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A Review on Current Scenario of Icthyodiversity of North-East India and Threats on Them

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Abstract

Northeast India refers to the easternmost region of India consisting of the contiguous states of Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Tripura, Sikkim, and parts of North Bengal and the diversity of this area being part of the Himalayas and Indo-Burma hotspot are highly diverse. The richness in fish diversity attracts a lot of researchers and they have reported different number of fish species in different time period from this area. This study compiles all the previous studies and found the icthyodiversity to be a total of 495 fish species from 39 families and 12 orders. But about 15.2% of fish diversity in North-East India comes under the threatened category for which proper conservation measures should be taken and about 30% of fishes come under the DD and NE category which needs more attention and whose conservation status should be known for their conservation.

Key words: North east India, Icthyodiversity, Conservation

Introduction

North-eastern states of India refers to the easternmost region of India consisting of the contiguous states of Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Tripura, Sikkim, and parts of North Bengal (Fig. 1). This part of India is surrounded by four different countries like China in the south, Bhutan in the southwest, Bangladesh in the west and Myanmar in the east. The diversity of this area being part of the Himalayas and Indo-Burma hotspot are highly diverse and of great regional importance in terms of the livelihood and the economic importance of the people living around it [1].

The diversity of this region is attributed to many reasons:

1. The tectonic setting in the Indo-China sub region caused by the collision of the Indian, Chinese and Burmese plates, resulting in the formation of the mighty Himalayas and Indo-Burman ranges [1, 2].
2. The geomorphology, consisting of hills, plateaus and valleys, resulting in the occurrence of a variety of torrential hill streams, rivers, lakes and swamps.
3. This region is drained by the Brahmaputra-barak river system in Assam, Meghalaya, Tripura and some parts of Mizoram, Manipur and Nagaland. The eastern part of Manipur, including the central plain, and Nagaland is drained by the Chindwin river system, while the southern part of Mizoram, by the Kaladan river system.

The biodiversity richness of the north east India has attracted many taxonomists to explore the fishes in the natural water bodies, to identify native, non-native and new species in order to prepare checklist of fish faunal resources of this geographical region and their sustainable utilization for the betterment of human life. Several attempts were made in the past to prepare the checklist of fishes of this part of India at different geographical scale in different time period. A brief description of the authors and the number of species reported were tabulated in table 1. Among these [1] consider all the past publications for the preparation of the checklist.

RESEARCHERS	NO OF SPECIES REPORTED
[3]	172
[4]	185
[7]	230
[5]	267
[6]	291
[1]	422
[2]	318

Table 1: Researches on fish diversity of N-E India

Materials and Methods

The fish species reported and described from the northeast region up to October (2018) were scanned for collecting the information [1-7]. A standard fish species data collection format was prepared and collected information on scientific name with its taxonomic status and IUCN conservation status were listed.

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Each species sheet was checked for synonyms and duplicate names were deleted. The old scientific name was replaced with the latest scientific name as per FishBase 2018 with name of the author (s) and year [8]. The threatened status of the fishes was revised as per the IUCN Red List (2012) (Table 2). Another list for the newly described fish species with their type locality, authors and family was prepared to know the current status of biodiversity (Table 3). In addition to these data the endemic fish diversity, ornamental fish diversity and some severe threats on the icthyodiversity were discussed below.

