

Fish Germplasm Diversity and their Conservation Status of River Kaldia in Lower Brahmaputra Valley of Assam, India

Pradip Kumar Sarma*

P.G. Department of Zoology, Bajali College, Pathsala, Barpeta, Assam - 781325, India

*Corresponding Author E-mail: pradip13sarma@gmail.com

ABSTRACT

The present study was done on the basis of a preliminary survey conducted during May, 2012 to April, 2014 for two consecutive year in the Kaldia river of Barpeta district in lower Brahmaputra valley of Assam, India to assess the diversity of fish germplasm and their conservation status on the river. Findings revealed that the occurrence of 116 indigenous freshwater fish species from 9 orders, 31 families and 72 genera. Order Cypriniformes was the most dominant with 55 species followed by Siluriformes, Perciformes, Osteoglossiformes, Clupeiformes, Anguilliformes, Cyprinodontiformes, Symbbranchiformes and Tetradontiformes. Among the families recorded, cyprinidae was the most dominant. Result of the present study showed that 50 species common, 48 species scanty and 18 species were found rare in the area. Among the collected ichthyofauna 1(0.86%) species are endangered, 4 (3.45%) species are vulnerable, 10 (8.62%) species are near threatened, 94 (81.03%) least concern, 5 (4.31%) data deficient, 2 (1.72%) not evaluated as per IUCN (2013.2). Whereas 5 (4.31%) species are endangered, 22 (18.96%) species are vulnerable, 37 (31.89%) species are lower risk near threatened, 8 (6.89%) are lower risk and least concern, 1 (0.86%) is data deficient, 1 (0.86%) is critically endangered and 42 (36.21%) are not evaluated according to CAMP status(1998). Anthropogenic pressure, habitat loss, use of pesticide for killing fish species, sand mining are the major threats of depleting fish germplasm diversity in the river of which habitat loss is the most contributing factor.

Keywords: Germplasm, anthropogenic, ichthyofauna.

INTRODUCTION

The North Eastern region of India with its unique topography and watershed is an attractive field for freshwater fish studies. This region has been considered as a global hotspot of freshwater fish diversity¹³. The river Brahmaputra and Barak form the principal drainage of North East India with numerous tributaries flowing through the different states along with myriads of rivulets and lentic water bodies. Being a part of this region, the state of Assam afford lucrative habitats for variety of fish germplasm in its lentic and lotic ecosystem. Presence of diversified natural water bodies is also an added advantage to the diversification of the species.

In India, there are 2500 species of fishes, of which, 930 live in freshwater and 1570 are marine¹². Number of researchers have documented freshwater fish germplasm diversity of north-eastern India, varying from 172 to 267 species (Ghosh and Lipton⁸; Motwani *et al.*¹⁴; Sen²⁰; Sinha²³; Sen²¹) belonging to 114 genera under 38 families and 10 orders having potential ornamental and commercial importance²⁴. This constitutes to about 33.13% of the total freshwater fish species of India.

The exclusive literature survey indicates that only limited information is available on fish germplasm diversity of lower Brahmaputra valley of Assam with special reference to its potential as cultivable, sport and ornamental fishes (Biswas and Baruah²; Biswas and Sugunan³; Pandey *et al.*¹⁵, Saha and Bordoloi¹⁶;

Sarma *et al.*¹⁷; Goswami *et al.*⁷; Sarma *et al.*¹⁸). Although survey on ichthyofauna of this region has been carried out by few workers, but yet in Barpeta, there is no detailed information regarding the diversity, abundance and status of Kaldia river. Considering the immense importance of this system, there is a lack of information regarding the availability of fish fauna in the drainage systems of the state. By this reason, the present communication was therefore carried out in order to assessment, documentation and evaluating the proper cause of declining of its fish germplasm diversity. In this context, it is primarily aimed to compile the information generated by the present author and previous workers on the diversity of freshwater fish germplasm in the Kaldia river of Barpeta district of Lower Assam and thereby evaluating the conservation status, taking into consideration of riverine ecosystem, aware and motivate the local rural people about their environment and its conservation for their livelihood.

MATERIALS AND METHODS

Study Area :

The district is situated in the lower Brahmaputra valley of Assam between 26°5'N and 26°51'N latitude and 90°38'E and 91°20'E longitudes. It is bounded by Nalbari District on the east and its north boundary is marked by the Kingdom of Bhutan. The district is characterised by almost plain topography with the highest elevation of 200m above MSL in north, while in the south it is below 18m above MSL. The river Kaldia is located in the north western side of the Barpeta district which originate from Bhutan foothill region and are perennial in nature. It joins near Barpeta town to form Nakhanda and one of the important riverine system which harbour varieties of fish germplasm. However, no detailed systematic fish inventory has been available on the ichthyofauna of the river Kaldia in Barpeta district of Assam.

