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Diversity of Freshwater Fish Species in the Local Market of Taunggyi Township in Winter Season

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Abstract:- A total number of fish species were recorded by interviewing with 20 local vendors from local market in Taunggyi. Fish species were identified and analyzed their abundance and diversity. Study period lasted from December 2023 to January 2024. Based on morphological identifications, fourteen fish species, under 7 orders, 10 families, 13 genera were recorded. The calculated diversity indices of fish were shown d value 1.314, in December, 1.4992 in January, D value 0.300 in December, 0.153 in January, H' 1.314 in December, 1.4992 in January, J' 0.1214 in December, 0.2143 in January. This occurrence of dominance of fish species indicated the present condition of the environment of lake. The origin of freshwater fish species is mainly transported from Inlay Lake. The present results seemed to represent the abundant species of fish that occurred in Inlay Lake. Order Cypriniformes were the most dominant with four species. Order Synbranchiformes, the occurrence of *Macrognathus caudiocellatus* was rare when compared with other species. *Macrognathus caudiocellatus* is quite popular common fish among local people. It was considered that long term agrochemicals application to the fields drained into Inlae Lake would be one of the major constraints. Therefore, it is needed to prevent from the status of endangered and maintain to produce such kinds of endemic fish species in accordance with environmental conservation, biodiversity and food sufficient in this region.

Keywords:- *Freshwater Fish; Diversity,; Macrognathus Caudiocellatus.*

I. INTRODUCTION

Fish are the most primitive vertebrates group and may be found in several types of environment. Fish and aquatic resources are important to human livelihoods, especially in many developing countries. The health of water bodies was shown by the abundance and health of fish [2], [10] which can be regarded as good indication of the ecological health of the water they inhibit.

Myanmar possesses extraordinary abundances and diversity or natural resources, but it is often acknowledged that benefits of their exploitation are in the hands of few individuals. Fishes hold a central place in national economy and the life of Myanmar people. They like fish and fishery products which are essential for their daily meals of them. Fish constitutes a major source of animals protein in the diet of Myanmar people. There are many natural habitats for spawning, breeding and rearing of fish [13] The extensive networks of rivers and flood plains have provided the bulk of fish for domestic consumption [21].

Inlay Lake second largest lake in Myanmar located in the Nyaungshwe Township of Shan State [8] and it is well known for tourism industry of Myanmar. Water in Inlae lake is slightly alkaline which can be home to a diverse fauna and many species found nowhere else in the world (endemics). The livelihood of local people rely mainly on fishing, growing rice, vegetables and flowers throughout the year. They distribute their products to local markets in Taunggyi, the capital city of Southern Shan state. Recently, poor management of agricultural practices by more agrochemicals usage has had a negative effect on the surface water, ecosystem and sediment of the lake was found [4]. It was considered that there might be possibility to be risk in fish diversity. and thus, it is needed to monitor diversity of fish species, abundance and distribution in Inlae Lake in terms of development of sustainable management and conservation programs. Studies of spatial and temporal of diversity, distribution and species composition of freshwater fishes are useful to examine factors influencing the structure of fish community [7]. The number of species present or species richness is one way of characterizing a community, although it ignores the numerical structure of communities [3]. Market surveys is the best method to know strong consumer preference and higher pricing towards revering fish species. Therefore, the present study is to identify and investigate the diversity of freshwater species from local market in Taunggyi township.

II. MATERIALS AND METHODS

- *Study Site and Duration*

Local market "No. 5 Zay" located in Taunggyi is the capital and largest city of Shan State, Myanmar.

Study period was from December 2023 to January 2024.

- *Specimen Collection*

An interview was conducted with each vendor (20 respondents) for the numbers of individuals of each species they sell, taken regions, and the total numbers of fishes were recorded by biweekly at local market site in December 2023 and January 2024. Photographs for similar morphology of fishes (minimum and maximum size) were carefully taken to get natural size and color after getting permission from fish vendors and around 10 different fish samples were bought.

Specimens were put into plastic bags and brought to the laboratory of Department of Zoology for further identification and measurement work.

➢ *Measurement of study fish for identification*

The specimens were measured total length (snout to end of the fin), standard length (gill to end of the fin), were measured. The scales along the lateral lines and the fin rays throughout the fish body were counted and described as fin formula. The local names of the fish were noted.

➢ *Identification of fishes*

The identification of fish for collected species was done according to [5], [6], [20], and [23].

