Freshwater Fish Species Diversity in Htanaung Taing In (Lake), Myingyan Township, Mandalay Region

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Abstract

A total number of 36 fish species (180282 individuals) confined to 27 genera and distributed among 15 families and eight orders were recorded during November, 2017 to July, 2018 in Htanaung Taing In (Lake), Myingyan Township, Mandalay Region. Among 36 fish species, 26 species (12621 individuals) in November, 25 species (49935, 15934 individuals) each in December and April, 27 species (26285 individuals) in January, 24 species (29239 individuals) in February, 26 species (23533 individuals) in March, 24 species (15156 individuals) in May, 18 species (6829 individuals) in June and 13 species (750 individuals) in July were observed. According to diversity indices of fish (d = 1.813-2.647), (D = 0.507-0.151), (H′ = 1.204-2.340) and (J′ = 0.388-0.718) were observed in the study area and during the study period. The present work revealed that the abundance and dominance of fish were dependent upon the healthy environment of lake.
Key words: Fish diversity, Htanaung Taing In (Lake), Mandalay Region

Introduction

Fishes play an important role in energy flows, nutrients cycling and maintaining community balances in fresh water ecosystems. An estimated 126,000 described species rely on freshwater habitats, including species of fishes, molluscs, reptiles, insects, plants and mammals. Freshwater fishes comprise almost 45 % of all fishes. An estimated 15,000 fish depend on freshwater habitats. Fish forms highest among all vertebral groups apart from its economic importance (Alexandar and Sankar, 2013).

In Myanmar, a total of 775 fish species including 465 species of marine and 310 species of freshwater were recorded (Ministry of Environmental conversation and forestry 2014). Fish are invariable living components of water bodies. These organisms are important food resource and good indication of the ecological health of the water they inhibit (Bagra *et al*, 2009).

Lake and freshwater resources are planets of most important resources and provide innumerable benefits. They are used for domestic and irrigation purpose, and provide ecosystem for aquatic life especially fish, thereby functioning as a source of essential protein, and for significant elements of the world's biological diversity (Silambarasan *et al*., 2014). Fish species are also an important indicator of ecological health. The abundance and health of fish will show the health of water bodies (Mace *et al*., 2005).

The number of species present or species richness is one way of characterizing a community, although it ignores the numerical structure of communities (Begon *et al*., 1996). However, species richness is valuable in describing and comparing communities, and can serve as a baseline for measuring future changes in community structure to assess the success of conservation and management strategies (Amarasinghe and Welcomme, 2002).

One important descriptor of a community is the number of species present and their relative abundances (species richness and diversity). The diversity of biological species in a river correlates strongly with the diversity of its habitat parameters (Kadye and Marshal, 2006).

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Htanaung Taing In (Lake) is situated in the east of Ayeyawady River, Myingyan Township, Mandalay Region in the central dry zone of Myanmar. There are fishery, local fisherman, and agricultural villages near this lake. It is the floodplain lake which provides nutritious fish for the local people and livelihoods of some. The present study was conducted to investigate the fish diversity in relation to abundance, richness in Htanaung Taing In (Lake).

The present study was conducted with the following objectives:

- to identify and record the fish species in Htanaung Taing In (Lake)

- to assess fish diversity of Htanaung Taing In (Lake)

Materials and Methods

Study Area

Htanaung Taing In (Lake) is situated in Myingyan Township, Mandalay Region. It is located between 21˚23'44.46" N and 21˚25'13.52" N and 95˚18' 17.54" E and 95˚21' 11.16" E. Myingyan Township located at the east of Ayeyawady River, in the dry zone of central Myanmar. In the rainy season, Htanaung Taing In covers an area of 768 ha with a water depth about 4.6 m but in the dry season; it reduces to 25.5 ha with an average depth of 1.1 m. It is connected with Ayeyarwady River via small channel during the flood season (Fig. 1).

Study Period

The study period was conducted from November 2017 to July 2018.

Fig. 1 Location of Htanaung Taing In (Lake) (Source: Google, 2018)

Specimen Collection and Preservation

Collection of specimens was made on twice per month during study period. Fishes captured using gill net (Tan pike), Trap (Hmyone), Hmaw and small cast net (let-pyit-kun) by local fishermen were collected monthly from the fisherman. Morphological characters and measurements of fish were recorded and photographed soon after collection. The numbers of individuals of each species were counted and the total numbers recorded. The local names were also noted down. The fishes were carried and preserved in ice box and then brought to the laboratory of Zoology Department, University of Mandalay. Specimens were preserved in 10% formalin for later studies.

Identification of the Specimens

Species identification was made based on Talwar and Jhingran (1991) and Jayaram (2013). Classification of fish was followed after Jayaram (2013).