ORDER	FAMILY	SPECIES NAME	IUCN STATUS
Osteoglossiformes	Notopteridae	Chitala chitala	NT
		Notopterus notopterus	LC
Anguiliformes	Anguillidae	Anguilla bengalensis	NT
	Ophichthidae	Pisodonophis boro	LC
Clupeiformes	Clupeidae	Gonialosa manmina	LC
		Gudusia chapra	LC
		Gudusia variegate	LC
		Nematalosa nasus	LC
		Tenualosa ilisha	LC
	Engraulidae	Setipinna phasa	LC
	Pristigasteridae	Ilisha melastoma	NE
Cypriniformes	Cyprinidae	Amblypharyngodon mola	LC
		Aspidoparia jaya	LC
		Aspidoparia(Cabdio) morar	LC
		Aspidoparia ukhrulensis	DD
		Bangana dero	LC
		Bangana devdevi	LC
		Bangana diplostoma	LC
		Barilius barila	LC
		Barilius barna	LC
		Barilius bakeri	LC
		Barilius barnoides	NE
		Barilius bendelisis	LC
		Barilius chatricensis	VU
		Barilius dimorphicus	VU
		Barilius dogarsinghi	VU
		Barilius gatensis	LC
		Barilius ngawa	VU
		Barilius radiolatus	DD
		Barilius shacra	LC
		Barilius tileo	LC
		Barilius vagra	LC
		Barilius lairokensis	NT
		Barilius profundus	NE
		Brachydanio albolineatus	LC
		Brachydanio choprai	LC
		Brachydanio nigrofasciatus	DD
		Brachydanio shanensis	DD
		Brachydanio sondhii	DD
		Chagunius chagunio	LC
		Chagunius nicholsi	LC
		Chela cachius	LC
		Laubuca laubuca	NE
		Chela fasciatus	NE
		Chela khujairokensis	VU
		Ctenopharyngodon idella	NE
		Cirrhinius ariza	NE
		Cirrhinius cirrhosus	NE
		Cirrhinus mrigala	LC
		Cirrhinus reba	LC
		Crossocheilus burmanicus	LC
		Crossocheilus latius	LC
		Cyprinion semiplotum	VU
		Cyprinus carpio	VU
		Danio dangila	LC
		Danio rerio	LC
		Danio jaintianensis	VU
		Devario annandalei	DD
		Devario acuticephala	VU
		Devario aequipinnatus	LC
		Devario assamensis	VU
		Devario anomalus	VU
		Devario devario	LC
		Devario horai	EN
		Devario naganensis	VU
		Devario regina	LC
		Devario yuensis	VU
		Esomus danricus	LC
		Garra abhoyai	NE
		Garra arupi	NE
		Garra Rupecula	NT
		Garra annandalei	LC
		Garra compressus	VU
		Garra elongate	NE
		Garra flavatra	VU
		Garra gotyla	LC
		Garra gravely	NE
		Garra kempi	LC
		Garra kalpangii	NE
		Garra lamta	LC
		Garra mcclellandi	LC
		Garra notata	LC
		Garra namyaensis	NE
		Garra lissorhynchus	LC
		Garra litanensis	VU
		Garra manipurensis	VU
		Garra naganensis	LC
		Garra nambulica	VU
		Garra nasuta	LC
		Garra paralissorhynchus	VU
		Gibelion catla	LC
		Gymnocypris dobula	VU
		Gymnocypris scleracanthus	VU
		Horalabiosa joshuai	EN
		Hypophthalmichthys molitrix	NT
		Hypophthalmichthys nobilis	DD
		Labeo ariza	LC
		Labeo angra	LC
		Labeo bata	LC

Table 2 Continue.....

Table 2 Continue.....

		Labeo bata	LC
		Labeo boggut	LC
		Labeo boga	LC
		Labeo calbasu	LC
		Labeo dyocheilus	LC
		Labeo fimbriatus	LC
		Labeo gonius	LC
		Labeo nandina	NT
		Labeo pangusia	NT
		Labeo rohita	LC
		Megarasbora elanga	LC
		Neolissochilus blythii	NE
		Neolissochilus hexagonolepis	NT
		Neolissochilus hexastichus	NT
		Neolissochilus paucisquamata	NE
		Neolissochilus stracheyi	LC
		Oreichthys cosuatis	LC
		Osteobrama belangeri	NT
		Osteobrama cotio	LC
		Osteobrama cunma	LC
		Osteobrama feae	LC
		Puntius ater	VU
		Puntius bizonatus(Pethia meingangbii)	LC
		Naziritor chelynoides	VU
		Puntius chola	LC
		Puntius conchonius	LC
		Dawkinsia filamentosa	LC
		Puntius fraseri	EN
		Puntius gelius	LC
		Puntius yuensis	VU
		Puntius guganio	LC
		Hypsibarbus myitkyinae	LC
		Barbonymus gonionatus	LC
		Pethia khugae	VU
		Pethia manipurensis	EN
		Pethia meingangbii	LC
		Pethia ornata	VU
		Pethia phutunio	LC
		Puntius puntio	NE
		Systomus sarana	LC
		Pethia shalynius	VU
		Pethia stoliczkanus	LC
		Puntius sophore	LC
		Puntius terio	LC
		Pethia ticto	LC
		Poropuntius burtoni	LC
		Poropuntius clavatus	NT
		Raiamas bola	LC
		Raiamas guttatus	LC
		Rasbora daniconius	LC
		Rasbora ornatus	VU
		Rasbora rasbora	LC
		Schizothorax labiatus	NE
		Schizothorax progastus	LC
		Schizothorax richardsonii	VU
		Schizopyge esocinus	NE

