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Diversity, Distribution and Abundance of Fishes in River Umngi of Meghalaya, India

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Abstract: The present study reveals that a total number of 30 species of fishes belonging to 9 families and 20 genera were recorded during the present study. Cypriniformes as the most dominant order with 23 species followed by Perciformes 5 and Siluriformes 2 species of fish recorded. During the present study bio-indices such as Shannon Weiner index (H) range a value from 1.87-2.79 in most ecological site and has a maximum index in overall distribution of 3.12. Simpson Dominance index (D) value range from 0.06-0.15 site wise and overall with 0.05 if D decrease, increase in species richness and Simpson index of diversity with a value range from 0.85-0.84 in site and 0.94 overall distribution. Analysis of Relative Abundance (RA) of fishes in river Umngi were found to be categorized under Very Rare (VR) 67%, Rare (R)17%, Common (C) 10% and Rarest (Rt) 6%. As per IUCN a total of 24species were categorized under Least Concern, 5 species not assessed and 1 Vulnerable.

Keywords : Ichthyo faunal Diversity, Distribution, Abundance, biodiversity indices, Umngi river, Threats.

Introduction

Rivers are one of the most important fresh water resources for mankind and have been playing a vital role in social,economic and political development of human society. River are characterized by a unidirectional flows at a relatively high velocity, which is highly variable with time and usually depending on climatic condition and the drainage pattern. Thorough and continuous vertical mixing is achieved in river due to the prevailing current velocity (Chapman *et al*., 1996). India is blessed with huge aquatic resources in the form of 29,000 km long of large, medium and small rivers. The entire himalayan range comprises three river system viz., Indus, Ganga and Brahmaputra (Unni, 2003). India is one of the twelve-mega biodiversity countries in the world having two biodiversity hotspots, namely the Western Ghats and the Eastern Himalayas and occupies 9th position in term of fresh water. India has, 930 are fresh water fishes belongs to 326 genera, 99 families and 20 orders (Das et al., 2014). Indian rivers form a repository of aquatic organisms which constitute the capture fisheries sector in the country (Balasubramanian *et al*., 2005 and Madhavi *et al*., 2012). The North East India comprises mainly of eight state namely, Arunachal Pradesh. Assam, Nagaland, Tripura, Manipur, Meghalaya, Mizoram and Sikkim are considered to be one of the most important hotspot of freshwater fish diversity in the world which provides unique ecological variations. The North East India forms two part of Biodiversity hotspots i.e. Himalayan and Indo-Burma (Vaiphei *et al*., 2016). Physiographically this region is categorized as Eastern Himalayan, Northeast Hills, the Brahmaputra and the Barak valley plains. The species richness of the north east region attributed to many factor like (a) the geomorphology consisting of hills, plateaus and valleys resulting in the occurrence of a variety of torrential hills streams, rivers, lakes and swamps, (b) river drainage systems which include the Ganga- Brahmaputra, Koladyne and Chindwin Irrawady Drainage systems, and (c) tectonic setting in the Indo-Chinese sub-region caused by the collision of Indian, Chinese and Burmese plate resulting in the

formation of the mighty Himalayas and Indo-Burma ranges. The hills of the undulated valleys give rise to alarge number of torrential streams which ultimately join to the big rivers, and finally become part of the Ganga-Brahmaputra-Barak-Chinwin-Kolodyne-Gomati-Meghna river system (Kottelat, 1989; Abel *et al*, 2008 and Kar, 2006).

Meghalaya is one of the states of North East India lies between $25^{0}02^{/}$ North to $26^{0}06^{/}$ North latitude and $89^{0}48^{/}$ East to 92^{0} $52^{/}$ East longitude. Meghalaya represent a remnant of an ancient plateau of the Indian peninsular. Its lies between the Surma Valley of Bangladesh on the south and the Brahmaputra valley on the north, it is dissected by a number of river and a network of their tributaries. The region itself form drainage pattern represent by a number of the torrential streams. The state itself have the highest length of river and canal with a stretch of about 5600 km followed by Assam 4820 km under the total resources of river and canal in North eastern state (Gurumayum *et al*.,2007). Meghalaya has both small and main rivers, the main rivers are in Garo hills that form the northern river system and flow from west coast to east are the Chagua, Kalu, Dudnai, Didram, Ringgi and Krishnai. Simsang rivers are the main rivers in Garo hills. The main rivers of the eastern and central regions of Meghalaya plateau that flows toward the north are the Umiam, Umkhri and Digaru etc, and some major river of the eastern and central regions that flows toward the south are Mawpna, Kynchiang (Jadukata), Myntdu, Kynshi and Umngot etc.