Data Analysis

Species Richness

The number of species per sample is a measure of richness. Species richness of fish was determined by using the formula of Margalef's index of richness (1958) as follows:

$$d = \frac{S - 1}{\ln N}$$

Where, d = Margalf's species richness index

S = number of species

N = total number of individuals

Simpson's Diversity Indices (1949)

Simpson's Index (D)

Simpson's index is based on the probability of any two individuals drawn at random from an infinitely large community belonging to the same species. It is calculated in the following formula.

$$D = \sum_{i=1}^{s} \frac{n_i(n_i - 1)}{N(N-1)}$$

Where, D = Simpson's index

n_i = number of individuals in the i^{st} species

N = total number of individuals of all species

With this index, 0 represents infinite diversity and 1, no diversity. That is, the bigger the value of D, the lower the diversity.

Shannon-Wiener's Index (1949)

It counts for both abundance and evenness of the species present. The formula for calculating H′ as follows:

$$H' = -\sum_{i=1}^{s} \left(\frac{n_i}{N}\right) \ln \left(\frac{n_i}{N}\right)$$

Where, H′ = Shannon-Wiener's index

n_i = number of individuals in the i^{st} species

N = total number of individuals of all species

Evenness

Evenness is a measure of fish species evenness or equitability or the relative abundance of the different species making up the richness of an area. Equitability assumes a value between 0 and 1 with 1 being complete evenness.

Pielou's evenness index (1966);

J′ = H′/lnS

J′ = Pielou's evenness index

H′ = Shannon-Wiener's index

S = total number of species

Results

Diversity Indices of Fish

A total of 36 species (180282 individuals) were recorded representing eight orders (Osteoglossiformes, Clupeiformes, Cypriniformes, Siluriformes, Mugiliformes, Synbranchiformes, Perciformes and Tetraodontiformes) and 15 families (Notopteridae, Clupeidae, Cyprinidae, Cobitidae, Bagridae, Siluridae, Schilbidae, Mugilidae, Mastacembelidae, Ambassidae, Cichlidae, Gobiidae, Anabantidae, Channidae and Tetraodontidae) (Table 1 and Plate 1).

Monthly occurrence of fish species (27 species, 26285 individuals) in January, followed by (26 species each; 12621 and 23533 individuals) in November and March, (25 species each; 49935 and 15934 individuals) in December and April, (24 species each; 29239 and 15156 individuals) in February and May, (18 species, 6829 individuals) in June and the lowest (13 species, 750 individuals) in July were observed (Table 2).

According to diversity indices, the highest value of fish species richness (d) (2.647) in November and followed by (2.555) in January, (2.484) in March, (2.480) in April, (2.389) in May, (2.237) in February, (2.218) in December, (1.925) in June and the lowest value (1.813) in July were calculated during study period (Table 2).

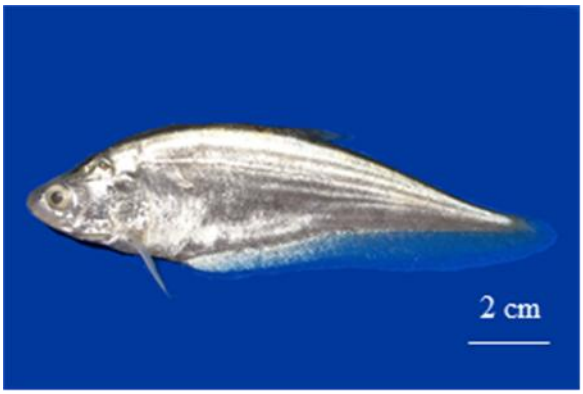
The monthly value of Simpson's index (D) (0.151) was observed the highest in November and followed by (0.255) in February, (0.275) in January, (0.330) in April, (0.372) in May, (0.403) in June, (0.440) in December, (0.485) in July and (0.507) in March (Table 2).

The value of Shannon-Weiner index (H') (2.340) was evaluated the highest in November and followed by (2.097) in February, (2.038) in January, (1.859) in April, (1.692) in May, (1.572) in December, (1.525) in June, (1.263) in March and (1.204) in July (Table 2).

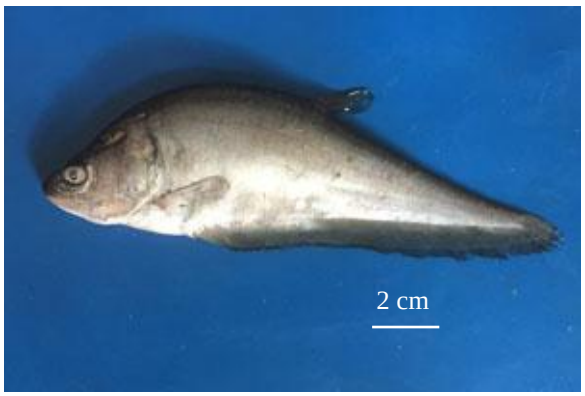
The value of Pielou's index (J) (0.718) was found to be the highest in November and followed by (0.660) in February, (0.618) in January, (0.577) in April, (0.533) in May, (0.528) in June, (0.488) in December, (0.469) in July and (0.388) in March (Table 2).