Table 2 continue.....

		Schismatorhynchos nukta	EN
		Schizopygopsis stoliczkae	NE
		Salmophasia bacaila	LC
		Salmophasia clupeoides	NE
		Salmophasia acinaces	LC
		Salmophasia sardinella	LC
		Salmophasia sladoni	LC
		Salmophasia phulo	LC
		Securicula gora	LC
		Semiplotus manipurensis	DD
		Semiplotus modestus	DD
		Semiplotus semiplotus	NE
		Tor progeneius	NT
		Tor putitora	EN
		Tor chelynoides	NE
		Tor mosal	NE
		Tor tor	NT
	Psilorhynchidae	Psilorhynchoides arunachalensis	DD
		Psilorhynchus balitora	LC
		Psilorhynchus breviminor	DD
		Psilorhynchus gracilis	LC
		Psilorhynchus homaloptera	LC
		Psilorhynchus microphthalmus	EN
		Psilorhynchus nudithoracicus	NE
		Psilorhynchus sucatio	LC
	Balitoridae	Balitora brucei	NT
		Balitora burmanica	LC
		Balitora cavia	NE
		Homaloptera modesta	DD
		Homaloptera rupicola	LC
	Nemacheilidae	Aborichthys garoensis	VU
		Aborichthys elongatus	LC
		Aborichthys kempi	NT
		Acanthocobitis botia	LC
		Acanthocobitis zonalternans	LC
		Schistura reticulofasciatus	NE
		Neonoemacheilus assamensis	NT
		Neonoemacheilus labeosus	LC
		Neonoemacheilus morehensis	DD
		Neonoemacheilus peguensis	DD
		Nemacheilus barapaniensis	NE
		Nemacheilus carletoni	NE
		Nemacheilus pavonaceus	VU
		Schistura rupecula	LC
		Aboricthys tikaderi	VU
		Physoschistura elongata	VU
		Scistura aizawlensis	NE
		Scistura arunachalensis	NE
		Schistura beavani	LC
		Schistura chindwinica	VU
		Schistura cincticauda	DD
		Schistura corica	LC
		Schistura devdevi	NT
		Scistura fasciata	NE
		Scistura inglishi	VU

Table 2 continue.....

