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Preliminary field study and taxonomic characterization of some of the icthyo species collected form Barak, Mizoram Drainage and Manipur

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Abstract
Fishes-good protein diet source, have been classified since old times so as to know their whereabouts and their exciting facts as water dwellers. Fishes belonging to different taxa are widely studied so as to gain a proper knowledge about them, as with increasing demand and simultaneous intensification of fish resources serving along with human exploitation, it has become a serious concern about the dwindling existence of the fishes.
The present investigation was to study the icthyo-diversity pertaining to the state of Manipur wherein there were Lake and Rivers that would get an insight to the presence of the varied types of fishes available in the concerned region. The endemic species population was also found and its abundance trend was brought out. The study also coincided with the knowing of the diversity of the fishes as well as the present scenario of the same.

Keywords: Barak, Mizoram, Manipur, fish diversity, IUCN

Introduction
Fishes are *unselfish cold-blooded* water dwellers serving as rich protein diet to mankind and maintaining aquatic ecological balance. They constitute more than half of the living vertebrates recognised (Nelson, 2006) [50]. The number of valid fish species is nearly 31,000, and 500 new species being constantly added in every year. This increase in the number of fish species in the recent years has been attributed to the increasing resource surveys or expeditions in new areas and depths which were not accessible earlier, modern approaches to taxonomy and cataloguing of the resources (Eschmeyer *et al*., 2010) [51]. Fish constitutes almost half the total number of vertebrates. Of the 39,000 species of vertebrates recognised the world over, 21,723 are fish species of which 8,411 species are freshwater, while 11,650 are marine (Jayaram, 1999) [19]. Fishes are one of the important elements in the health and economy of many countries as they have been a staple item of diet of many people in the world. They constitute slightly more than half of the total number approximately 54,711 recognized living vertebrate species; there are descriptions of estimated 27,977 valid species of fishes.
The fishes are one of the main exploitable resources of the aquatic ecosystems that provide a cheap source of protein. Fishes are one of the important elements in the economy of many nations as they have been a stable item in the diet of many people (Kar *et al*., c2005) [53]. Adequate protection of ecosystems is a necessary requirement for survival of all species and proper care is needed to overcome anthropogenic stresses. In the case of commercial species, rational exploitation is a pre-requisite for sustainability of the resources. The study of fishes is devoted to a branch of zoology called Ichthyology wherein detailed fish study is done.
India ranks ninth in terms of freshwater mega biodiversity hotspots of the world (Mittermeier and Mittermeier, 1997) [54]. In India, there are 2500 species of fishes of which 930 live in freshwater and 1570 species live in marine water (Kar, 2003) [52]. The Indian fish fauna is divided into two classes, *viz*., Chondrichthyes and Osteichthyes. The Chondrichthyes are represented by 131 species under 67 genera, 28 families and 10 Orders in the Indian region.

The annual average landings of the Indian Chondrichthyes is 33,442 tons, of which, 15,537 tons come from the east coast and 17,605 tons come from the west coast and the rest come from the Andaman and Nicobar, and Lakshadeep Islands.

The Indian Osteichthyes are represented by 2,415 species belonging to 902 genera, 226 families and 30 orders, of which, five families, notably the family Parapsilorhynchidae are endemic to India. These small hillstream fishes include a single genus, *viz*., *Parapsilorhynchus* which contains 3 species. They occur in the Western Ghats, Satpura Mountains and the Bailadila range in Madhya Pradesh only. Further, the fishes of the family Psilorhynchidae with the only genus Psilorhynchus are also endemic to the Indian region. Other fishes endemic to India include the genus *Olytra* and the species *Horaichthys* setnai belonging to the families Olyridae and Horaichthyidae respectively. The latter occur from the Gulf of Kutch to Trivandrum coast. The endemic fish families form 2.21 percent of the total bony fish families of the Indian region. 223 endemic fish species are found in India, representing 8.75 percent of the total fish species known from the Indian region and 128 monotypic genera of fishes found in India, representing 13.20 percent of the genera of fishes known from the Indian region.

About 22000 species of fishes have been recorded in the world; of which, about 11% are found in Indian waters. Out of the 2200 species so far listed, 73 (3.32%) belong to the cold freshwater regime, 544 (24.73%) to the warm fresh waters domain, 143 (6.50%) to the brackish waters and 1440 (65.45%) to the marine ecosystem.