According to the IUCN (International Union for Conservation of Nature) Red List (2018), one species is Data Deficient (DD) (*Anabas testudineus*), another one (*Oreochromis* sp.) species is not evaluated, four species are Near Threatened (NT) (*Notopterus chitala*,

Osteobrama belangeri, *Ompok bimaculatus* and *Wallago attu*) and 30 species are Least Concern (LC) in the present study species. Among the 36 species, 29 native species, four endemic species (*Gudusia variegata*, *Osteobrama belangeri*, *Mystus leucophasis* and *Neotropius acutirostris*) and three species of unknown were occurred in present work.

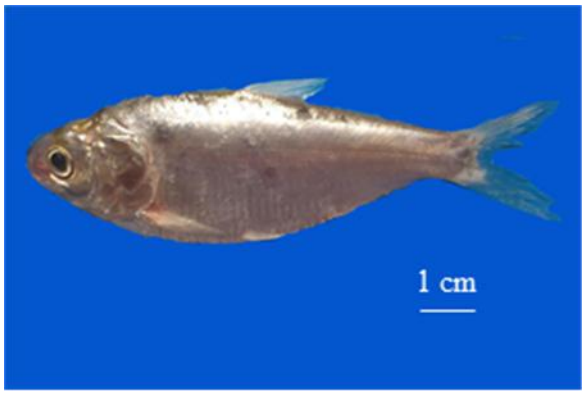


A. *Notopterus notopterus*

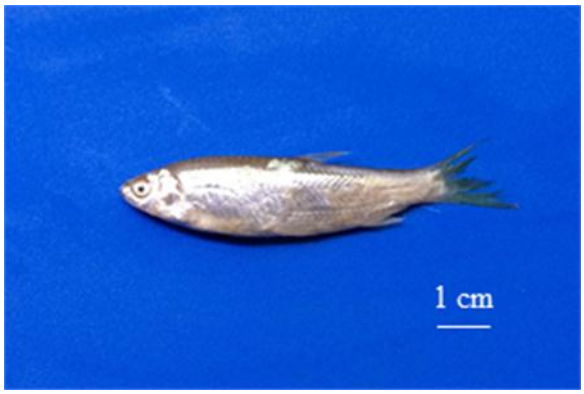


B. *Notopterus chitala*

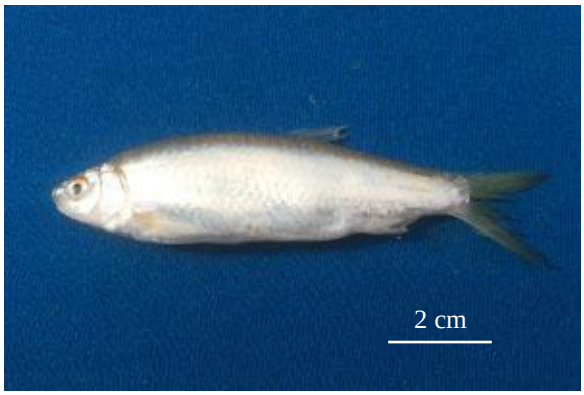
C. *Tenualosa ilisha*



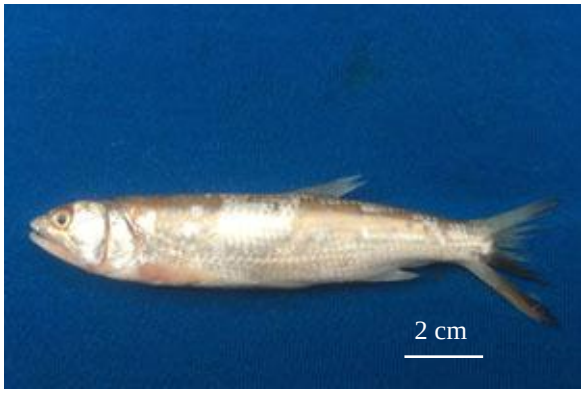