		Scistura koladynensis	NE
		Schistura kangjupkhulensis	EN
		Schistura khugae	VU
		Schistura manipurensis	NT
		Schistura minutus	EN
		Schistura montanus	NE
		Schistura multifasciatus	NE
		Schistura nagaensis	VU
		Schistura papulifera	CR
		Scistura porocephala	NE
		Schistura prashadi	VU
		Schistura reticulata	EN
		Schistura savona	LC
		Schistura scaturigina	LC
		Schistura sikmaiensis	LC
		Schistura singhi	VU
		Schistura sijuensis	EN
		Schistura tigrinum	EN
		Schistura tirapensis	LC
		Schistura inglisi	VU
		Schistura reticulofasciata	VU
		Schistura vinciguerrae	LC
		Triplophysa gracilis	NE
		Psycoschistura elongata	NE
		Psycoschistura chindwinesis	NE
		Psycoschistura triginum	NE
		Psycoschistura tuivaiensis	NE
		Psycoschistura dikrongnensis	NE
	Cobitidae	Acantopsis multistigmatus	NT
		Acantopsis choirorhynchos	LC
		Acantopsis spectabilis	NT
		Botia almorhae	LC
		Botia Dario	LC
		Botia histrionica	LC
		Botia lohachata	NE
		Botia rostrata	VU
		Canthophyrs gongata	LC
		Lepidocephalichthys arunachalensis	EN
		Lepidocephalichthys berdmorei	LC
		Lepidocephalichthys guntea	LC
		Lepidocephalichthys irrorata	LC
		Lepidocephalichthys manipurensis	LC
		Lepidocephalichthys annandalei	LC
		Lepidocephalichthys menoni	DD
		Lepidocephalichthys scaudofurcatus	NE
		Lepidocephalichthys goalparensis	LC
		Neoeucirrhichthys maydelli	LC
		Pangio pangia	LC
		Pangio longipinnis	NE
		Syncrossus berdmorei	NT
		Somileptus gongota	NE
Siluriformes	Bagridae	Batasio batasio	LC
		Batasio convexirostrum	NE
		Batasio fasciolatus	LC
		Batasio affinis	DD
		Batasio spilurus	DD

Table 2 continue.....

		Batasio tengana	LC
		Chandramara chandramara	LC
		Hemibagrus menoda	LC
		Hemibagrus microphthalmus	LC
		Hemibagrus peguensis	LC
		Mystus armatus	LC
		Mystus bleekeri	LC
		Mystus carcio	LC
		Mystus ngasep	NE
		Mystus dibrugarensis	LC
		Mystus cavasius	LC
		Mystus falcarius	LC
		Mystus horai	NE
		Mystus montanus	LC
		Mystus pulcher	LC
		Mystus rufescens	LC
		Mystus tengara	LC
		Mystus vittatus	LC
		Olyra kempi	LC
		Olyra longicaudata	LC
		Olyra horae	DD
		Olyra burmanica	DD
		Rama rama	NE
		Rita rita	LC
		Sperata acicularis	LC
		Sperata aor	LC
		Sperata seenghala	LC
	Siluridae	Ompok bimaculatus	NT
		Ompok pabda	NT
		Ompok pabo	NT
		Pterocryptis barakensis	NT
		Pterocryptis berdmorei	LC
		Pterocryptis indicus	DD
		Pterocryptis afghana	DD
		Pterocryptis torrentis	NE
		Pterocryptis gangelica	DD
		Wallago attu	NT
	Schilbeidae	Ailia coila	NT
		Ailia punctata	DD
		Clupisoma garua	LC
		Clupisoma montana	LC
		Eutropiichthys vacha	LC
		Eutropiichthys murius	LC
		Neotropius atherinoides	LC
		Silonia silondia	LC
	Pangasiidae	Pangasius pangasius	LC
		Pangasius sutchi	EN
	Amblycipitidae	Amblyceps apangi	LC
		Amblyceps arunachalensis	NE
		Amblyceps laticeps	LC
		Amblyceps cerinum	NE
		Amblyceps mangois	LC
		Amblyceps torrentis	DD
		Amblyceps tuberculatum	DD
	Akysidae	Akysis manipurensis	DD
		Akysis prashadi	LC
	Sisoridae	Bagarius bagarius	NT

Table 2 continue.....