Manipur (Latitude 23.80° N to 25.68°N and Longitude 93.03°E to 94.78°E) a state in the northeast corner of India has a subtropical climate with average temperature ranging from 0^0 C-32^0C and and annual rainfall as 1657.6 mm. The state has a total geographical area of 22,356 sq.km and is characterized by three River systems namely-Manipur, Chindwin, River Barak. The state is drained by various streams which belong to the Manipur River and its tributaries along with other smaller streams and associated Lakes forming the water resources of the valley. A catchment of 6,332sq.km constituting about 28.4% area of the state discharge maximum quantity of water through Manipur River system during monsoon months (May-September) and frequently inundate the land along their bank. The state of Manipur with its Lakes like the Loktak, Awangsoi, Utra and also the Rivers-Imphal River, Nambul River, Lokchao River, Thoubal River, Khujailok River is a paradise of beauty with its water bodies enriching the scenario. Variety of fishes are available in the hilly streams, Lakes, and Rivers of the valley starting from the Cypriniformes family upto the Cichlidae family.There are catfishes,live fishes, ornamental fishes and also endemic species like *Osteobrama belangeri* that add to the biodiversity of the icthyodiversity of the state.

Loktak is a Ramsar site with abundancy of varied fish species. Awamgsoi Lake and Utra Lake are also having huge Perciformes and Cypriniformes species. Principal River Imphal and others like Thoubal, Nambul in the southern part of the state has varied fish species composition. Also Rivers like Khujailok, Lokchao houses some near threatened and vulnerable species.*Ostebrama belangeri*,*Oreochromis mossambica*, *Glyptothorax manipurensis*, *Schistura manipurensis* are some such species.

The proper identification of a specimen in a museum aids to the fact that it is taxonomically studied and identified and thus is categorized as per norms of IUCN or standard literature. Then the diversity of the species in the concerned geographical area can be ascertained and also the status of the fish can be very well known. This would help in the conservation of the species as that is the main aim of taxonomic study.

Objective of the study

The objectives of the present work is to study the fishes of Manipur, Barak and Mizoram drainage preserved in AUS fish museum taxonomically and to know the diversity index of the preserved fishes. Also the current status of the preserved fishes was ascertained according to IUCN Red List.

Review of Literature

There is an urgent need to undertake a thorough taxonomic review of several genera and species of freshwater fishes. Fishes constitute more than half of the living vertebrates recognised (Nelson, 2006) [50]. The number of valid fish species is nearly 31,000 and 500 new species being constantly added in every year.This increase in the number of fish species in the recent years has been attributed to the increasing resource surveys/expeditions in new areas and depths which were not accessible earlier, modern approaches to taxonomy and cataloguing of the resources (Eschmeyer *et al*., 2010) [51]. Distribution and taxonomy of freshwater fish have been studied in India over the years (Raj 1916, Motwani and Saigal 1974, Barman 1994, Easa and Shaji 1997, 'Kumar *et al*. 1999, and Rema devi *et al*. 1999) [55, 56, 57, 58, 59]. Although, there are several studies on the natlve fish fauna In general, very few studies have been done.

North East India is considered as one *of* the hot spots of freshwater fish biodiversity in the world (Xottelat and Whitten, 1996). It is a well recognised fact that there has been drastic reduction in abundance of the freshwater fishes in this region due to destruction *of* the habitat, overexploitation and other anthropogenic effects. Review of Iiterature indicates that only limited information is available on fish germplasm resources of North East India with special reference to its potential as cultivable, sport and ornamental fishes. There has been a wide variation in the number of fishes reported from this region ranging from 172 (Ghosh and Lipton, 19S2) to *267* (Sen, 2000) [61, 62]. Also detailed drainage wise distribution, seasonal abundance, endemism and preferred microhabitats have not been critically examined.

NBFGR, Lucknow in I992 had identified nine endemic fishes of North East region as most 'threatened'. These are Ompok *pabda, 0. pabo, Labeo dyocheilus*, *Sernipiotus semrpiots*, *0lyra longicaudata*, *Psbiorhynchus homaioptera*, *Noemacheilus elongatus*, *Balitora brucci* and *Barbus dukai*. Sinha (1994) [63] has listed 13 species as threatened from NorthEast. Yadav and Chandra (1994) [64] reported total disappearacce of some species from the landing from Brahmaputra since 1975 onwards. *Labeo dyocheilus* and *Mystus vittatus* have not been reported by them since I977 from River Brahamaputra. Recent report (Biswas and Barua, 2001) [65] show dominancy of undersized fishes in fish landings in North Eastern states especially from Brahamaputra River system.

Of the 587 freshwater fishes reported in India, 320 were assessed in a sjx-day Conservation Assessment and Management Plan (CAMP) workshop under the Biodiversity Conservation Prioritization workshop jointly organized by NBFGR and Zoo Outreach organization based on International Union for Conservation *of* Mature and Natural