D. *Gudusia variegate*



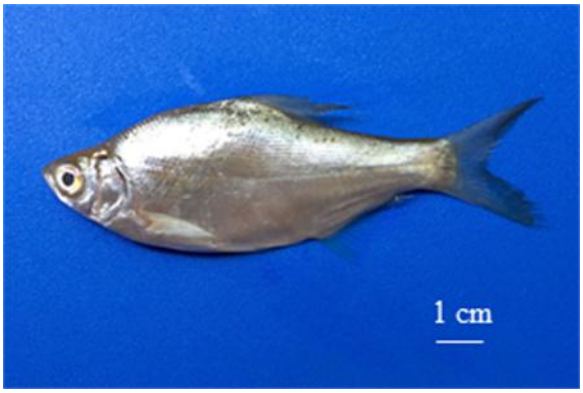
E. *Salmophasia sardinella*



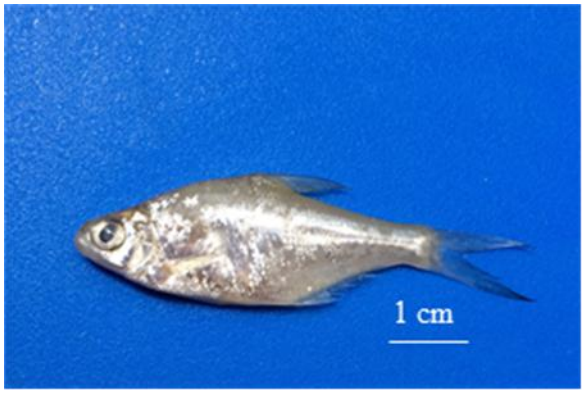
F. *Cabdio morar*



G. *Raiamas guttatus*

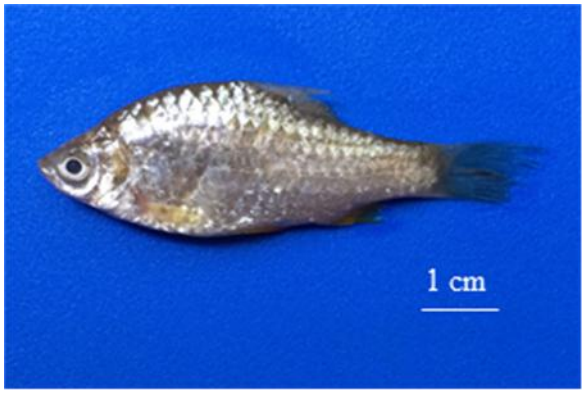


H. *Osteobrama belangeri*

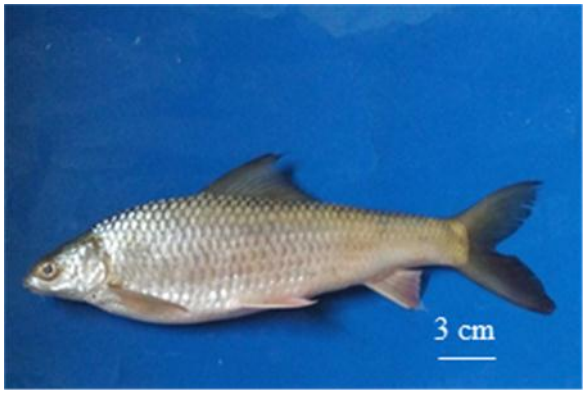


I. *Osteobrama cunma*

J. *Osteobrama feae*



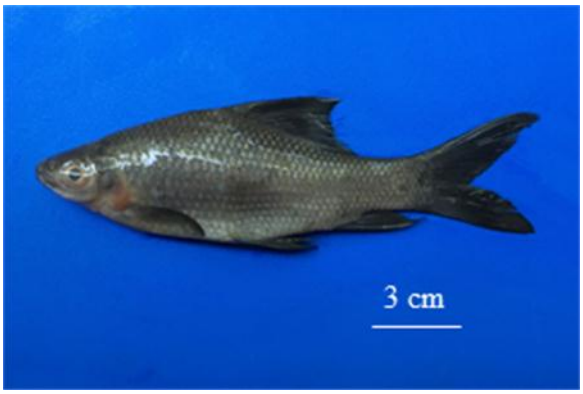
K. *Systomus sarana*



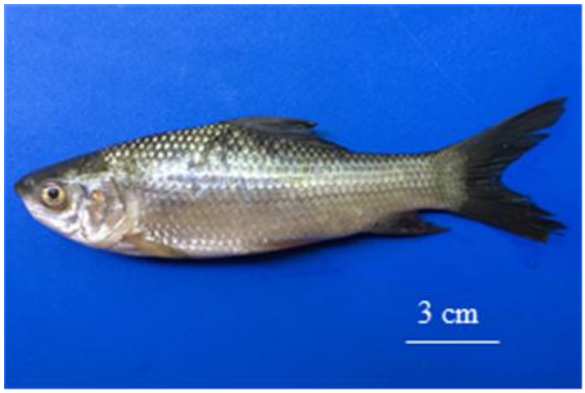
L. *Cirrhinus mrigala*

M. *Gibelion catla*

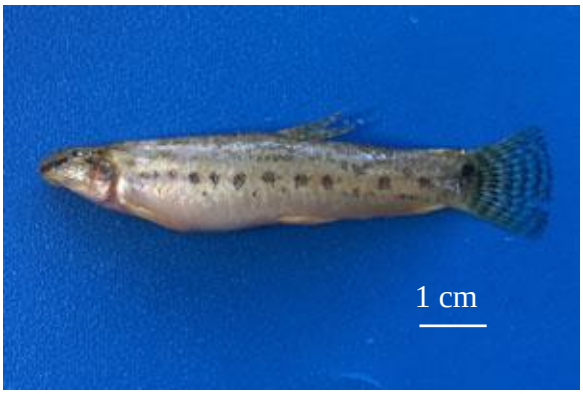
N. *Labeo boga*



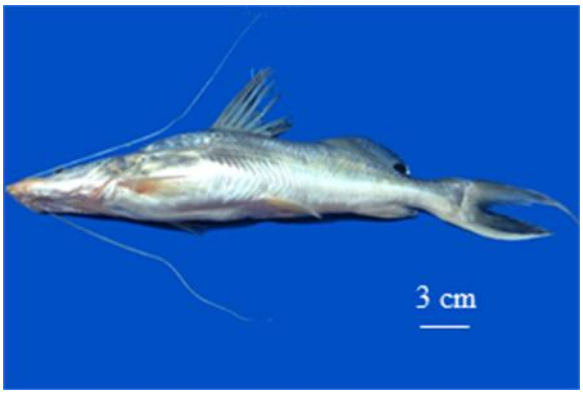
O. *Labeo calbasu*



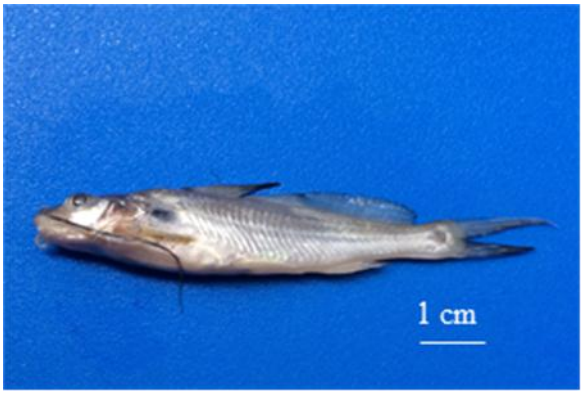
P. *Labeo rohita*



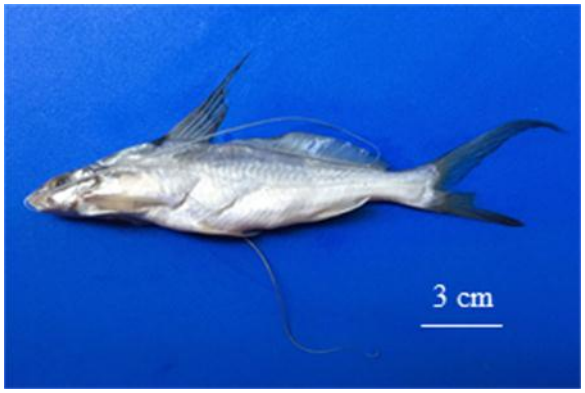
Q. *Lepidocephalichthys thermalis*



R. *Sperata aor*

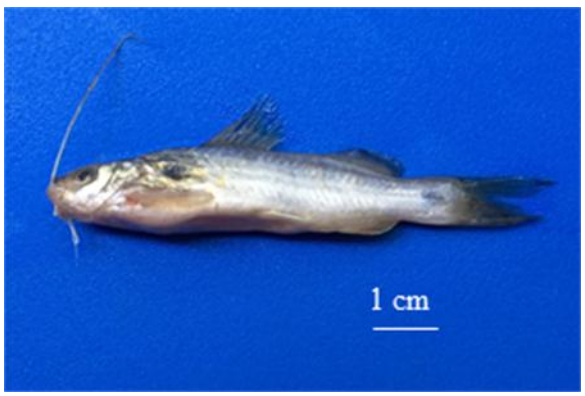


S. *Mystus bleekeri*

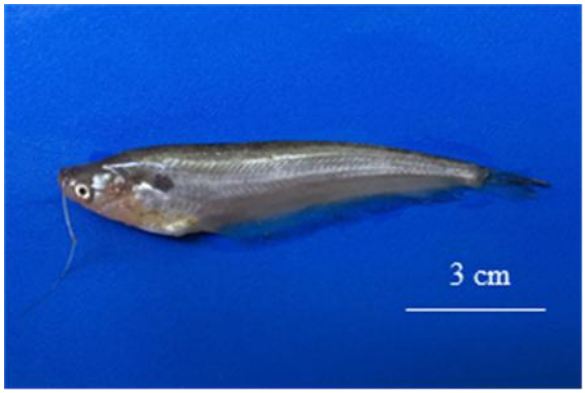