Meghalaya is drained by two drainage basins namely Brahmaputra and Barak-Surma -Meghna basin. Rivers of Meghalaya either flowing northerly towards Brahmaputra or southerly to river Barak. and comprising 104 fish species (Sen *et al*., 1984). Sen *et al*., 1995 reported 152 species belonging to 74 genera under 29 families and 8 orders from the state. However, Sen (2000) revised the numbers and reported 165 fish species from the state of Meghalaya. Meghalaya hold a great potential in term of ornamental fish also it has a rich biodiversity of the species present available in almost every water bodies from narrow stream to a large water bodies of lakes, rivers, ponds, pools, reservoirs etc, the state of Meghalaya is endowed with 47 ornamental fish species, if plan properly the ornamental fish trade in the state play a key role to boost up the local economy as well as for self employment (Mahapatra et al.,2004). In the recent time it is reported that Meghalaya is inhabitant by 190 species under 32 families and 11orders (Vaiphei and Gupta *et al*., 2016)

Umngi River is one of the important rivers of the South West Khasi hills district of Meghalaya, originates from the central plateau regions at elevation 1800 meter (6000 ft) MSL and flowing through Balat, Ranikor, and ultimately joining with river Barak in Bangladesh (Chopra, 1996). The river has a long stretch with a total length of about 87 km and it flows border of India and Joins with river Surma in Bangladesh, falling under Barak-Surma-Meghna Basin. As perusual of literature reveals that there is no on systematic study carried out in terms of fish diversity of river Umngi. In view of the above the present study entitled **"Diversity, distribution and abundance of fishes in river Umngi of Meghalaya, India".** Therefore the present study has been taken with the following objectives.

1. To investigate of fish species diversity in the river Umngi.
2. To investigate distribution of fishes in Umngi river with regard to altitudes.
3. To study of abundance of fishes in the Umngi river.

MATERIALS AND METHODS

Study area:

Umngi river is originated from Sohiong of West Khasi hills and lies between 25º24′24.8″N latitude and 91º33′45.9″E longitude at an elevation approximately at 1550m Mean Sea Level (MSL) and at lower level elevation 15m above MSL in Balat, before entering into Bangladesh. This river joins with river Surma in Bangladesh and ultimately linked with river Meghna.

Sampling design:

In the present study total four stations were selected to survey the river in different elevations. Stations were selected in four gradient zone described by Sen, 1984. The zone with altitudinal coverage are Zone I (2000 -1500 MSL), Zone II (1500-1001MSL), Zone III (1000-500 MSL) and Zone IV (below 500 MSL). Each station was again divided into two sites viz., Site I and Site II. Fishes was collected from each station in two different season's *viz.*, during Monsoon season (June - September) and Retreating monsoon (October to November after Borthakur, 1986. Two seasons were taken purposively due to convenience of research work. Fish sample were collected during 9.00 hr to 15.00hr to assess Ichthyofaunal diversity in the river. Each site was visited two times in each season and total 32 visits were conducted during entire research period. The collected fishes were photographed during live condition and then dip in 10% formalin in a labelled properly spacious container. Preserved fish species were taken into research laboratory of Department of Fishery Science, St Anthony's College, Shillong for further taxonomic exercise. Morphometric and meristic counts of collected fishes were done by using Inverted microscope (KSz5000) and digital calliper (Mitutoyo) and later fishes were identified following methods after Talwar and Jhingran, 1991 and Jayaram, 2010 and Sen, 1995.

Survey stations

On the basis of altitudinal variation the entire rivers was divided in to four zones as survey station during this investigation which are as follows:

Station	Site	Location	Elevation m MSL
Station 1 Dewsaw	Site I	25º24′24.8″N latitude and 91º33′45.9″E longitude	1550
	Site II	25º24′28.1″N latitude and 91º33′38.6″E longitude	1520
Station 2 Lawblei	Site I	25º24′01.4″N latitude and 91º33′22.2″E longitude	1100
	Site II	25º23′42.9″N latitude and 91º32′20.0″E longitude	1070
Station 3 Umjarain	Site I	25º22′55.5″N latitude and 91º32′15.6″E longitude	990
	Site II	25º22′33.6″N latitude and 91º32′22.1″E longitude	897
Station 4 Balat	Site I	25º12′00.6″N latitude and 91º22′29.7″E longitude	67
	Site II	25º11′16.3″N latitude and 91º22′27.6″E longitude	15

Table 1: Elevational different of location and site of each gradient zone.

Analysis of Fish Diversity:

Diversity is measured by two main components namely species richness and species evenness. The total number of species is called as species richness, whereas species evenness tells how evenly selected community of the fish species are distributed. Present study in the diversity of fish species was evaluated using bio-diversity indices like, Shannon-Weiner index (H); Shannon Equitability (EH), (Shannon et. al, 1949); Simpson Dominance index (D); Simpson index of diversity (1-D) (Simpson et. al, 1949).

Shannon-Weiner index (H)

Shannon diversity index measured the order with in the community (Denoted as H'). Shannon index was proposed by Claude Shannon in 1949 and has been an important and popular index in the ecological literature. It is characterized by the number of individual observed for each species in the environment. More order in the community as the value of the index increases. A small value in the community indicates lack of diversity. The following formula is use to estimate Shannon Weiner index (H).

$$H = -\sum_{i=0}^{S} (pi * \ln pi)$$

Where:

P_i: Relative abundance of i^{th} taxon in the sample

Pi: Sample/Sum

S: Total number of taxons in the sample

Σ = Sum

Shannon Equitability **(EH)** is estimated by using Shannon Weiner index (H).

Simpson's Dominance index (D)

Simpson's index of dominance (D) is a measure of diversity account to which the number of species present, as well as the relative abundance of each species. It is a measure of both the richness and the proportion of percentage of each species, it is therefore, a measure of dominance, meaning that a community having high diversity will have low dominance value. A large value (close to one) of 1 implies clumping of individuals in a few species, a small value (close to zero) of 0 implies uniform distribution of individual among the species. Said another way: "Simpson index. Ranges from zero (0) (all species are equally present) to one (1) (one species dominates the community completely (Doherty, 2011).

$$D = \frac{}{n(n-1)}$$

Where:

N= Total number of organism of all species

n= total number of organism of a particular species. Zero represent infinite diversity and 1 represent no diversity

Simpson's index of diversity (1-D) (1-D) is calculated from Simpson index of Dominance (D).