Resources criteria in 4997. Of the 320 species assessed, about 105 were from North Eastern region of these five are categorized as: criticalIy endangered (CR), one extinct En the wild (EW), 31 are endangered (En), 46 are vulnerable (Vu), 42 are lower risk near threatened (LR-nt), eight are Lower risk least concern (LR-lc) and three are data deficient (DD). Of the North East species, 513 species were not covered in CAMP evaluation. Based on IUGN Red-list criteria and available information, the experts at the CAMP workshop had concluded that one species Osteobrama *belangeri* (Valenciennes) as extinct in the wild. Later interactions with other fishery experts from North East indicated that 0. *belangeri* is not extinct from all locations from North East and the earlier CAMP assessment was based on local extinction of some populations of this species, In a very recent survey conducted by Loktak Development Authority, Manipur *0steobrama belangeri* was collected from Loktak Lake (Singh, 1999). The five species under CR category are Garra *litanensis*, *G. manipumsis*, Aborichthys *garoensis*, Lepidocephalus *goalparenis* and Pangasius *pangasius*. Of these, three species are endemic to this region. Thirty one species categorized as endangered are also facing a high risk of extinction in the wild in the near future. Eleven of the endangered species are endemic. Forty six species are assessed under vulnerable (Vu) category which indicates that they are also facing a high risk in the future.

Immense works on taxonomy have been done by Hamilton (1822) [12]; Shaw and Shebbeare (1937); Hora (1921a, b, 1930, 1937, 1939, 1940, 1943, 1951,1953); Misra(1959); Menon (1974 [34], 1999) [36]; Dey (1973); Jayaram (1981, 1999) [19, 16]; Sen (1982,1985); Talwar and Jhingran (1991) [46]; Nath and Dey (1999, 2000); Dey and Kar (1989a,b,c, 1990); Kar and Dey (1986, 2000, 2002); Kar and Barbhuiya (200a,a, 2004); Kar *et al*. (2002a, b, c, 2003, 2004); Kar (1984, 1990, 2003a,b, 2004, 2005a,b,c,d,e). The recent studies on deep-sea fish taxonomy from Indian EEZ include the documentation and redescription of *Glyptophidium oceanium* from the west coast (Kurup *et al*., 2008), deep-sea eel *Bassozetus robustus* (Cubelio *et al*., 2009a), *Dicrolene nigricaudis* (Cubelio *et al*., 2009b),deep-sea sharks like *Hexanchus griseus*,*Deania profundorum*, *Etmopterus pusilllus* by Akhilesh *et al*. (2010), *Symphysanodon xanthopterygion* by Anderson and Bineesh (2011).Kar *et al*. reported immense works on Lakes and Rivers of Manipur valley with respect to the icthyofaunal characters as well as taxonomic studies.

Materials and Methodology

Duration of the project work: The Project work span was from February, 2014 to April, 2014. The preserved fish specimens were re-identified and then kept in 10% formaldehyde solution.

The identification, systematic list and classification of the preserved fishes were done following standard literature of Jayaram (1998, 2010) [18], and Kar, (2007), while nomenclature was after Fish-Base (http//www.fishbase.org). The morphometrics and meristics calculation were based on APHA (1998, 2006). The status of the preserved fish species in the studied Rivers and wetlands was preliminarily ascertained after Menon (1994) [35] and Molur & Walker (1998). The taxonomic study of identifying the specimens was done following literature and these studies were also aided by certain materials such as scale, point needles, forceps, dividers, electronic balance and thus the species was specimen was identified upto species level.

The diversity indices of the fishes was calculated after Shannon-Weaver index of diversity (Shannon-Weaver, 1949 [43]; Wolda, 1983). The status of preserved fishes was confirmed after IUCN (1994) and also the vulnerability was assessed after Fish Base.

Result

The taxonomic study of the fishes preserved in the museum was done following appropriate methodology and thus the total number of species was studied. The following tables (TABLE I, TABLE II, TABLE III) represents the diversity (including Order and Family) of the collected fish specimen from different wetlands, Rivers of Manipur, Barak and Mizoram Drainage. While TABLE IV represents the IUCN Red list and Vulnerability status of those collected specimen.

Table 1: Fishes of Manipur

Sl.	Wetland/River name	Order	Family
1	Nambul	Cypriniformes	Cyprinidae, Clariidae, Cobitidae
		Siluriformes	Bagridae
		Perciformes	Channidae, Belonidae
		Osteoglossiformes	Notopteridae
2	Lokchao	Cypriniformes	Cyprinidae
		Perciformes	Anabantidae, Belonidae, Channidae, Cichlidae
		Siluriformes	Heteropneustidae
3	Imphal	Cypriniformes	Cyprinidae,
		Perciformes	Belonidae, Gobiidae, Channidae
		Osteoglossiformes	Notopteridae
3	Thoubal	Cypriniformes	Cyprinidae,
		Perciformes	Belontidae, Gobiidae, Channidae
4	Loktak Lake	Cypriniformes	Cobitidae, Cyprinidae
		Siluriformes	Bagridae, Heteropneustidae
		Perciformes	Anabantidae, Belonidae, Channidae
		Osteoglossiformes	Notopteridae
5	Awangsoi Lake	Cypriniformes	Cobitidae, Cyprinidae
		Perciformes	Anabantidae, Belonidae, Channidae,
		Siluriformes	Heteropneustidae
6	Utra Lake	Cypriniformes	Cyprinidae
		Perciformes	Anabantidae, Belonidae, Channidae,
		Siluriformes	Heteropneustidae