T. *Mystus cavasius*

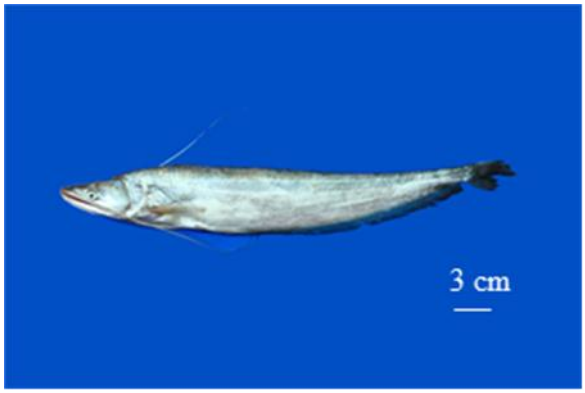
U. *Mystus leucophasis*



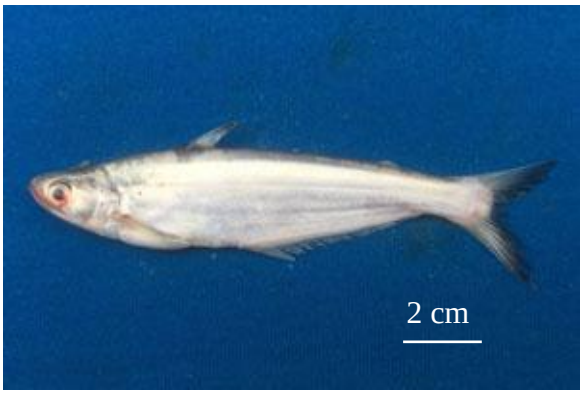
V. *Mystus pulcher*



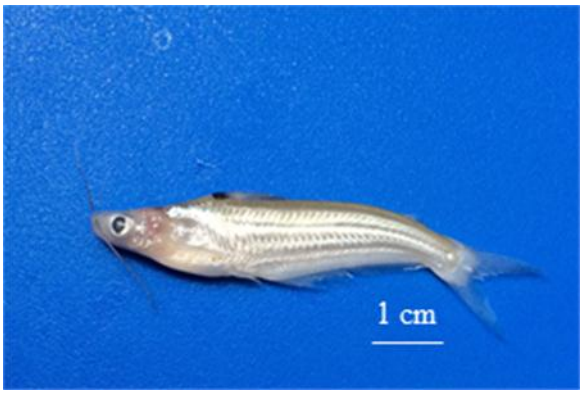
W. *Ompok bimaculatus*



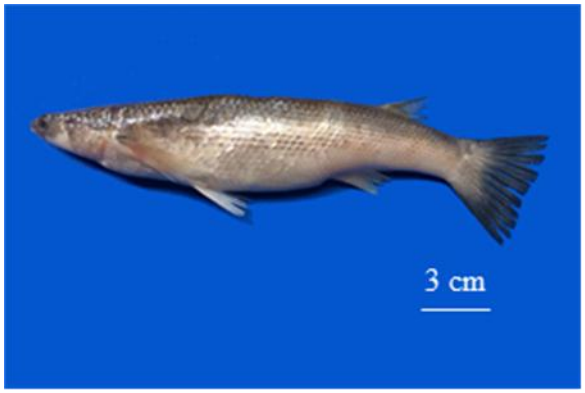
X. *Wallago attu*



Y. *Eutropiichthys vacha*



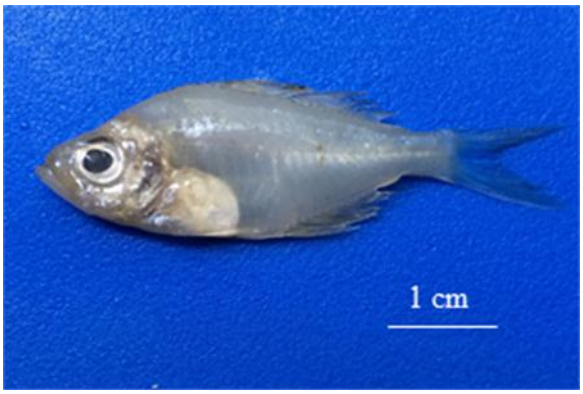
Z. *Neotropius acutirostris*



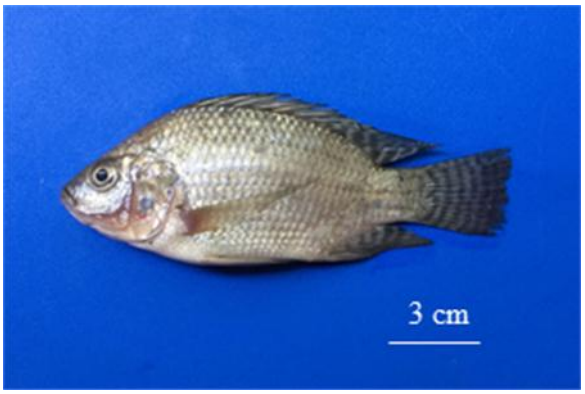
AA. *Rhinomugil corsula*

BB. *Macrognathus aral*

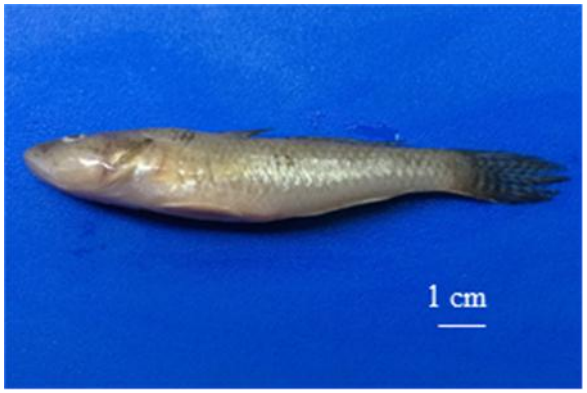
CC. *Mastacembelus armatus*



DD. *Parambassis ranga*



EE. *Oreochromis* sp.

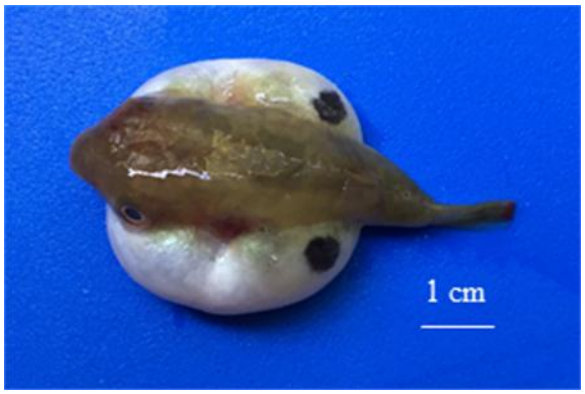


FF. *Glossogobius giuris*

GG. *Anabas testudineus*

HH. *Channa punctata*

II. *Channa striata*



JJ. *Leiodon cutcutia*

Plate 1 Fish species recorded under different orders

Table 1 Fish species recorded in Htanaung Taing In (Lake) during study period

