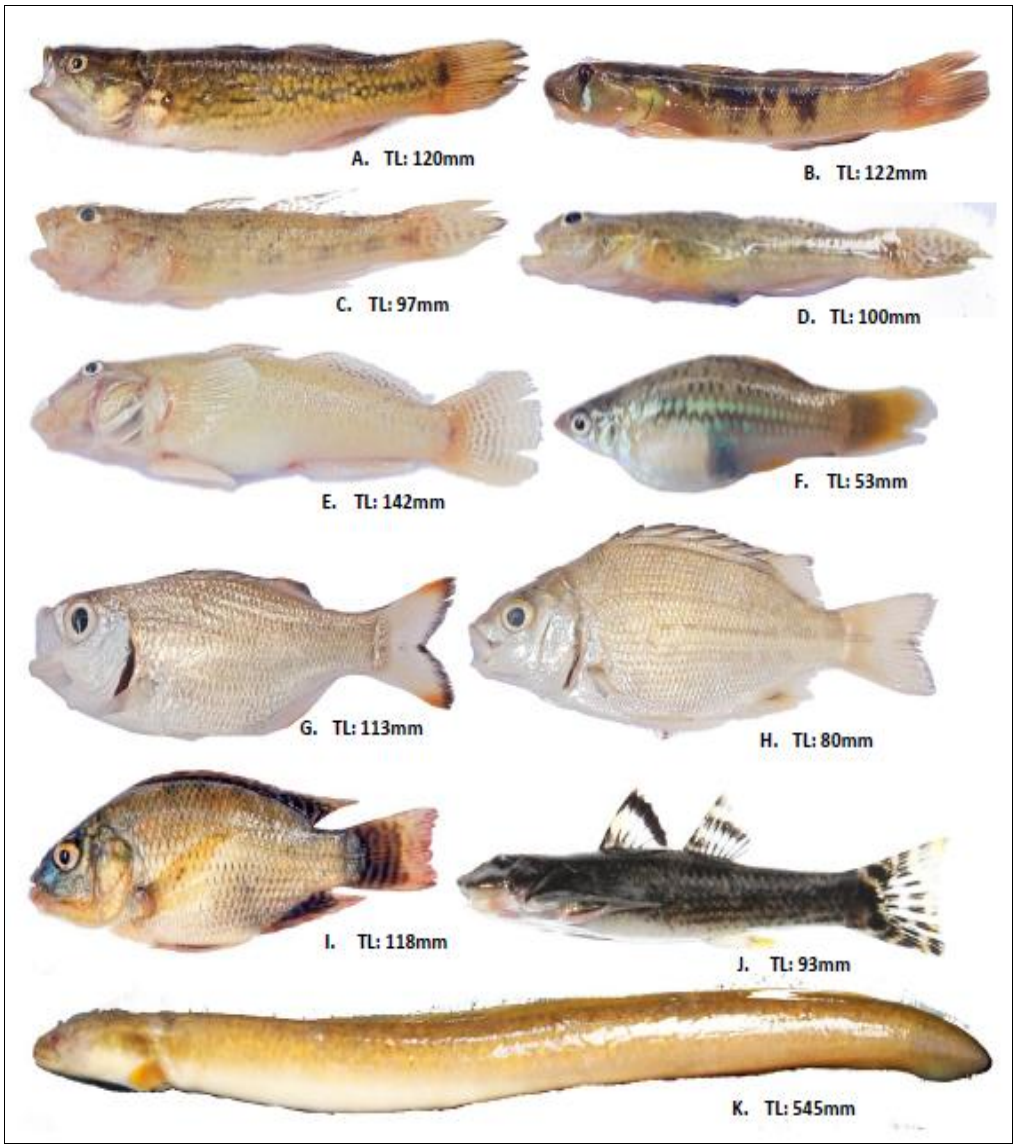

Fig 2: Freshwater fishes: *Giuris margaritacea (A), Sicyopterus lagocephalus (B), Glossogobius celebius (C), Glossogobius giuris (D), Awaous melanocephalus (E), Xiphophorus hellerii (F), Gerres limbatus (G), Mesopristes cancellatus (H), Oreochromis niloticus (I), Rhyacichthys aspro (J)* and *Anguilla marmorata (K)* inhabiting the Talabaan River system in Naawan, Misamis Oriental.