Table 2: Fishes of Barak Drainage & its Wetlands:

Sl.	Wetland/River name	Order	Family
1	Baskandi Anua	Cypriniformes	Cyprinidae
		Siluriformes	Heteropneustidae
		Perciformes	Channidae, Ambassidae, Sciaenidae
		Beloniformes	Belonidae
		Clupeiformes	Clupeidae
2	Deocherra beel	Cypriniformes	Cyprinidae
		Perciformes	Ambassidae, Gobiidae, Cichlidae
		Siluriformes	Heteropneustidae, Bagridae
		Beloniformes	Belonidae
3	Dolu Lake	Perciformes	Cichlidae, Sciaenidae, Channidae
		Cypriniformes	Cobitidae, Cyprinidae
		Siluriformes	Bagridae, Heteropneustidae
		Clupeiformes	Clupeidae
		Osteoglossiformes	Notopteridae
4	Dubria beel	Cypriniformes	Cyprinidae,
5	Salchapra anua	Cypriniformes	Cyprinidae
		Beloniformes	Belonidae
		Perciformes	Gobiidae
6	Kharbala Wetland	Cypriniformes	Cyprinidae
		Beloniformes	Belonidae
		Siluriformes	Clariidae
6	Sat beel	Siluriformes	Bagridae, Heteropneustidae
		Perciformes	Anabantidae
7	Srikona beel	Perciformes	Channidae, Gobiidae
		Beloniformes	Belontidae
		Siluriformes	Heteropneustidae
		Cypriniformes	Cyprinidae
8	Angang beel	Perciformes	Channidae, Anabantidae
		Beloniformes	Belonidae
		Cypriniformes	Cyprinidae
9	Tapang beel	Osteoglossiformes	Notopteradae
		Siluriformes	Bagridae
		Cypriniformes	Cyprinidae
10	Bakri haor	Synbranchiformes	Mastacembelidae
11	Ramnagar anua	Perciformes	Anabantidae, Gobiidae
12	Chatla haor	Osteoglossiformes	Notopteradae
		Cypriniformes	Nemacheilidae
13	Sonebeel	Perciformes	Channidae
14	Barak River	Cypriniformes	Cyprinidae, Nemacheilidae
		Tetraodontiformes	Tetraodontidae
		Beloniformes	Belonidae
		Perciformes	Gobiidae, Channidae
		Osteoglossiformes	Notopteridae
		Siluriformes	Bagridae
		Synbranchiformes	Mastacembelidae
		Clupieformes	Clupeidae
15	Madhura River	Cypriniformes	Cyprinidae, Nemacheilidae
		Perciformes	Gobiidae, Anabantidae
		Siluriformes	Sisoridae, Bagridae
		Synbranchiformes	Mastacembelidae
16	Katakhal River	Beloniformes	Belonidae
		Cypriniformes	Cyprinidae, Cobitidae, Nemacheilidae
		Perciformes	Channidae, Osphronemidae, Gobiidae
		Siluriformes	Schilbeidae, Bagridae
		Synbranchiformes	Mastacembelidae
17	Surma River	Beloniformes	Belonidae
		Cypriniformes	Cyprinidae, Cobitidae
		Perciformes	Sciaenidae
		Siluriformes	Schilbeidae, Bagridae, Sisoridae, Schilbeidae
18	Ghagra River	Cypriniformes	Cyprinidae, Cobitidae
		Siluriformes	Schilbeidae
19	Jatinga River	Beloniformes	Belonidae
		Cypriniformes	Cyprinidae
		Siluriformes	Schilbeidae, Heteropneustidae, Sisoridae
		Synbranchiformes	Mastacembelidae,
		Perciformes	Gobiidae, Sciaenidae

		Clupeiformes	Clupeidae
20	Dhaleswari River	Siluriformes	Bagridae, Sisoridae, Schilbeidae
		Cypriniformes	Cyprinidae
21	Jiri River	Siluriformes	Schilbeidae, Bagridae, Sisoridae
		Perciformes	Gobiidae
		Cypriniformes	Cyprinidae
22	Damcherra River	Beloniformes	Belonidae
		Cypriniformes	Cyprinidae
		Perciformes	Ambassidae
		Osteoglossiformes	Notopteridae
		Siluriformes	Bagridae
23	Dhalai River	Siluriformes	Bagridae, Sisoridae
		Cypriniformes	Cyprinidae
		Perciformes	Gobiidae, Channidae, Cichlidae
24	Choto Jalenga River	Cypriniformes	Cyprinidae
25	Singla River	Siluriformes	Schilbeidae, Heteropneustidae, Bagridae
		Cypriniformes	Cyprinidae
		Synbranchiformes	Mastacembelidae
		Perciformes	Nandidae
		Beloniformes	Belonidae
26	Balacherra River	Siluriformes	Schilbeidae
27	Longai River	Perciformes	Osphronemidae, Anabantidae
28	Sonai River	Cypriniformes	Cyprinidae
		Siluriformes	Sisoridae