Order	Family	Genus	Species	Common Name	Vernacular Name
Osteoglossiformes	Notopteridae	*Notopterus*	*N. notopterus*	Grey Featherback	Nga-phe
			N. chitala	Humped Feather back	Nga-phe-khone
Clupeiformes	Clupeidae	*Tenualosa*	*T. ilisha*	Hilsa	Nga-Tha-lauk
		Gudusia	*G. variegata*	Burmese shad	Nga-la-bi
Cypriniformes	Cyprinidae	*Salmophasia*	*S. sardinella*	Sardinella razorbelly minnow	Yin-baung-zar
		Cabdio	*C. morar*	Morar	Nga-phyin
		Raiamas	*R. guttatus*	Burmese trout	Nga-la-wah
		Osteobrama	*O. belangeri*	Manipur Osteobrama	Nga-phan-ma
			O. cunma	Cunma Osteobrama	Nga-lay-daung
		Osteobrama	*O. feae*	Burmese Osteobrama	Nga-lin-bam
		Systomus	*S. sarana*	Olive barb	Nga-khon-ma-toke
		Cirrhinus	*C. mrigala*	Mrigal	Nga-gyin-phyu
		Gibelion	*G. catla*	Catla	Nga-thaing
		Labeo	*L. boga*	Boga labeo	Nga-loo
			L. calbasu	Black rohu	Nga-nat-pyar