Data collection, analysis and preservation :

Extensive field survey were conducted to study the fish germplasm diversity of Kaldia river of Barpeta district of Assam and the random sampling was carried out two times in every month of May, 2012 to April 2014, having total catchment area *ca* 50 sq km .Survey was conducted in the early morning or evening because those hours all the fishermen and fish landing zone is much more active than in other times of a day. Secondary data were also collected through observation and interview with fishermen through questionnaires. Skilled fishermen were involved in netting and collection of fish samples at the studied area. Fishing gears and devices used during fishing operation were moving nets (*Dhekijal*, *Khewali jal*, *Toni jal* and *Drag nets* of various mesh sizes), Gill net, hooks and lines and different types traps namely *Jakoi*, *Polo*, *Sepa* and *Bamboo bana*. The moving nets were used throughout the year while Gill net is extensively used during the monsoon period. Fish samples were also collected from the fish landing centres and local fish markets of the studied area to ascertain the fish species composition as far as possible, the fish species were identified in the field itself. The samples were photographed, immediately prior to preservation as formalin decolorizes the fish colour on long preservation. Unidentified collected specimens were preserved in 7-10% aqueous formaldehyde solution and were brought to Fishery Science and Limnology Laboratory, Department of Zoology, Bajali College, Pathsala and were identified following different literature such as Sen²⁰, Talwar and Jhingran²⁴ and Jayaram¹⁰. The nomenclature followed in this context were made according to Talwar and Jhingran²⁴ and Jayaram¹⁰. Valid scientific names were taken from www.Fishbase.org. Current conservation status as evaluated by Conservation Assessment and Management Plan (CAMP) workshop held at NBFGR⁴ and IUCN⁹.

RESULTS AND DISCUSSION

No information is available till now on the occurrence of freshwater fish germplasm diversity of Kaldia river of Barpeta district in Lower Brahmaputra valley of Assam and present work in the first attempt in this direction. The list of freshwater fish including their order, family, name of the species, common English name, conservation status and relative abundance are depicted in Table - 1. The status of the fishes are based on the CAMP Report⁴ and IUCN⁹ data base as it was prevalent and followed during the sample collection time but the status of some of the species mentioned may have got changed in recent times. The occurrence of 116 indigenous freshwater fish species belongs to 9 orders, 31 families and 72 genera, out of the total fishes order Cypriniformes was dominant with 56 species.

In the present communication, the sequence of dominance of recorded order is as follows -

Cypriniformes > Siluriformes > Perciformes > Osteoglossiformes = Clupeiformes = Anguilliformes = Cyprinodontiformes > Symbranchiformes = Tetradontiformes

Out of 9 recorded orders Siluriformes contributed 10 families, followed by Perciformes 08, Cypriniformes 04, Clupeiformes, Anguilliformes and Cyprinodontiformes each with 02 and Osteoglossiformes, Symbranchiformes and Tetradontiformes each with 01 families.

Conservation status of the fish germplasm in the present study reveals that, according to IUCN⁹ Red List of threatened species, 01 (0.86%) species is endangered, 04 (3.45%) species are vulnerable, 10 (8.62%) species are near threatened, 94 (81.03%) was least concern, whereas 05 (4.31%) species are endangered, 22 (18.96%) species are vulnerable, 37 (31.89%) species are lower risk and near threatened, 08 (6.90%) lower risk and least concern and 01 (0.86%) is critically endangered as per CAMP⁴ (Fig.1). Out of total fish species observed under study, 50 common, 48 scanty and 18 were found rare in the area. According to CAMP⁴ Report *Chitala chitala*, *Ompak bimaculatus*, *O. pabo*, *Eutropiichthys vacha*, *Neotropius atherionoides* are the endangered species whereas *Chitala chitala*, *Labeo nandina*, *Hypophthalmichthys molitrix*, *Ompak bimaculatus*, *O. pabda*, *O. pabo*, *Wallago attu*, *Ailia coila*, *Bagarius bagarius*, *Oreochromis mossambicus* are near threatened species as per IUCN⁹ status.

It is established from the present investigation that all the recorded species have some food as well as some potential ornamental value. The earlier study reveals that no effort have been made to assess the rich fish germplasm resources available in the studied area with respect to its commercial utilisation. Among the air breathing fishes such as *Clarias magur*, *Heteropneustes fossilis*, *Channa spp.* and *Mastcembelus armatus* fetch having high market value as live fish. Other fish species like *Labeo rohita*, *Cirrhinus mrigala*, *Catla catla* of Indian Major Carp, *Bagarius bagarius*, *Wallago attu*, *Ompak spp.* have good economic value. It is mentionable that some of the species such as *Labeo nandina*, *Riamas bola*, *Botia rostrata*, *Olyra kempi*, *Ompak bimaculatus*, *O. pabda*, *Pisodonophis boro* and *Aplocheilus panchax* were found to be rare during investigation and therefore have immense importance and necessity for conservation in the studied river.