Table 3: Fishes of Mizoram

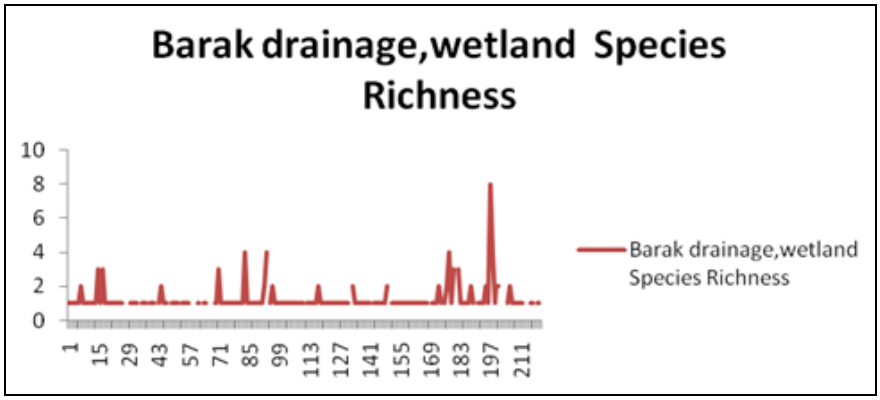
Sl.	Wetland/River name	Order	Family
1	Karnafuli River	Cypriniformes	Cyprinidae
		Siluriformes	Bagridae, Schilbeidae, Sisoridae
		Perciformes	Ambassidae
2	Tuichong River	Siluriformes	Bagridae
		Perciformes	Cichlidae, Anabantidae, Channidae
		Osteoglossiformes	Notopteridae
3	Mat River	Cypriniformes	Cyprinidae
		Beloniformes	Belonidae
		Synbranchiformes	Mastacembelidae
4	Kolodyne River	Perciformes	Ambassidae, Gobiidae
		Cypriniformes	Cyprinidae

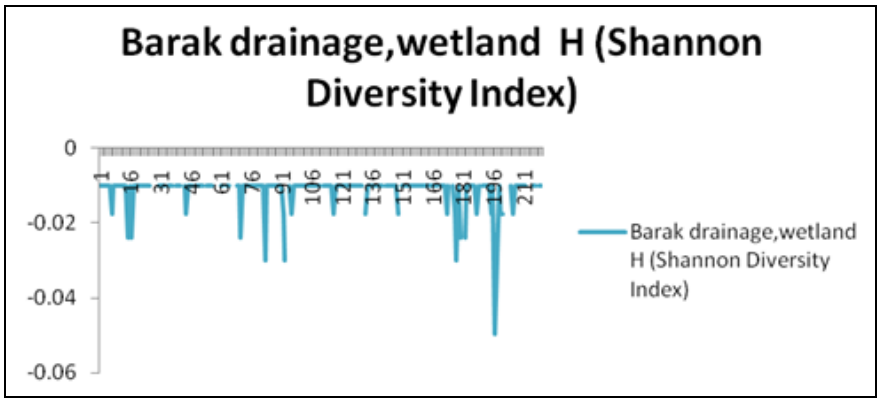
Table 4: IUCN RED List Status of the fishes studied form Barak-Mizoram Drainage

	Species	IUCN Red list Status	Vulnerability status
Barak and Mizoram Drainage	*Puntius sophore*	Least concern	Low vulnerability
	Puntius chola	Least concern	Low vulnerability
	Pethia ticto	Least concern	Low vulnerability
	Puntius Puntio	Not evaluated	Low vulnerability
	Puntius terio	Least concern	Low vulnerability
	Chanda nama	Least concern	Low vulnerability
	Heteropneustes fossilis	Least concern	Low vulnerability
	Channa striatus	Least concern	Moderate vulnerability
	Channa punctatus	Least concern	Low vulnerability
	Oreochromis mossambica	Near threatened (NT)	Low to moderate vulnerability
	Salmostoma bacaila	Least concern	Low to moderate vulnerability
	Lepidocephalus guntea	Least concern	Low vulnerability
	Mystus bleekeri	Least concern	Low to moderate vulnerability
	Mystus vittatus	Least concern	Moderate vulnerability
	Mystus tengara	Least concern	Low vulnerability
	Mystus keletius	Least concern	Low to moderate vulnerability
	Mystus cavasius	Least concern	Moderate to high vulnerability
	Gudusia chapra	Least concern	Low vulnerability
	Macrospinosa cuja	Not evaluated	High to very high vulnerability
	Trichogaster labiosa	Least concern	Low vulnerability
	Trichogaster fasciata	Least concern	Low vulnerability
	Notopterus notopterus	Least concern	Moderate to high vulnerability
	Labeo rohita	Least concern	Moderate to high vulnerability
	Labeo gonius	Least concern	Very high vulnerability
	Labeo pangusia	Near threatened (NT)	High vulnerability
	Labeo calbasu	Least concern	High vulnerability