		Labeo	*L. rohita*	Rohu	Nga-gyin-myat-san-nee
	Cobitidae	*Lepidocephalichthys*	*L. thermalis*	Malabar loach	Nga-tha-le-doe
Siluriformes	Bagridae	*Sperata*	*S. aor*	Long whiskered catfish	Nga-gyaung
		Mystus	*M. bleekeri*	Day's mystus	Nga-zin-yine-kywe
			M. cavasius	Gangetic mystus	Nga-zin-yine-phyu
			M. leucophasis	Sittang mystus	Nga-nauk-thwar
			M. pulcher	Pulcher mystus	Nga-zin-yine-kyet-chay
Siluriformes	Siluridae	*Ompok*	*O. bimaculatus*	Indian butter catfish	Nga-nu-than
		Wallago	*W. attu*	Boal	Nga-butt
	Schilbidae	*Eutropiichthys*	*E. vacha*	Batchwa vacha	Nga-myin-kun-mar
		Neotropius	*N. acutirostris*	Myanmar neotropius	Nga-za-kar
Mugiliformes	Mugilidae	*Rhinomugil*	*R. corsula*	Corsula mullet	Nga-zin-lone
Synbranchiformes	Mastacembelidae	*Macrognathus*	*M. aral*	One-stripe-spinyeel	Nga-mway-ni
		Mastacembelus	*M. armatus*	Tire track spinyeel	Nga-mway-nagar