➢ *Species Richness*

It was calculated according to Margalef's index of richness (1958) [11].

d = S-1/InN

d = Margalf's species richness index

S = number of species

N = total number of individuals

Simpson's diversity Index (D) [19] is calculated using the following formula. Where,

D = Simpson's index ni = number of individuals in the ist species

N = total number of individuals of all species

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

➢ *Shannon-Wiener's Index (1949)*

It counts for abundance and evenness of the species present and H was calculated by using the formula [17]

H = -Σpi * ln (pi)

H as follows: Where,

H = Shannon-Wiener's index

ni = number of individuals in the ist species

N = total number of individuals of all species

➢ *Evenness*

It is a measure of fish species evenness or equitability or the relative abundance of the different species making up the richness of an area [14]

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

III. RESULTS AND DISCUSSION

➢ *Morphology Description*

Morphological description of recorded species were shown in Table 1. According to key taxonomic characters described by [5], [6], [20],and [23], a total of 14 species (25,530 individuals) belonging to 13 genera, 10 families and 7orders name as Osteoglossiformes, Cypriniformes, Siluriformes, Cichliformes, Anabantiformes, Gobiiformes and Synbranchiformes were identified in this study. Out of 7 orders, Cypriniformes is a larger species group of freshwater fishes that include Mrigal carp, Common carp and Rohu fish. Among 14 species, 8 species are regarded as native ones including *Macrognathus Caudiocellatus* and *Channa harcourtbutleri* endemic fish species of Inlae Lake and remaining are introduced species (Table 2).

Table 1 Morphological Description of Recorded Fish Species

No.	Scientific name	Average (cm) (N=5)		Lateral line	Fin formula
		Total length	Standard length		
1	*Notopterus notopterus*	21 -60	20-57	Complete	D. (7-9); A+C. (100-110); V. (5-6)
2	*Cirrhinus migala*	35 – 100	30 -90	Complete	D. ii (12)-iii (13); A. iii 5, P. i (15); V. i (18)
3	*Cprinus carpio*	35 – 120	30-100	Complete	D. iii (17)- iv (23); A. ii (5)- iii (6), P. i (15); V. i (8)
4	*Labeo rohita*	57 – 160	38 -149	Complete	D. iii (12)- iv (14); A. ii (5)- iii (5); P. i (16-18); V. i (8)
5	*Lepidocephalichthys berdmorei*	8.5 – 15	7.6 -13	Complete	D. ii (6)- iii (6); A. ii 5-6; P. i (7-8); V. i (6-7)
6	*Clarias gariepinus*	30– 50	27 -46	Complete	D. (61- 80); A. (45-65)
7	*Heteropneustes fossilis*	13 – 30	11.5 -28	Complete	D. (6- 7); A. (60-70); P. I (7); V. i (5)

8	*Oreochromis mossambicus*	18.5– 39	18.5 -33	Interrupted	D. XV. (10) XVI. (12); A.III (10-11); P. (14-15); V.I (5)
9	*Oreochromis niloticus*	18.5 – 39	18.5 -33	Interrupted	D. XV-(10) XVI-(12); A.III (10-11); P. (14-15); V.I (5)
10	*Channa harcourbutleri*	11 – 22	9 -19	Complete	D. (35-37); A. (25-27); P. (13-15); V. 5
11	*Anabus testudineus*	11 – 22	9 -19	Complete	D.XVII- (8) XVIII- (9); A.X- (9) XI (10); P. (15-17); V. (5)
12	*Glossogobius giuris*	11 – 50	9-40	Complete	D.VII+ I (8-9); A. I (7-8); P. I (16-21); V.(11)
13	*Monopterus albus*	47– 50	47 -50	Complete	Absent
14	*Macrognathus caudiocellatus*	18 – 25	17.5 -23	Complete	D. (62-68); A. (60-68); P. (15)

D= Dorsal fin, A= Anal fin, C= Caudal fin, V= Ventral fin, P= Pectoral fin, Roman numeral (small letter) = position of hard fins and its number, Roman numeral (Capital letter) = saw-like spines positions