		Bagarius yarrelli	NT
		Creteuchiloglanis kamengensis	DD
		Exostoma barakensis	DD
		Exostoma berdmorei	DD
		Exostoma labiatum	LC
		Exostoma stuarti	DD
		Exostoma vinciguerrae	DD
		Gagata cenia	LC
		Gagata gagata	LC
		Gagata dolichonema	LC
		Gagata sexualis	LC
		Glyptothorax ater	NE
		Glyptothorax jayarami	NE
		Glyptothorax caudimaculatus	NE
		Glyptothorax churamanii	NE
		Glyptothorax dikrongensis	NE
		Glyptothorax maceriatus	NE
		Glyptothorax scrobiculus	NE
		Glyptothorax ventrolineatus	NE
		Glyptosternon maculatum	LC
		Glyptothorax annandalei	LC
		Glyptothorax botius	LC
		Glyptothorax saisii	VU
		Glyptothorax conirostris	DD
		Glyptothorax brevipinnis	DD
		Glyptothorax cavia	LC
		Glyptothorax saisii	VU
		Glyptothorax sinensis	DD
		Glyptothorax platypogonides	NE
		Glyptothorax chindwinica	LC
		Glyptothorax granulus	LC
		Glyptothorax manipurensis	VU
		Glyptothorax ngapang	LC
		Glyptothorax striatus	NT
		Glyptothorax pectinopterus	LC
		Glyptothorax telchitta	LC
		Glyptothorax ventrolineatus	LC
		Glyptothorax indicus	LC
		Glyptothorax gracilis	DD
		Glyptothorax trilineatus	LC
		Glyptothorax chimtuipuiensis	DD
		Gogangra viridescens	LC
		Hara koladynensis	DD
		Myersglanis jayarami	VU
		Myersglanis blythii	DD
		Nangra assamensis	LC
		Nangra nangra	LC
		Nangra robusta	NE
		Oreoglanis setiger	DD
		Oreoglanis majusculus	NE
		Parachiloglanis hodgarti	LC
		Pareuchiloglanis kamengensis	DD
		Pseudecheneis crassicauda	DD
		Pseudecheneis sulcata	LC
		Pseudecheneis ukhrulensis	VU
		Pseudecheneis sirenica	VU
		Pseudecheneis koladynae	NE

Table 2 continue.....

		Sisor barakensis	VU
		Sisor chennuah	DD
		Sisor rabdophorus	LC
	Erethistidae	Conta conta	DD
		Conta pectinata	DD
		Erethistes horai	NE
		Erethistes pusillus	LC
		Erethistoides montana	DD
		Erethistoides senkhiensis	DD
		Erethistoides sicula	DD
		Erethistes hara	LC
		Erethistes jerdoni	NE
		Erethistes serratus	NE
		Pseudolaguvia ferula	DD
		Pseudolaguvia inornata	DD
		Pseudolaguvia muricata	DD
		Pseudolaguvia ribeiroi	LC
		Pseudolaguvia shawi	LC
		Pseodolaguvia spicula	NE
		Pseudolaguvia vrigulata	NE
	Clariidae	Clarias magur	EN
		Clarias gariepinus	LC
		Heteropneustes fossilis	LC
	Chacidae	Chaca chaca	LC
Mugiliformes	Mugilidae	Rhinomugil corsula	LC
		Sicamugil cascasia	LC
Beloniformes	Belonidae	Xenentodon cancila	LC
		Strongylura strongylura	NE
Cyprinodontiformes	Aplocheilidae	Aplocheilus panchax	LC
Syngnathiformes	Syngnathidae	Microphis deocata	NT
Synbranchiformes	Synbranchidae	Monopterus albus	LC
		Monopterus cuchia	LC
		Monopterus hodgarti	DD
		Ophisternon bengalense	LC
	Mastacembelidae	Macrognathus aral	LC
		Macrognathus morehensis	LC
		Macrognathus pancalus	LC
		Mastacembelus armatus	LC
		Garo khajuriai	NT
	Chaudhuridae	Pillaia indica	EN
Perciformes	Ambassidae	Chanda nama	LC
		Parambassis baculis	LC
		Parambassis lala	NT
		Parambassis ranga	LC
		Parambassis tenasserimensis	DD
	Scianenidae	Johnius coitor	LC
	Nandidae	Badis assamensis	DD
		Badis badis	LC
		Badis blosyrus	LC
		Badis chittagongis	DD
		Badis dibruensis	DD
		Badis ferrarisi	LC
		Badis kanabos	DD
		Badis tuivaiei	EN
		Nandus nandus	LC
	Cichlidae	Oreochromis niloticus niloticus	NE
		Oreochromis mossambicus	NE

Table 2 continue.....