Table 2: Distribution of fish species recorded in all sampling stations of Talabaan River

Family	Local Name	Scientific Name	Endemism	Conservation Status	Lubilan	Tagbalogo	Patag	Total	Relative Abundance (%)
Gobiidae	*anga*	*S. lagocephalus*	Non-endemic	Least Concern	23	7	0	30	20.00
	iswil	*G. giuris*	Non-endemic	Least Concern	0	0	4	4	2.67
	iswil	*G. celebius*	Non-endemic	Least Concern	0	0	10	10	6.67
	subok	*A. melanocephalus*	Non-endemic	Least Concern	0	0	8	8	5.33
Anguilidae	*kasili*	*A. marmorata*	Non-endemic	Least Concern	3	0	0	3	2.00
Eleotridae	*panghal*	*G. margaritacea*	Non-endemic	Least Concern	0	2	10	12	8.00
Rhyacichthyidae	*dalapakan*	*R. aspro*	Non-endemic	Least Concern	8	0	0	8	5.33
Poeciliidae	*molly*	*X. hellerii*	Non-endemic	Least Concern	12	48	7	67	44.67
Cichlidae	*tilapia*	*O. niloticus*	Non-endemic	Least Concern	0	0	4	4	2.67
Gerreidae	*putian*	*G. limbatus*	Non-endemic	Least Concern	0	0	2	2	1.33
Teraponidae	*pigok*	*M. cancellatus*	Non-endemic	Least Concern	0	0	2	2	1.33
Families:	8				4	3	8		150
Species:	11				4	3	8		
% Endemism	None								
% Threatened	None								

3.2 Fish diversity

Using PAST (ver. 9.2) statistical software, fish diversity mean diversity (Shannon's Diversity Index) values in the study area were relatively low ranging from 0.52 to 1.93, observed in Brgys. Tagbalogo and Patag, respectively, wherein the difference among stations is not significant (P-value 0.49) based on Kruskal-Wallis test. In terms of evenness index, mean values ranged from 0.56 to 0.86, which could be an indication of certain fish species dominating in the study area. In this case, it is dominated by *X. hellerii*. Mean dominance values ranging from 0.16 to 0.73 were relatively low as expected since this index is the reverse of diversity and evenness indices. Index of similarity values ranged from 0.47 to 0.93 which means that a number of species were not commonly present along the specific sites of the Talabaan River (Table 3). Variations in the ecological indices of fish species in Talabaan River could be due to the difference in substrate classification which dictated their mode of habitat preference. Sedimentation is also a factor in affecting fish diversity based on the findings of Alima and Patricio (2010) [1]. Since majority of fish species recorded are in the goby family, technically, their life history allows them to have post-larval migration from the estuary back to the upper reaches of their river of origin (Belle *et al*., 1995; Radtke *et al*., 1988; Ego, 1956) [3, 9].

Table 3: Diversity index values of fish species recorded in all sampling stations of Talabaan River

Indices	Lubilan	Tagbalogo	Patag
Taxa	4	3	8
Individuals	46	57	47
Dominance	0.35	0.73	0.16
Simpson	0.65	0.27	0.84
Shannon	1.18	0.52	1.93
Evenness	0.81	0.56	0.86
Equitability	0.85	0.47	0.93
Kruskal-Wallis test			
Chi-square value	1.40		
P-value	0.49		

4. Conclusions and Recommendations

The eleven (11) fish species, serving as additional information, may indicate that Talabaan River, is indeed, a good ecosystem for the indigenous fishes, and therefore, must be protected from further exploitation through holistic and concerted efforts of all sectors of the community. This is due to the threats of a changing land-use patterns and water pollution from various anthropogenic-based activities done within the river system and its periphery. The population ecology of the fishes differed may be due to these factors: (1) the indigenous fishes recorded in each site were interrelated from each other, although separated geographically, and would allow same species interrelationship like in-breeding and utilization of similar needed resources like food and habitat, (2) the differed abundance could be a result of different environmental variables that influenced their spatial and temporal distributions, their ecological roles and interactions, their density and spawning behaviors, and their close association with their habitat and food sources, and (3) the potential influences of various anthropogenic disturbances in the river system that may adversely affect them through generation of point and non-point sources of pollutants where the level of contamination was increasing towards downstream. Finally, a concerted of all sectors of the community is needed, that is, to protect the fishes from overexploitation and to safeguard their corresponding habitat and food sources. Implementing regulations can be done as well as increasing their additional level of awareness of the riverine and socio-economic undertakings of the constituents. Further assessment and monitoring can be done to update timely survey of fishes along the river system.

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