The present study reveals that river Kaldia exhibit a unique combination of ichthyo species compared to the different water bodies in other region of the state and recorded highest number of fish species from this particular river of Assam. There are 16 exotic species reported from India and many of them are cultured in the closed water body¹¹. Among these, 7 species were recorded in the present investigation and *Ctenopharyngodon idella*, *Hypophthalmichthys molitrix* are quiet frequent. Emergence of *Clarias gariepinus* which is voracious and carnivorous feeding habit established itself in this river and become serious threat to the smaller indigenous ichthyo species. Similar findings were made by Sarma *et al.*,¹⁸ who reported the presence of 6 exotic species from Bishan Nalah rivulet of Assam.

In the present context of study, it is noticed that indiscriminate harvesting of fish species from their natural habitat is regularly done by the rural people, which may lead to serious decline of fish population. Through interviewing the local people, it is clear that some commercial and economically important fishes which are high market value both in domestic and international market are at present in very threatened condition. Unfortunately, the important riverine fishery of Indian Major Carps has either collapsed or it is at the threshold of collapse. To overcome this problem, these fishes can be reared and breed in captive environment and vocational training could be provided to the fisher folk in rural areas for rearing and breeding of those threatened fish. Drastic modification of riverine ecosystem by siltation leading to freshwater fish species¹⁹. Earlier report also suggest that there has been drastic depletion in availability of the freshwater ichthyofauna in north-eastern region due to destruction of the breeding ground, overexploitation and various anthropogenic stress⁶.

The importance of state fisheries education in Assam is still neglected in fish resources sector in comparison to other part of the country. Unfortunately, over last few decades the riverine ecosystem have been subjected to intense anthropogenic activities resulting in its degradation and habitat loss for the fishes. As a result, many riverine fish species have become highly endangered¹⁹.

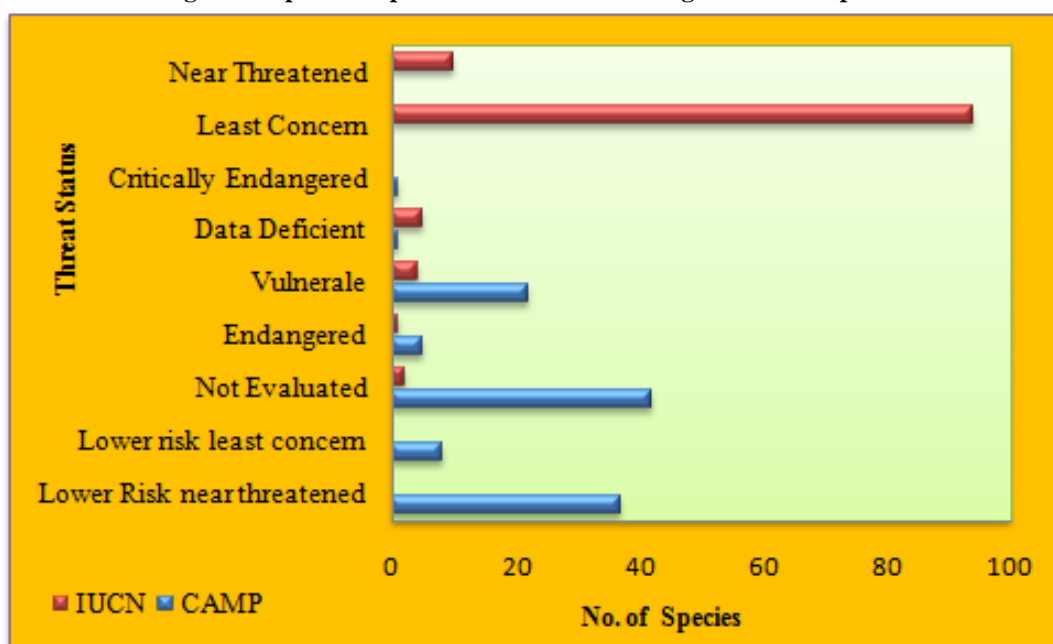
Table - 1 : List of Fish germplasm diversity and Conservation status recorded from Kaldia river, Barpeta district of Lower Brahmaputra Valley of Assam