	Gobidae	Apocryptes bato	NE
		Glossogobius giuris	LC
	Anabantidae	Anabas testudineus	DD
		Anabas cobojiu	NE
	Osphronemidae	Ctenops nobilis	NT
		Polyacanthus fasciatus	LC
		Trichogaster lalius	LC
		Polyacanthus sota	NE
		Trichogaster chuna	LC
		Trichogaster labiosus	LC
		Osphronemus goramy	LC
	Channidae	Channa amphibeus	LC
		Channa aurantimaculata	DD
		Channa barca	DD
		Channa bleheri	NT
		Channa gachua	LC
		Channa marulius	LC
		Channa punctatus	NE
		Channa stewartii	LC
		Channa striata	LC
		Channa orientalis	NE
		Channa hatcourtbutleri	NE
	Tetraodontidae	Tetraodon cutcutia	LC
	Poecilidae	Gambusia affinis	LC
Salmoniformes	Salmonidae	Salmo trutta fario	NE
		Oncorhynchus mykis	NE

Table 2: All the fish species in North East India (Excluding fishes described from 2013-18)

Sl. No.	Name of the species	Family	Location	Source
1.	Garra arunachalensis	Cyprinidae	EasternHimalayan-foothills	[9]
2.	Garra biorostris	Cyprinidae	EasternHimalayan-foothills	[9]
3.	Garra quadratirostris	Cyprinidae	EasternHimalayan-foothills	[9]
4.	Pethia expletiforis	Cyprinidae	Mizoram (Koladyne basin)	[10]
5.	Psilorhynchus chakpiensis	Psilorhynchidae	Manipur (Chindwin basin)	[11]
6.	Schistura ferruginea	Nemacheilidae	Manipur (Barak River)	[12]
7.	Schistura nebeshwari	Nemacheilidae	Mizoram (Koladyne basin)	[13]
8.	Schistura paucireticulata	Nemacheilidae	Mizoram (Tuirial River)	[14]
9.	Schistura porocephala	Nemacheilidae	Mizoram (Koladyne basin)	[15]
10.	Schistura scypnovectata	Nemacheilidae	Mizoram (Koladyne basin)	[13]
11.	Devario deruptotalea	Cyprinidae	Manipur (Dutah Stream)	[16]
12.	Glyptothorax clavatus	Sisoridae	Manipur (Barak-Meghna)	[17]
13.	Psilorhynchus ngathenu	Psilorhynchidae	Manipur (Chindwin basin)	[18]
14.	Schistura andrewi	Nemacheilidae	Mizoram (Koladyne basin)	[19]
15.	Schistura phambringi	Nemacheilidae	Manipur (Dutah Stream)	[20]
16.	Garra chakpiensis	Cyprinidae	Manipur (Chindwin River)	[21]
17.	Garra cornigera	Cyprinidae	Manipur (Sanalok River)	[22]
18.	Garra nkhruletisis	Cyprinidae	Manipur (Chindwin River)	[21]
19.	Garra trilobata	Cyprinidae	Manipur (Sanalok River)	[22]
20.	Parambasis serrata	Ambassidae	Mizoram (Kaladan basin)	[23]
21.	Badis pancharatnaensis	Badidae	Assam (Brahmaputra)	[24]
22.	Psilorhynchus konemi	Psilorhynchidae	Manipur (Chakpi River)	[25]
23.	Garra bilorostris	Cyprinidae	Assam (Kanamarka River)	[26]
24.	Garra chindwinensis	Cyprinidae	Manipur (Chindwin River)	[27]
25.	Garra clavirostris	Cyprinidae	Assam (Dilaima River)	[28]
26.	Lebuka parafasciata	Cyprinidae	Mizoram (Sala River)	[29]
27.	Opsarius kanaensis	Cyprinidae	Manipur	[30]
28.	Schistura larketensis	Nemacheilidae	Meghalaya (Khung cave)	[31]
29.	Garra moymkhulleni	Cyprinidae	Manipur (Chindwin River)	[32]
30.	Garra substrictorostris	Cyprinidae	Manipur (Barak Basin)	[33]
31.	Pethia poiensis	Cyprinidae	Manipur (Chindwin River)	[34]

Table 3: Newly described fish species from North eastern states of India (2013 to 2018).