Relative Abundance

The commonness or rarity of a species in a defined location, communities and in the water bodies under study was determined using relative abundance (RA) which was calculated as follows:

Relative Abundance,

$$(RA) = \frac{\text{Number of sample of particular}}{\text{Total number of species}} \times 100$$

Five conservation categories of collected species assign on the basis of frequency occurrence of each species in the catch and collection site after Singh *et al*., 2009, which can be classified is as follows:

1	**Abundant (A):**	Frequency occurrence 30-40% in the catch and 100% in the collection sites.
2	**Common (C):**	Frequency occurrence 10-30% in the catch and 100% in the collection sites.
3	**Rare (R):**	Frequency occurrence 5-10% in the catch and 100% in the collection sites.
4	**Very Rare (VR):**	Frequency occurrence 1-5% in the catch and 100% in the collection sites.
5	**Rarest (Rt):**	Occur very occasionally in the catch and in the collection sites.

Table 2: Conservation categories on the basis of frequency occurrency

Statistical Analysis

The statistical analysis has been performed using standard methods as column diagram, pie diagram etc. One factor ANOVA

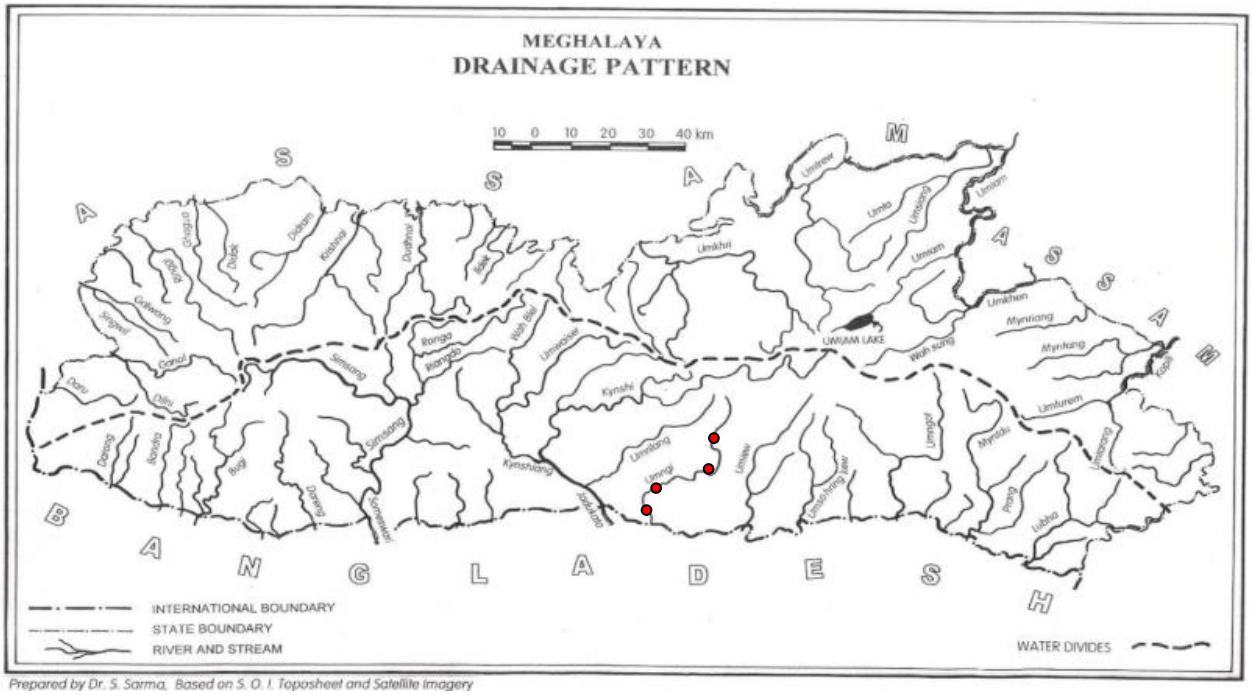
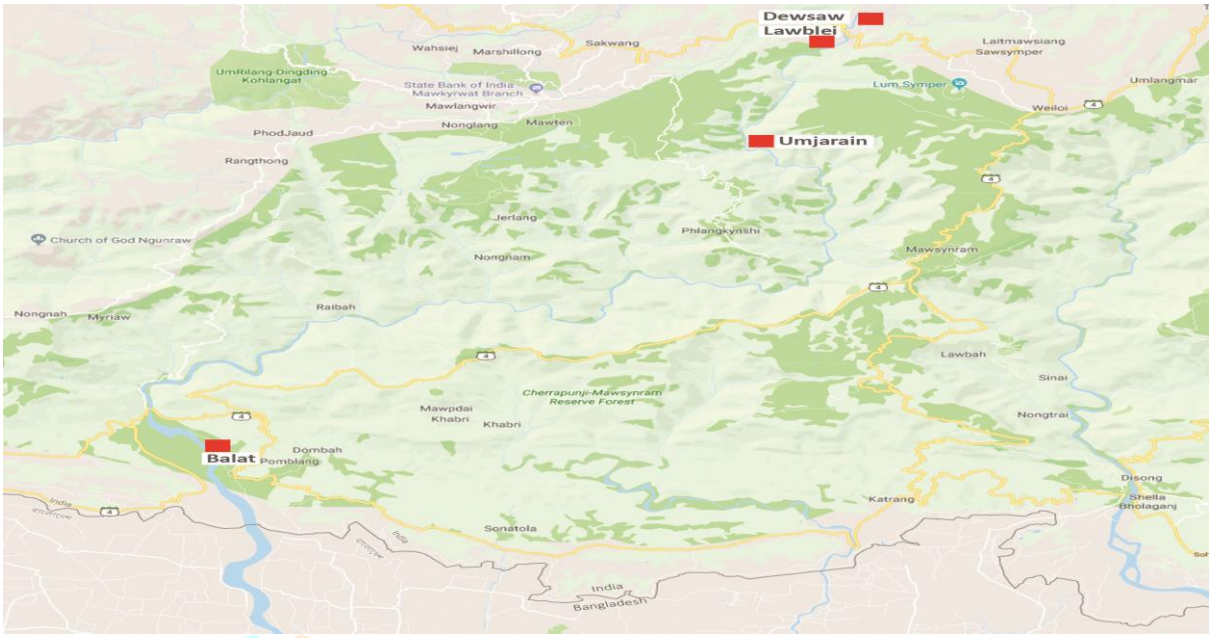