Table 1 Continued

Order	Family	Genus	Species	Common Name	Vernacular Name
Perciformes	Ambassidae	*Parambassis*	*P. ranga*	Indian glassfish	Nga-zin-sat
Perciformes	Cichlidae	*Oreochromis*	*O. sp.*	Tilapia	Tilapia
	Gobiidae	*Glossogobius*	*G. giuris*	Tank goby	Katha-boe
	Anabantidae	*Anabas*	*A. testudineus*	Climbing perch	Nga-byay-ma
	Channidae	*Channa*	*C. punctata*	Spotted snakehead	Nga-yant-panaw
		Channa	*C. striata*	Striped snakehead	Nga-yant-auk
Tetraodontiformes	Tetraodontidae	*Leiodon*	*L. cutcutia*	Ocellated puffer fish	Nga-si-pu

Table 2 Monthly diversity indices of fish species recorded in Htanaung Taing In (Lake) during study period

Diversity Indices	Nov., 2017	Dec., 2017	Jan., 2018	Feb., 2018	Mar., 2018	Apr., 2018	May, 2018	Jun., 2018	Jul., 2018
Total number of species	26	25	27	24	26	25	24	18	13
Total number of individuals	12621	49935	26285	29239	23533	15939	15156	6829	750
d	2.647	2.218	2.555	2.237	2.484	2.480	2.389	1.925	1.813
D	0.151	0.440	0.275	0.255	0.507	0.330	0.372	0.403	0.485
H’	2.340	1.572	2.038	2.097	1.263	1.859	1.692	1.525	1.204
J	0.718	0.488	0.618	0.660	0.388	0.577	0.533	0.528	0.469

Discussion

In the present research, altogether 36 species (180282 individuals) under 27 genera, 15 families and eight orders were collected from the study area during study period. Among these orders, Cypriniformes (13 species), Siluriformes (9 species), Perciformes (6 species), Osteoglossiformes, Clupeiformes and Synbranchiformes (2 species each) were observed. Mugiliformes and Tetraodontiformes were represented one species each.

According to result, the family Cyprinidae was found to be dominant group in the present study. The five speies *Notopterus notopterus, Systomus sarana, Cirrhinus mrigala, Gibelion catla* and *Oreochromis* sp. were found all study months. Htay Htay Sein (2010) and Aye Aye Thin (2012) reported that family Cyprinidae is most dominant in Lay-Ein-Su-Let-Kyar In (Lake) and Htanaungdaing In (Lake) respectively. The present study also agreed with Day (1889) who reported that Carps (Cyprinidae) are well represented in the freshwater and estuaries of India, Ceylon and Myanmar. Rainboth (1991) also reported the freshwater fish faunas of East and Southeast Asia are dominated by cyprinids.

The richness is the number of species per sample, the more species present in a sample, the richer the sample. Evenness is a measure of the relative abundance of the different species making up the richness of an area. Two commonly used indexes to measure biodiversity Simpson index D and Shannon’s index H′. Simpson’s index D is similarity index (the higher the value the lower in diversity). While Shannon index is combining evenness and richness and less weighted on dominant species. Both indexes are more reflective in nature and can predict the environment health (Supriatna, 2018).

The concept of the “species diversity” involves two components: the number of species or richness and the distribution of individuals among species (Chowdhury *et at*., 2010). Galib *et al.* (2013) documented diversity and richness indices showed that diversity of fish was higher in the winter months (November to February) than other months. This is because water depth reduced to minimum due to lack of sufficient rainfall this time allowing fishermen to

employ their fishing gears more effectively. In the present study, the highest value of species richness (d) was noted in November and the lowest in July. The present result coincided with above authors.

The Simpson's index (D) of the present result ranged from 0.507 to 0.151. The highest (D) was observed in November and the lowest in March. The present result indicates cold months were more diverse than the rest months. This may be due to no flood during that cold months.

The Shannon-Weiner diversity index (H′) of the different months showed considerable variation and ranged from 1.204 to 2.340. The highest diversity index was recorded in November and the lowest in July. These results indicate good diversity. According to Wilhm and Dorris (1966), the values of H′ ranged from >3 indicates clean water. 1.00 to 3.00 indicates moderate water and <1.00 indicates heavily polluted water.

The Pielou's evenness index (J′) ranged from 0.388 to 0.718. The highest evenness was recorded in November and the lowest in March. The result revealed that *Sperata aor*, *Mystus leucophasis, Rhinomugil corsula* and *Mastacembelus armatus* as a rare species were studied in March. Heip *et al.* (1998) noted that evenness expresses how evenly the individuals in the community are distributed over the different species. On the other hand, species richness is a measure of the total number of the species in the community.

The present study has accumulated information relating to fish species diversity of Htanaung Taing In (Lake). This will be useful in the management of fish fauna in the lake so as to sustain the lake fishery for the fisher folks in particular and also provide nutritious food for local people.

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