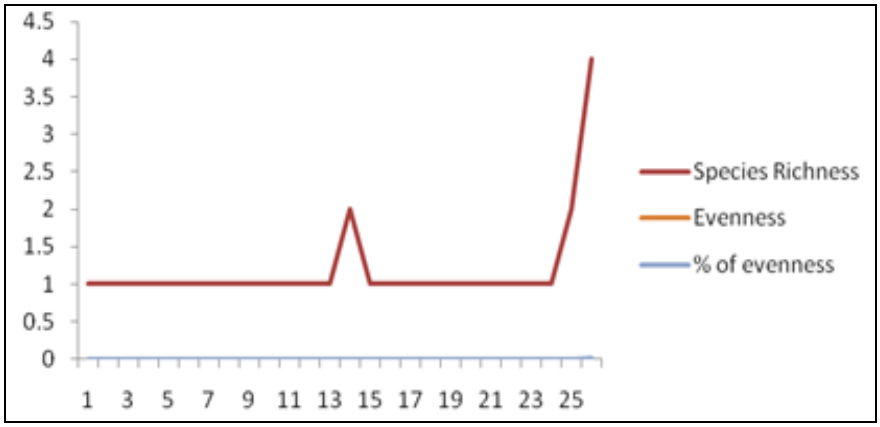
	Xenentodon cancila	Least concern	Low to moderate vulnerability
	Glossogobius giuris	Least concern	Low to moderate vulnerability
	Mastacembalus armatus	Least concern	Low vulnerability
	Mastacembalus pancalus	Least concern	Low vulnerability
	Anabas testudineus	Data deficient (DD)	Low vulnerability
	Cirrhinus mrigala	Least concern	High to very high vulnerability
	Cirrhinus reba	Least concern	Moderate vulnerability
	Schistura devdevi	Near threatened	Low vulnerability
	Schistura vinciguerrae	Least concern	Low vulnerability
	Clarias batrachus	Least concern	Low vulnerability
	Tetraodon cutcutia	Least concern	Low vulnerability
	Acanthocobitis botia	Least concern	Low vulnerability
	Ailia coila	Near threatened (NT)	Low to moderate vulnerability
	Barilius barna	Least concern	Low to moderate vulnerability
	Barilius bendelisis	Least concern	Low to moderate vulnerability
	Barilius dogarsinghi	Vulnerable (VU)	Low vulnerability
	Barilius modestus	Not evaluated	Low vulnerability
	Botia dario	Least concern	Low to moderate vulnerability
	Botia rostrata	Vulnerable (VU)	Low to moderate vulnerability
	Gagata cenia	Least concern	Moderate vulnerability
	Gagata gagata	Least concern	Moderate to high vulnerability
	Glyptothorax prashadi	Data deficient (DD)	Low to moderate vulnerability
	Glyptothorax telchitta	Least concern	Low to moderate vulnerability
	Sperata seenghala	Least concern	Very high vulnerability
	Erethistes pussilus	Least concern	Low vulnerability
	Laubuca laubuca	Least concern	Low to moderate vulnerability
	Garra lissorhynchus	Least concern	Low vulnerability
	Garra nasuta	Least concern	Low to moderate vulnerability
	Tenualosa ilisha	Not evaluated	Low to moderate vulnerability
	Tor tor	Near threatened (NT)	Moderate to high vulnerability
	Eutropiichthys vacha	Least concern	Low to moderate vulnerability
	Eutropiichthys murius	Least concern	Low to moderate vulnerability
	Clupisoma garua	Least concern	High vulnerability
	Cyprinus carpio	Vulnerable (VU)	Moderate vulnerability
	Amblypharyngodon microlepis	Least concern	Low vulnerability
	Amblypharyngodon mola	Least concern	Low to moderate vulnerability
	Catla catla	Least concern	Moderate to high vulnerability
	Rita rita	Least concern	Very high vulnerability
	Nandus nandus	Least concern	Low vulnerability
	Esomus danricus	Least concern	Low vulnerability
	Bagarius bagarius	Near threatened (NT)	Very high vulnerability
	Erethistes pussilus	Least concern	Low vulnerability
	Ailia colia	Near threatened	Low to moderate vulnerability
	Osteobrama cotio	Least concern	Low to moderate vulnerability
	Sperata seenghala	Least concern	Very high vulnerability
	Chanda nama	Least concern	Low vulnerability
	Gagata gagata	Least concern	Low to moderate vulnerability
	Esomus altus	Least concern	Low vulnerability
	Laubuca laubuca	Least concern	Low to moderate vulnerability
	Salmostoma bacaila	Least concern	Low to moderate vulnerability
	Barilius barila	Least concern	Low vulnerability
	Channa striatus	Least concern	Moderate vulnerability
	Mastacembalus alboguttatus	Least concern	Low to moderate vulnerability
	Mystus bleekeri	Least concern	Low to moderate vulnerability
	Oreochromis mossambica	Near threathened	Low to moderate vulnerability
	Notopterus notopterus	Least concern	Moderate to high vulnerability
	Anabas testudineus	Data deficient	Low vulnerability
	Pethia shalynius	Vulnerable	Low vulnerability
	Barilius barna	Least concern	Low to moderate vulnerability
	Xenentodon cancila	Least concern	Low to moderate vulnerability
	Mastacembalus armatus	Least concern	Low vulnerability
	Glossogobius giuris	Least concern	Low to moderate vulnerability
	Puntius sophore	Least concern	Low vulnerability
	Parambassis ranga	Least concern	Low vulnerability