Plate I : Drainage pattern of meghalya with river Umngi.

Plate II : Drainage pattern of meghalya with river Umngi



Result and Discussion.

Fish Diversity

During the present investigation total 30 numbers of fish species belonging to 20 genera, 11 families and 4 orders were recorded from the river Umngi Of the total 30 species recorded from different collection sites during study period, 29 species were found indigenous and 1 species were exotic species i.e. common carp (*Cyprinus carpio*). Order Cypriniformes represented the maximum species (77%) belonged to 5 families namely Cyprinidae, Cobitidae, Botidae, Nemacheilidae, Psilorhynchidae. Order periformes represented (17 %) by 3 families namely Ambassidae, Badidae, and Channidae. Order Siluriformes represented about 6 % with species of 2 families Bagridae and Amblycepitidae. Indigenous fish species recorded include 1 sp of. *Amblyceps*, 1 sp. of *Badis*, 3 sp. of genus *Barilius*, 1 sp. of *Botia*, 2 sp. of *Cirrhinus*, 2 sp. of *Channa*, 1 sp. of *Chanda*, 1 sp. of *Cyprinus*, 2 sp. of Devario, 2 sp. of Danio, 1 sp. of Garra, 3 sp. of Labeo, 1 sp. Of Lepidocephalichthys, 1 sp. of *Mystus*, 1 sp. of *Neolissochilus*, 2 sp. of *Pethia*, 1 sp. of *Paracanthocobitis*, 1 sp. of *Psilorhynchus*, 1 sp of *Parambassis*, 1 sp. of *Salmophasia*, and 1 sp. of *Schistura*.

Sl.No	Order	Families	Number
1	Cypriniformes	Cyprinidae, Danionidae, Cobitidae, Botidae, Nemacheilidae and Psilorhynchidae	23
2	Perciformes	Ambassidae, Badidae and Channidae	5
3	Siluriformes	Bagridae and Amblycepitidae	2

Table 3 : Orders families and numbers of species recorded during investigation

Cypriniformes		
Family	**Genus**	**Species**
Cyprinidae	*Labeo*	*Labeo gonius*
		Labeo dero
		Labeo calbasu
	Cirrhinus	*Cirrhinus mrigala*
		Cirrhinus reba
	Pethia	*Pethia shalynius*
		Pethia ticto
	Neolissocheilus	*Neolissocheilus hexagonolepis*
	Cyprinus	*Cyprinus carpio*
	Garra	*Garra lamta*
	Salmophasia	*Salmophasia bacaila*
Danionidae	*Barilius*	*Barilius barila*
		Barilius bendelisis
		Barilius barna
	Devario	*Devario aequipinnatus*
		Devariodevario
	Danio	*Danio rerio*
		Danio dangila
Psilorhynchidae	*Psilorhynchus*	*Psilorhynchus balitora*
Cobitidae	*Lepidocephalichthys*	*Lepidocephalichthys guntea*
Botidae	*Botia*	*Botia dario*
Nemacheilidae	*Schistura*	*Schistura sikmaiensis*
	Paracanthocobitis	*Paracanthocobitis botia*
Perciformes		
Badidae	*Badis*	*Badis badis*
Channidae	*Channa*	*Channa punctata*
		Channa gachua
Ambassidae	*Chanda*	*Chanda nama*
	Parambassis	*Parambassis baculis*
Siluriformes		
Bagridae	*Mystus*	*Mystus bleekeri*
Amblycipitidae	*Amblyceps*	*Amblyceps apangi*