Table 3 Continue.....

Result and Discussion

Total fish diversity

The present compilation documented a total of 495 fish species from north-eastern India of 39 families and 12 orders (Table 3). This number of fishes is about 48.72% of the total freshwater fish diversity in the country. The orderwise distribution of fishes is shown in (figure 1 and 2) which shows that the highest contribution is from Cypriniformes (53.6%) followed by Siluriformes (31%) and Perciformes (9%). These three orders alone contribute about 92.6% of northeast fish diversity.

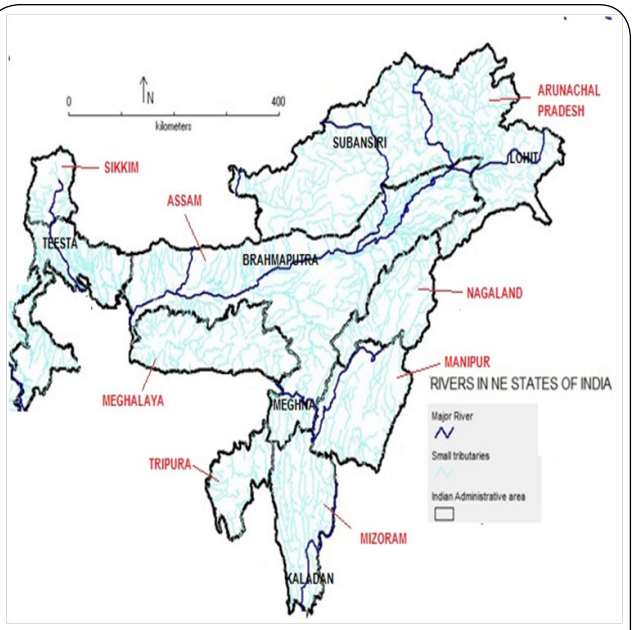

Figure 1: Different states of northeast India and the Rivers

The statewise distribution of fishes is shown in figure 3 which shows that the highest contribution is from Manipur followed by Assam and Sikkim.

All the 495 fish species have been checked for their

conservation status in IUCN red databook and found the following result (Table 4).

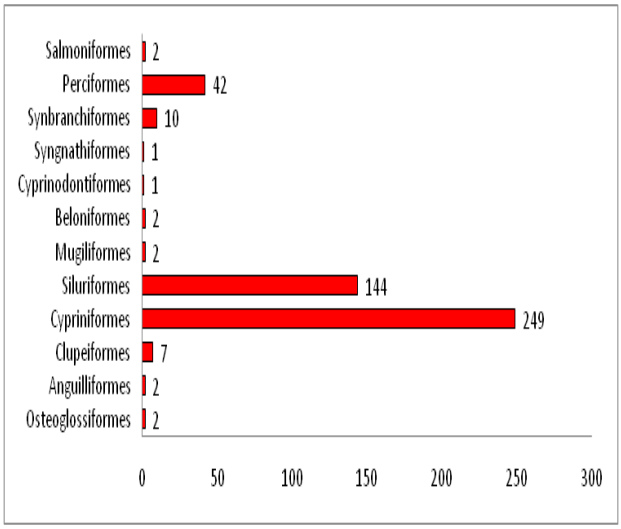

Figure 2: Orderwise distribution of fishes in N-E India

IUCN CATEGORY	NO OF SPECIES	EXAMPLE
CR	01	Schistura papulifera
EN	17	Tor putitora Puntius manipuriensis
VU	49	Barilius dogarsinghi, Garra manipuriensis
NT	35	Ompok bimaculatus, Neolissocheilus hexagonolepis
LC	220	Labeo bata, Cyprinus carpio
DD	61	Anabas testudinus, Channa barca
NE	112	Channa pnctatus, Salmo trutta fario

Table 4: Conservation status of fishes

Endemic fish diversity

As per [35], endemic means, "confmed to, occurring nowhere except in the place in quenstion" [36] also opined that endemic means confined to a given place or area; occurring nowhere else. As per biological terms also endemic means "native", restricted to a certain region or part of region. [4] Identified 48 species to be endemic to Assam and neighbouring North Eastern States. [37] reported 66 species endemic to this region. [3] reported 33 species as restricted in their distribution to this region. Endemic species of major river systems are given below (Table 5).