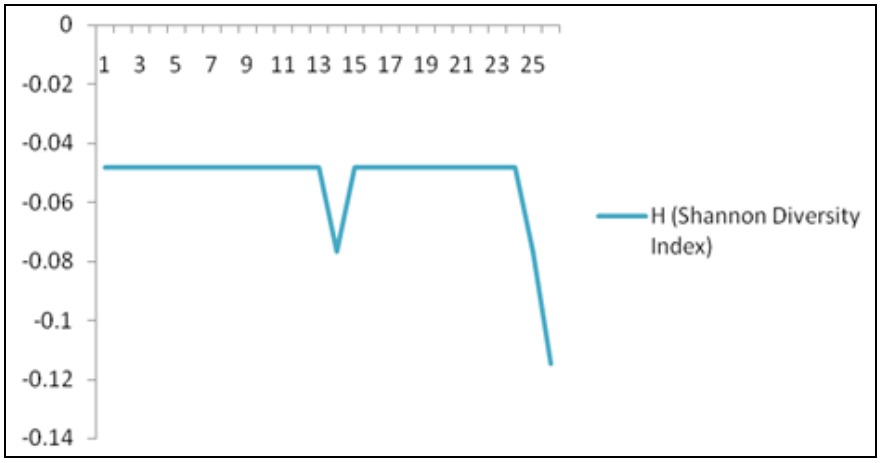
Statistical Represenation



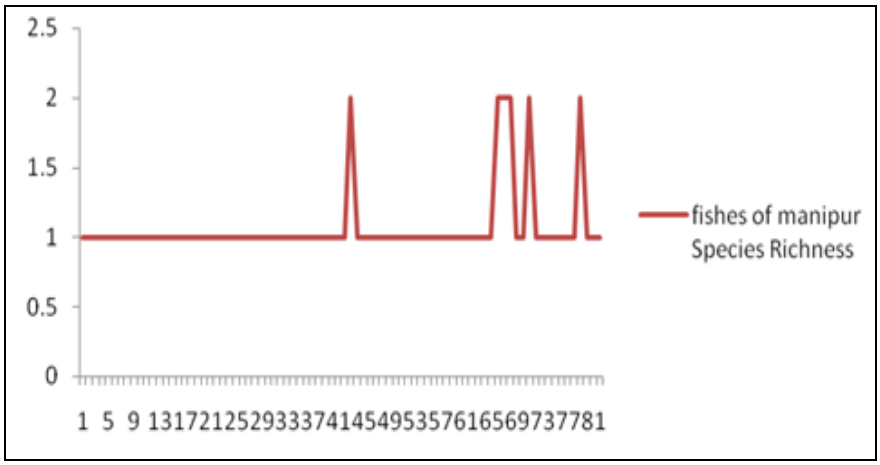


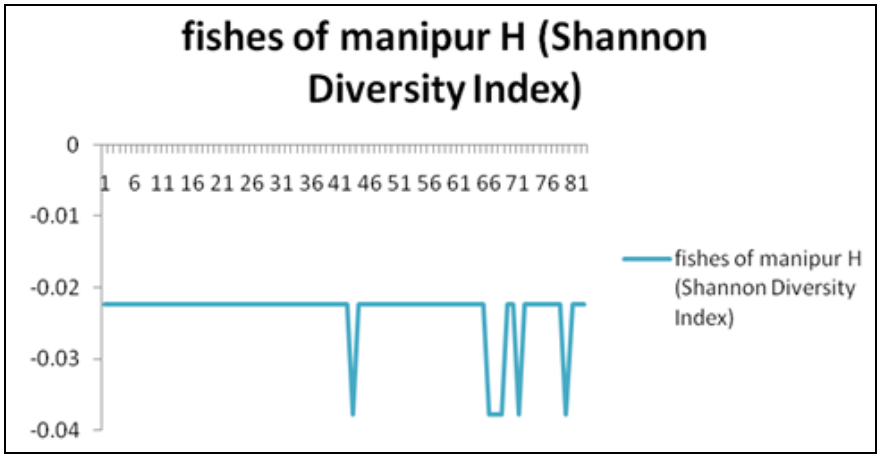
Graph (1 & 2): Represents the species richness and fish species diversity index of Barak drainage and its wetlands