Table 4 : Checklist of fish species recorded during the periods of investigation

Distribution of fishes on the basis of altitude

1. Cyprinids

Carp namely *Labeo gonius, Labeo dero, Labeo calbasu, Cirrhinus mrigala, Cirrhinus reba, Neolissochilus hexagonolepis* and *Cyprinus carpio* were recorded during the investigation. *Neolissochilus hexagonolepis* were recorded mostly in all stations from lower to higher altitude of zone I, zone II, zone III and zone IV at an altitude ranged 1550-15 m above MSL. However *Labeo gonius, Labeo dero, Labeo calbasu, Cirrhinus mrigala, Cirrhinus reba,* were recorded from zone IV only at an altitude of (67-15 m) above MSL. Others cyprinid namely *Barilius barna, Barilius bendelisis, Barilius barila* commonly known hill trout, *Pethia shalynius, Pethia ticto (barb), Garra lamta (Sucker head),Danio rerio, Danio dangila, Devario aequipinnatus, Devario devario (danionin). Psilorhynchus balitora* were also recorded during investigation. Among these *Pethia shalynius, Garra lamta, Danio rerio, Danio dangila* were recorded in three zones (zone I, II, III) a altitude below 1550 m and above 897 m above MSL. *Devario aequipinnatus* are recorded from zone I at an altitude (1550-1520 m) and zone III (990-897 m) above MSL. *Psilorhynchus balitora* was recorded from all three zones i.e. Zone I, Zone II and Zone IV except zone III. Whereas *Barilius barna, Barilius barila, Barilius bendelisis, Pethia ticto, Devario devario* were recorded from zone IV at an altitude of 15-67 m above MSL.

However *Cyprinus carpio* an exotic species was recorded few in numbers from zone I (1550-1520 m) only.

2. Loaches

During present investigation total 4 species were recorded. 2 species namely *Lepidocephalichthys guntea* and *Botia dario* of family Cobitidae and 2 species namely *Schistura sikmaiensis, Paracanthocobitis botia,* belong to family Nemacheilidae were recorded. *Lepidocephalichthys guntea* restricted to zone I to zone IV (1550-15 m MSL) whereas *Botia dario* restricted in zone IV (15-67 m MSL). Distribution of *Schistura sikmaiensis* and *Paracanthocobitis botia* were basically restricted at an altitude 1550-15 m above MSL. *Schistura sikmaiensis* alone are distributed restricted basically in zone I to zone III, where as *Paracanthocobitis botia* was found only in zone I and zone IV.

3. Glass fish

Two species namely *Chanda nama* and *Parambassis baculis* belong to Ambassidae family were recorded during investigation. Distribution of both the species are restricted in zone IV at an altitude of 67-15m above MSL.

4. Snakeheads

A total of 2 species namely *Channa punctata* and *Channa gachua* belong to family channidae were recorded. *Channa punctata* were distributed at an altitude 1550 m below to 15 m above MSL at zone I, zone II, zone III and zone IV where as *Channa gachua* recorded at two zones (zone I and zone II) at an altitude between 1550 m to below 1070 m above MSL.

5. Catfishes

During the present study two species were collected, one species belong to the family Bagridae i.e.,*Mystus bleekeri* and the other species is *Amblyceps apangi* belonging to the family Amblycepitidae. Distribution of both the fishes is basically restricted to zone IV (15-67 m) above MSL.

6. Mud perches

One species *Badis badis* belonging to the family Badidae was recorded during the present investigation. *Badis badis* are restricted to zone III and zone IV, recorded at an altitude from 990-15 m above MSL.

Sl.No	Fish Group	Number
1	Cyprinids	479
2	Loaches	161
3	Snakeheads	125
4	Glass fish	32
5	Mud perch	18
6	Catfish	16
	Total fishes collected	831

Table 5 : Groups and number of fishes collected

Altitude wise fish diversity indices:

During present investigation it was observed that station 4 at an altitude of (67-15 m) in Zone IV has the highest diversity of fishes with 26 number of fish species. The bio diversity indices calculated as H= (2.79, 2.72), 1-D = (0.94, 0.93) and D = (0.06, 0.07). In Station 1 in Zone at altitude 1550-1520 m second highest number of fishes were found i.e., 12 species with H= (2.37, 2.25), 1-D = (0.91-0.9) and D = (0.1-0.09). In Station 2 at Zone II (1100-1070 m) 10 species were recorded, with H = (2.2-1.99), 1-D = (0,89-0,87) in and D = (0.13-0.11) and Station 3 in Zone III (990-897 m) found lowest fish diversity i.e., H = (2.23-1.87), 1-D = (0.89-0.85) and D = (0.15-0.1).

The overall fish diversity indices were estimated in Umngi river as Shannon Weiner index (H)= 3.12, Simpson dominance (D)= 0.05 and Simpson index of diversity (1-D)= 0.94.

	Station 1 (1520-1540 m)		Station 2 (1070-1100m)		Station 3 (900-950m)		Station 4 (15-50m)	
Diversity Index	Site1	Site 2	Site3	Site4	Site5	Site6	Site 7	Site 8
Shannon weinner Index	2.25	2.37	1.99	2.2	1.87	2.23	2.72	2.79
Simpson index of diversity	0.9	0.91	0.87	0.89	0.85	0.89	0.93	0.94
Simpson's Dominance Index	0.1	0.09	0.13	0.11	0.15	0.1	0.07	0.06

Table 6 : Station and Site wise Bio-indices of fish Index of Umngi river

Overall diversity index of river Umngi calculated	
Shannon Weiner index (H)	3.12
Simpson dominance (D)	0.05
Simpson index of diversity (1-D)	0.944335178

Table 7 : Overall fish diversity index of Umngi river

Statistical Analysis ANOVA single factor

It was observed that there was no major

Significance different of fish diversity among the 4 stations and 8 sites of river Umngi ($p > 0.05\%$).