River System	Total Species	Endemic Species
Brahmaputra	229	29
Chindwin	103	41
Kaladan	200	20

Table 5: Endemic fish species in major river system in N-E India [2]

Ornamental Fish Diversity

Mandal eta l. [38] reported 250 sp of ornamental fishes from 114 genus, 37 families and 10 orders. The major species having a large number of ornamental fishes belong to the Order Cypriniformes, followed by Siluriformes and Perciformes. Out of this, the highest no. recorded from Assam (187), followed by Arunachal Pradesh (165), Meghalaya (159), Manipur (139), Tripura (103), Nagaland (71), Mizoram (46), and Sikkim (29).

Threats to fish diversity

Freshwater fishes of this region in general are facing the threats different categories:

- Overfishing
- Water pollution
- Habitat loss
- Exotic species invasion
- Climate change

Overfishing

- Overfishing is a form of overexploitation where fish stocks are reduced to below acceptable levels.
- This can leads to reduction of targeted fish population size, imbalance of the ecosystem and finally affect the livelihood of the people who depends on fishing.
- In sone beel (Assam) fishes like- Gudusia chapra, Salmostoma bacaila, Nandus nandus, Ompak bimaculatus, Alia coila, Clupisoma garua shows a decline in abundance between the period of 1990 to 2000. This is due to the overfishing of these fishes by the local fishermen [39].

Habitat loss

- Damming, deforestation, diversion and withdrawal of water for irrigation, urban and industrial consumption has caused large scale changes in the channel bed and hydrology of the river which affects the habitat of the fishes.
- For instance, with the construction of the Ithai barrage in the Loktak lake of Manipur, there has been disruption in the migration of fish from the lake and some species have lost their spawning habitats. Species such as Syncrossus berdmorei and Raiamas guttatus that were widely found in swamps, streams, and irrigation canals have been lost from these habitats around the lake [2].

Introduction of Exotic species

- The introduction of exotic aquatic organisms, particularly fishes, brought about a worldwide concern as it resulted in a wide array of problems including extirpation of indigenous species [40,41].
- They may prey upon native fishes, introduce new diseases and parasites, result in the production of hybirds and cause genetic 'erosion' of indigenous species and degradation of the physicochemical nature of aquatic ecosystems [41]. All this will subsequently lead to loss of biodiversity [40].
- For instance the introduction of common carp in Loktak lake (Manipur) and Sone beel (Assam) resulted decreasing of diversity of indigenous fishes [39, 40].

Climate change

- Climate variability is a key factor controlling the distribution and abundance of aquatic organisms and ecosystem structure [42].
- The impact of temperature shift due to climate change on aquatic organisms will affect their biological functions, as most of them are poikilothermic in nature. The Himalayan coldwater fish species may be at the highest risk of global warming as many of them are endangered.

Pollution

- Large areas of both the Brahmaputra and Barak Valley are suffering from arsenic poisoning, containing more than 50 ppm amount of arsenic, which is above the permissible level.
- The discharge of a large quantity of xenobiotics, pesticides, weedicides etc in various agricultural programmes, and in the tea industry constitute a sizeable amount of the in both soil and water. There is continuous use of plant poisions for fishing in some regions of Meghalaya and Arunachal Pradesh [43]. It has been found that there are oil spills in the upper reaches of the Brahmaputra basin.

Conclusion

About 15.2% of fish diversity in North-East India comes under the threatened category for which proper conservation measures should be taken. More over about 30% of fishes comes under the DD and NE category which needs more attention and whose conservation status should be known for their conservation. The United Nations has declared the years 2011 to 2020 as the International Decade for Biodiversity. We all should put our best concerted efforts to conserve the freshwater biodiversity. Proper planning and conservation management should be adopted now. Otherwise, it may become too late for freshwater diversity.

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