Table 2 Classification of Collected Species based on Morphology

No.	**Order**	**Family**	**Genus**	**Scientific name**	**Common name**	**Vernacular Name**	**Status**
1	Osteoglossiformes	Notopteridae	Notopterus	*N. notopterus*	Bronze featherback	Nga- Phere	Native
2	Cypriniformes	Cyprinidae	Cirrhinus	*C. mrigala*	Mrigal carp	Nga-gyin-phyu	Native
3			Cyprinus	*C. carpio*	Common carp	Shwe-war-nga-gyin	Introduced
4			Labeo	*L. rohita*	Rohu fish	Nga-gyin-myet-san-ni	Introduced
5		Cobitidae	Lepidocephalichthys	*L.berdmorei*	Burmese loach	Nga-tha-lae-htoe	Native
6	Siluriformes	Claridae	Clarias	*C. gariepinus*	African catfish	Nga-khu	Introduced
7		Heteropneustidae	Heteropneustes	*H. fossils*	Stinging catfish	Nga-gyee	Native
8	Cichliformes	Cichlidae	Oreochromis	*O. mossambicus*	Mozambique tilapia	Tilapia	Introduced
9				*O. niloticus*	Nile tilapia	Tilapia	Introduced
10	Anabantiformes	Channidae	Channa	*C. harcourtbutleri*	Burmese snakehead	Nga-ohn-mat	Native
11			Anabus	*A. testudineus*	Climbing perch	Nga-pyae-ma	Introduced
12	Gobiiformes	Gobiidae	Glossogobius	*G. giuris*	Tankgoby	Ka-tha-boe	Native
13	Synbranchiformes	Synbranchidae	Monopterus	*M. albus*	Swamp eel	Nga-shint-ni	Native
14		Mastacembelidae	Macrognathus	*M. caudiocellatus*	Spiny eel	Nga-mway-htoe	Native

➢ *Diversity Indices of Freshwater Fish*

According to diversity indices, total individuals observed in December were 19,700 and 5830 in January. The value of fish species richness (d) indicated 1.49 in December and 1.31 in January. The Simpson's index (D) showed 0.12 in December and (0.300) in January while the value of Shannon-Weiner index (H') in December was 1.7 and (3.2) in January. The value of Pielou's index (J) was found 0.12 and 0.21 in December and January (Table 3).

Table 3 Diversity indices of fish species recorded in local market of Taunggyi during winter season (December 2023, January 2024)

Diversity indices	**Dec, 2023**	**Jan, 2024**
Total number of species	14	14
Total number of individuals	19,700	5,830
d	1.314	1.499
D	0.300	0.153
H'	1.69	3.17
J	0.12	0.21

In our study, the family Cyprinidae was found to be the dominant group. Rainboth et al. (1991) [15] stated that Carps (Cyprinidae) are well represented in the freshwater and estuaries of India, Ceylon and Myanmar and dominant group among freshwater fishes [1],[16] and [20]. Thus, present findings are also agreed with their surveys. Species richness is a fundamental component of biodiversity and used as an indicator of ecosystem health. It was interesting that we observed 14 species in local market in winter seson while 25 and 27 species in December and January were observed in Htanungdaing In (Lake) reported by [1] and [22]. Compared to this, freshwater fish species occurrence in December and January seemed to be not high in Inlae Lake region. However, seven species such as N. notopterus, C. mrigala, C. carpio, L. rohita, H. fossils, O. mossambicus, O. niloticus were common in survey periods. Among species, individuals of Macrognathus Caudiocellatus were significantly low in this study period. We surveyed the species abundant in local market, in which fish species and individuals recorded are categorized as native and introduced species, and thus, except introduced ones native species can assume dominant groups in Inlae Lake. Because vendors answered that sources of majority of fish species were caught from Inlae lake and were distributed directly in Taunggyi local market although some of them are transported from Yangon area.

IV. CONCLUSION

The present study concluded that the diversity of freshwater fish species during winter season can be known. During study period, fish species under family Cyprinidae are the most dominant, in contrast, Macrognathus Caudiocellatus a freshwater endemic fish species in Inlae lake has currently very rarely occurred. This pointed out the situation of some native species in Inlae Lake and so, it needs to be prohibited from the status of endangered. Inlae region is well known for cultivation of upland and lowland crops throughout the year, and farmers annually applied agrochemicals to their fields. Due to this extensive usage, agrochemicals can be polluted in irrigation and drainage water to some extent that flowed into Inlae Lake would be considered one of the major constraints to be rare M. caudiocellatus species. Therefore, further research should be carried out to maintain and produce such kinds of native fish species to fulfil the food sufficient and environmental conservation.

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