ANOVA					
Source of Variation	*SS*	*df*	*MS*	*F*	*F crit*
Between Groups	0.0722	1	0.0722	0.668983	5.987378
Within Groups	0.64755	6	0.107925		
Total	0.71975	7			

Table 8 : Summary of single factor ANOVA for river Umngi

Threat categories

Out of 30 fish species recorded during present investigation, 24 species were categorized under least concern, 5 species not assessed and 1 species vulnerable as per IUCN (2015.3). Least concern species recorded were *Pethia ticto, Schistura sikmaiensis, Devario aequipinnatus, Devario devario, Labeo gonius, Labeo dero, Labeo calbasu, Cirrhunus reba, Cirrhinus mrigala, Barilius barila, Barilius barna, Psilorhynchus balitora, Garra lamta, Channa gachua, Channa punctata, Paracanthocobitis botia, Lepidocephalichthys guntea, Badis badis, Amblyceps apangi. Chanda nama, Parambassis baculis, Salmophasia bacaila, Mystus bleekeri* and *Botia dario* falls under this category. 5 species under not assessed namely *Danio rerio, Danio dangila, Neolissochilus hexagonolepis, Cyprinus carpio*(exotic) *and Barilius bendelisis*. 1 species under vulnerable, *Pethia shalynius*.

Sl.No	Threat category as per IUCN 2015 ver. 3	
1	Least concern	24
2	Not assessed	5
3	Vulnerable	1

Table 9 : IUCN threat status of fish species recorded during investigation

Sl.No	Sciencetific Name	Local name	Threat categories (IUCN -2015)
1	*Pethia shalynius* Yazdani & Talukdar, 1972	Kha ktung	Vulnerable
2	*Pethia ticto* Hamilton, 1822	Kha thoh tdong	Least concern
3	*Schistura sikmaiensis* Hora, 1921	Syngkai kroh	Least concern
4	*Danio rerio* Hamilton, 1822	Doh ksoid	Not assessed
5	*Danio dangila* Hamilton, 1822	birthih saw	Not assessed
6	*Devario aequipinnatus* McClennand, 1838	Birthih heh	Least concern
7	*Devario devario* Hamilton, 1822		Least concern
8	*Neolissochilus hexagonolepis* McClelland, 1839	Kha saw	Not assessed
9	*Cyprinus carpio* Hamilton, 1822	Kha dkhar	Not assessed
10	*Labeo gonius* Hamilton, 1822	Kha ski	Least concern
11	*Labeo dero* McClelland, 1839	Kha tin	Least concern
12	*Labeo calbasu* Hamilton, 1822	Kha iong	Least concern
13	*Cirrhinus reba* Hamilton, 1822	Kha laso	Least concern
14	*Cirrhinus mrigala* Hamilton, 1822	Kha merang	Least concern
15	*Barilius bendelisis* Hamilton, 1822	Kha jyndem	Not assesed
16	*Barilius barila* Hamilton, 1822		Least concern
17	*Barilius barna* Hamilton, 1822	Kha her	Least concern
18	*Psilorhynchus balitora* Hamilton, 1822	Kha dilong	Least concern
19	*Garra lamta* Hamilton, 1822	Doh jei	Least concern
20	*Channa gachua* Hamilton, 1822	Doh thli	Least concern
21	*Channa punctata* Bloch, 1793	Doh thli khasi	Least concern
22	*Paracanthocobitis botia* Hamilton, 1822		Least concern
23	*Lepidocephalichthys guntea* Hamilton, 1822	Syngkai ktieh	Least concern
24	*Badis badis* Hamilton, 1822	Kha sniang	Least concern
25	*Amblyceps apangi* Nath &Dey, 1989		Least concern
26	*Chanda nama* Hamilton, 1822	Kha tengra	Least concern
27	*Parambassis baculis* Hamilton, 1822	Kha snad	Least concern
28	*Salmophasia bacaila* Hamilton, 1822		Least concern
29	*Mystus bleekeri* Day, 1877	Kha wait tarei	Least concern
30	*Botio dario* Hamilton, 1822		Least concern

Table 10 : Threat Assessment categories of Recorded Fishes as per IUCN

Abundance category:

The relative abundance (RA) of indigenous fish of Umngi river recorded highest in *Channa punctatus* (11.54%), followed by *Neolissochilus hexagonolepis* (11.07%), *Lepidocephalichthys guntea* (10.12%), dominance during present study and is found to be Common in river Umngi. Fish species such as *Danio rerio* (5.18%), *Schistura sikmaiensis* (5.06%), *Pethia shalynius* (5.06%), *Danio dangila* (5.06%), *Labeo gonius* (5.06%) becoming Rare. Relative abundance was found to be Very Rare in species like *Pethia ticto* (3.06%), *Channa gachua* (3.18%), *Labeo calbasu* (2.35%), *Devario aequipinnatus* (2.47%), *Garra lamta* (2.35%), *Labeo calbasu* (2.35%), *Paracanthocobitis botia* (2.35%), *Cirrhinus mrigala* (2.12%), *Badis badis* (2.12%), *Parambassis baculis* (2.00%), *Labeo dero* (1.88%), *Barilius barila* (1.88%), *Cirrhinus reba* (1.76%), *Psilorhynchus balitora* (1.76%), *Chanda nama* (1.76%), *Barilius bendelisis* (1.64%), *Barilius barna* (1.64%), *Botia dario* (1.43%), *Devario devario* (1.30%), *Mystys bleekeri* (1.27%). However two species were found to be Rarest *viz*, *Amblyceps apangi* (0.58%) and one exotic fishes *Cyprinus carpio* (0.60 %).