Graph (3 & 4): Represents the species richness and fish species diversity index of Mizoram drainage





Graph (5 & 6): Represents the species richness and fish species diversity index of Manipur drainage

Discussion

Ichthyological survey conducted since 1996, in the north bank tributaries of River Barak (*viz*. Jiri, Chiri, Madhura and Jatinga) and south bank tributaries (*viz*. Sonai, Rukni, Ghagra, Dhaleswari and Katakahal) revealed the occurrence of 47 fish species (belonging to 39 genera, 14 families and 6 orders) and 44 species (belonging to 34 genera, 14 families and 6 orders) respectively till date.

The ichthyological survey conducted in the upstream regions of River Tuirial, Tuirini, Tuivai and Tlawang in Mizoram, joining the Barak drainage, revealed the occurrence of 18 species of fish (belonging to 17 genera, 18 families and 3 orders) till date. Moreover, collection of ichthyofauna from the River Chhimtuipui (Kolodyne or Kaladan) in Mizoram bordering Myanmar and from River Mat joining River Chhimtuipui in Mizoram, revealed the occurrence of 12 species of fishes (belonging to 10 genera, 4 families and 3 orders).

From the above study, a total of 195 different species of fishes found to be observed in from the Barak Drainage System belonging to different Order and Family (Table II), and 51 species of fishes found to observed in different wetlands of the Barak Drainage System (Table II), while a total of 26 different species are found from Mizoram (Table III). Where in Barak Drainage System have 8 orders of fishes as Cypriniformes 79 species, Perciformes 38 species, Siluriformes 48 species, Beloniformes 13 species, Clupiformes 4 species, Osteoglossiformes 5 species, Synbranchiformes 7 species, and Tetraodontiformes 1 species each respectively. And in Mizoram there are 6 orders of fishes observed, in which Cypriniformes have 10 species, followed by Siluriformes 7 species, and Perciformes 6 species, Beloniformes, Osteoglossiformes, Synbranchiformes have 1 species, each respectively.

As a whole a total 487 no. of fish species were recorded, analysed, and identified, the Shannon Diversity Index (H) of the whole mesuem specimen were found to be raning from-0.05 to-0.12 (Graph 2, 4 & 6). The Shannon diversity index (H) is commonly used to characterization of species diversity in a community, it also accounts for the both abundance and evenness of the species present. The resulting products is summed across the species, where equability assumes a value between 0 and 1 with 1 being complete evenness.

The detailed taxonomic study of the preserved fish species done during the project term revealed many aspects that can be helpful for not only knowing the species identities but also helpful in knowing their current status and their conservation measures. The fishes collected from Nambul, Lokchao, Thoubal, Imphal River and and also from three Lake namely, Loktak, Awangsoi, Utra were identified upto specific level with the help of standard literature and it was found that fish species belonged to the order-Osteoglossiformes, Cypriniformes, Perciformes, Siluriformes. Also diversity in terms of families observed such as Notopteridae, Cyprinidae, Cobitidae, Channidae was also observed. The most number of species were observed in order Cypriniformes (45spp.) followed by Perciformes (33spp.), then Siluriformes (4spp.)

Conclusion

In the light of global decline in biodiversity, it has become essentially urgent to gain a thorough idea about the taxonomic perspectives of the fish species so as to hava a detail idea of

the classification practices as well as to know the diversity indices of the different species and their present status that would help in their proper conservation. Manipur being a beautiful state with hydrographical scenario harbours Lakes and Rivers with rich species diversity, but the deterioration of the water conditions has led to a decrease in the number of species concerned as the number of vunerable species and threatened have comparatively increased.

With context to my present study, it can be concluded that the total species studied diversely belong to order CYPRINIFORMES and PERCIFORMES, and to the families CYPRINIDAE and CHAANNIDAE largely. The further study of the present status revealed facts about existence of endemic species *Osteobrama belangeri* and its dwindling scenario. Positive measures like more detailed study of the fish species on taxonomic perspectives has become inevitable for the existence of the species as because with the advent of environmental hazards it has become a need for the hour to preserve the specimens in the museum and to gather extensive and sound knowledge of their status and diversity as it would help in preventing their extinction, thereby lending a penny to the mere global diversity and icthyodiversity which is at stake these days. However, further study is still required for the accomplishment of the aforesaid perspectives that would differentially aid in fish resource conservation and prioritization.

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