Sl.No	Sciencetific Name	Local Name	Relative Abundance (RA)	Category
1	*Pethia shalynius*	Kha ktung	5.06	Rare
2	*Pethia ticto*	Kha thoh tdong	3.06	very rare
3	*Garra lamta*	Doh jei	2.35	very rare
4	*Danio rerio*	Doh ksoit	5.18	Rare
5	*Danio dangila*	Birthih saw	5.06	Rare
6	*Devario aequipinnatus*	Birthi hheh	2.47	very rare
7	*Devario devario*		1.30	very rare
8	*Neolissochilus hexagonolepis*	Khasaw	11.07	common
9	*Cyprinus carpio*	Kha dkhar	0.60	Rarest
10	*Labeo gonius*	Kha ski	5.06	Rare
11	*Labeo dero*	Kha tin	1.88	very rare
12	*Labeo calbasu*	Kha iong	2.35	very rare
13	*Cirrhinus reba*	Kha laso	1.76	very rare
14	*Cirrhinus mrigala*	Kha merang	2.12	very rare
15	*Barilius bendelisis*	Kha jyndem	1.64	very rare
16	*Barilius barila*		1.88	very rare
17	*Barilius barna*	Kha her	1.64	very rare
18	*Psilorhynchus balitora*	Kha dilong	1.76	very rare
19	*Schistura sikmaiensis*	Kha syngkai	5.06	Rare
20	*Botio dario*		1.41	very rare
21	*Lepidocephalichthys guntea*	Syngkai ktieh	10.12	common
22	*Paracanthocobitis botia*		2.35	very rare
23	*Channa punctata*	Doh thli khasi	11.54	common
24	*Channa gachua*	Doh thli	3.18	very rare
25	*Salmophasia bacaila*		2.12	very rare
26	*Chanda nama*	Kha tengra	1.76	very rare
27	*Parambassis baculis*	Kha snad	2.00	very rare
28	*Amblyceps apangi*		0.59	Rarest
29	*Mystus bleekeri*	Kha wait tarei	1.30	very rare
30	*Badis badis*	Kha sniang	2.12	very rare

Conclusion:

During present investigation a total of 30 fish species belongs to 20 genera, 9 families and 4 orders were recorded from river Umngi. Of 30 fish species 29 were indigenous fish species and 1 exotic fish species. Similar study was carried out by Sen, 1984, Sen 1995 and Ramanujam, 2010 for entire state Meghalaya and reported 104, 152 and 68 fish species respectively. Study conducted by Valentina *et al*., 2015 in hilly river of Karbi Anglong, Assam and found total 62 fish species. The present finding is agreeing with the investigation of Nath *et al*, 2016 on fish diversity of river Umngot of Meghalaya where a total 24 species belonging to 19 genera and 6 orders were reported.

In the present study it was found that majority of the species were belong to order cypriniformes (77%). This finding is in conformity with the previous report of national, regional and also Meghalaya state given by various researchers. Shukla *et al*., 2013 reported that fishes of order cypriniformes were most abundant in all sites of Aami river of Uttar Pradesh. Nath *et al*, 2016 also observed that fishes of order cypriniformes (67%) were dominating in river Umngot of Meghalaya. Srivastava *et al*., 2013, Lakra *et al*, 2010, Das *et al*., 2012 and Mail *et al*., 2017 had reported similar findings with regard to dominance of fishes of Cyprinidae family in river Gandak, Ganga basin, river Jamuna in Karbi Anglong, Assam and Jia Bholeli river of Assam respectively. Ramanujam *et al*., 2010 stated that Cyprinidae was the most dominant group represented by 30 species in Meghalaya and this finding is agreeing the present investigation.

In the present study the biodiversity indices *viz*., Shannon weiner index (H), Simpson's diversity index (1-D), Simpson's dominance index (D) were calculated as 3.12, 0.94 and 0.06 respectively. It indicates the richness of fish species, high diversity, and lack of dominance of any fish species in the Umngi river. Nath *et al*., 2012 reported similar findings for Chandubi lakes in Assam with bio diversity indices H= (2.938 – 3.602) and D = (0.923-0.959). Finding of the present investigation is also in conformity with the study of Valentina *et al*., 2015 on bio diversity indices H = (3.48 - 3.88) in hill streams of Karbi Anglong, Assam.

In the present investigation the fish diversity with regard to different altitude was studied and it was found that highest number of fishes i.e. 22 numbers in Zone IV at altitude 15 m - 67 m above MSL followed by Zone I at altitude 1520-1550 m above MSL. Sen *et al*, 1984 also reported similar findings on high fish diversity at Zone IV at altitudes below 500 m above MSL. Bio diversity indices in Zone IV at the both sites were calculated as H = (2.72 – 2.79), 1- D = (0.90 – 0.91) and D = (0.1 – 0.09). Similar finding was reported in the previous study of Nath *et al*., 2016 on fish diversity at lower altitude of river Umngot with bio diversity indices H = (1.83-1.99) and 1-D = (0.91 – 0.93). But the present investigation has disagreed with Yazdani, 1977 on the diversity of fishes. He stated that fish diversity in Khasi hills is decreasing above 4000ft but in the present study second highest fish diversity was recorded at altitude more than 1500 m MSL i.e. Zone I with H = (2.25-2.37), 1-D = (0.90-0.94), and D = (0.10-0.90). Some fishes namely *Neolissochilus hexagonolepis*, *Lepidocephalichthys guntea* and *Channa punctata* has shown wide distribution in all the Zones i.e. from Zone I to Zone IV. Distribution of fish species like *Pethia shalynius*, *Danio rerio*, *Danio dangila*, *Devario aequipinnatus* and *Garra lamta* was restricted to Zone I to Zone III i.e. from 887 m to 1550 m MSL. Economically important fish species under genus *Labeo* viz. *Labeo rohita, L gonius, L dero* and Genus *Cirrhinus* viz., Cirrhinus mrigala, C reba were recorded from Zone IV at altitude 15 m – 67 m MSL. These finding is in conformity with study of Sen, 1984. In the present study it was found that there is no significant difference in fish diversity within the sites of same station and between the all stations.(Table:8)

During the period of investigation, as per IUCN assessment it was observed that out of 30 fish species recorded in river Umngi, 22 numbers (80%) are least concern namely *Pethia ticto*, *Schistura sikmaiensis*, *Devario aequipinnatus, Devario devario, Labeo gonius, Labeo dero, Labeo calbasu, Cirrhunus reba, Cirrhinus mrigala, Barilius barila, Barilius barna, Psilorhynchus balitora, Garra lamta, Channa gachua, Channa punctata,Paracanthocobitisbotia,Lepidocephalichthys guntea, Badis badis, Amblyceps apangi. Chanda nama, Parambassis baculis, Salmophasia bacaila, Mystus bleekeri* and *Botia dario*, 5 (17%) species were Not assessed namely *Danio rerio, Danio dangila, Neolissochilus hexagonolepis, Cyprinus carpio*(exotic) *and Barilius bendelisis* and only 1(3%) species *Pethia shalynius* was found which is categorized under vulnerable category. *Pethia shalynius* is also known as endemic to North East India was recorded from all four Zones i.e, Zone I to Zone IV during study period. Sen, 1999 recorded and reported P shalynius from Lohit, Tirap and Chalang district of Arunachal Pradesh. Sarkar *et al*, 2012 reported 143 species

from river Ganga and out of that 29 species were listed under threatened category. Srivastava, et al, 2013, revealed that out of 54 fish species recorded from river Gandak 45% were LRnt, 11% LRlc, 26% VU, 11% NE and 7% EN category.

Analysis of Relative Abundance (RA) for fishes species of Umngi river revealed that *Channa punctata* is the most common fish species with RA (11.5%) followed by *Neolissochilus hexagonolepis* with RA (11.1%), *Lepidocephalichthys guntea* with RA (10.1%). Maximum fishes i.e. 20 numbers were found under Very Rare category with RA less than(5%), namely *Pethia ticto* (3.06%), *Channa gachua* (3.18%), *Labeo calbasu* (2.35%), *Devario aequipinnatus* (2.47%), *Garra lamta* (2.35%), *Labeo calbasu* (2.35%), *Paracanthocobitis botia* (2.35%), *Cirrhinus mrigala* (2.12%), *Badis badis* (2.12%), *Parambassis baculis* (2.00%), *Labeo dero* (1.88%), *Barilius barila* (1.88%), *Cirrhinus reba* (1.76%), *Psilorhynchus balitora* (1.76%), *Chanda nama* (1.76%), *Barilius bendelisis* (1.64%), *Barilius barna* (1.64%), *Botia dario* (1.43%), *Devario devario* (1.30%), *Mystys bleekeri* (1.27%). 5 species were categorized as rare with RA within the range 5 – 10% namely *Pethia shalynius* (3.06%), *Channa gachua* (3.18%), *Labeo calbasu* (2.35%), *Devario aequipinnatus* (2.47%), *Garra lamta* (2.35%), and two species namely *Amblyceps apangi* (0.58%) and one exotic fishes *Cyprinus carpio* (0.60 %). was qualified for rarest category with RA less than 1%. The low percentage of RA of majority of fishes indicates that population of fishes has been declined to critical level in the river Umngi and it needs urgent conservation measures. Srivastava *et al*., 2013 also studied on conservative prospective, evaluation status of fishes in Gandak river and reported 26% species were threatened category which needs conservation attention.

One Exotic fish species i.e. *Cyprinus carpio* were recorded during the period of investigation. It has been found that the fishes were categorised to be Rarest (0.70%) during investigation. The presence of *Cyprinus carpio* in Umngi river may be due to accidental entry from aquaculture pond from surrounding area. Common carp was also reported by Sugunan, 1995 and Nath *et al*, 2014 in Umiam reservoir of Meghalaya. Sarma *et al*., 2012 together has reported 6 exotic fish species from lower reaches of Brahmaputra river of Assam and becoming a threat to the native fauna.

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