Name of the Species	Common English Name	Conservation Status		Abundance
		CAMP 1998	IUCN 2013.2	
ORDER : OSTEOGLOSSIFORMES				
Family : Notopteridae				
<i>Chitala chitala</i> (Ham-Buch,1822)	Clown Knifefish	EN	NT	S
<i>Notopterus notopterus</i> (Ham-Buch,1822)	Bronze featherback	LRnt	LC	S
ORDER : CLUPEIFORMES				
<i>Gudusia chapra</i> (Ham-Buch,1822)	Indian river shad	LRlc	LC	S
Family : Engraulididae				
<i>Setipinna phasa</i> (Ham-Buch,1822)	Gangetic hairfin anchovy	NE	LC	R
ORDER : CYPRINIFORMES				
Family : Cyprinidae				
<i>Amblypharyngodon mola</i> (Ham-Buch,1822)	Mola carplet	LRlc	LC	C
<i>Aspidoparia jaya</i> (Ham-Buch,1822)	Jaya	VU	LC	S
<i>Barilius barna</i> (Ham-Buch,1822)	Barna baril	LRnt	LC	S
<i>B. bandelisis</i> (Ham-Buch,1807)	Hamilton's barila	LRnt	LC	S
<i>B. shacra</i> (Ham-Buch,1822)	Shacra baril	LRnt	LC	S
<i>B. tileo</i> (Ham-Buch,1822)	Tileo baril	LRnt	LC	S
<i>B. vagra</i> (Ham-Buch,1822)	Vagra baril	VU	LC	S
<i>Cabdio morar</i> (Ham-Buch,1822)	Morari	LRnt	LC	S
<i>Catla catla</i> (Ham-Buch,1822)	Catla	VU	LC	C
<i>Chagunius chagunio</i> (Ham,1822)	Chaguni	NE	LC	S
<i>Chela cachius</i> (Ham-Buch,1822)	Silver hatchet chela	NE	LC	C
<i>Cirrhinus mrigala</i> (Ham-Buch,1822)	Mrigal carp	LRnt	LC	C
<i>C. reba</i> (Ham-Buch,1822)	Reba carp	VU	LC	S
<i>Ctenopharyngodon idella</i> (Val,1844)*	Grass carp	NE	NE	C
<i>Cyprinus carpio communis</i> (Linn.,1758)*	Common carp	NE	VU	C
<i>C. carpio specularis</i> (Linn.,1758)*	Common carp	NE	VU	C
<i>Cyprinion semiplotum</i> (McClelland,1839)	Assamese kingfish	VU	VU	S
<i>Danio aequipinnatus</i> (McClelland,1839)	Giant danio	LRnt	LC	R
<i>D. dangila</i> (Ham-Buch,1822)	Dangila danio	NE	LC	R
<i>D. devario</i> (Ham-Buch,1822)	Sind danio	LRnt	LC	C
<i>D. rerio</i> (Ham-Buch,1822)	Zebra danio	NE	LC	S
<i>Dawkinsia filamentosa</i> (Val,1844)	Blackspot barb	NE	LC	S
<i>Esomus danricus</i> (Ham-Buch,1822)	Flying barb	LRlc	LC	C
<i>Garra gotyla</i> (Gray,1830)	Sucker head	VU	LC	S
<i>Hypophthalmichthys molitrix</i> (Val.,1844)*	Silver carp	NE	NT	C
<i>H. nobilis</i> (Richardson, 1845)*	Bighead carp	NE	DD	C
<i>Labeo bata</i> (Ham-Buch,1822)	Bata	LRnt	LC	C
<i>L. calbasu</i> (Ham-Buch,1822)	Orangefin labeo	LRnt	LC	C
<i>L. dero</i> (Ham-Buch,1822)	Kalabans	VU	LC	R
<i>L. dyocheilus</i> (McClelland,1839)	-	VU	LC	R
<i>L. gonius</i> (Ham-Buch,1822)	Kuria labeo	LRnt	LC	C
<i>L. nandina</i> (Ham-Buch,1822)	-	NE	NT	R
<i>L. rohita</i> (Ham-Buch,1822)	Roho labeo	LRnt	LC	C
<i>Laubuca laubuca</i> (Ham-Buch,1822)	Indian glass barb	LRlc	LC	C
<i>Osteobrama cotio cotio</i> (Ham-Buch,1822)	Cotio	LRnt	LC	C
<i>Pethia phutunio</i> (Ham-Buch,1822)	Spotted sail barb	LRlc	LC	S
<i>Puntius conchoniis</i> (Ham-Buch,1822)	Rosy barb	VU	LC	S
<i>P. chola</i> (Ham-Buch,1822)	Swamp barb	VU	LC	S
<i>P. gelius</i> (Ham-Buch,1822)	Golden barb	NE	LC	S
<i>P. sophore</i> (Ham-Buch,1822)	Pool barb	LRnt	LC	C
<i>P. terio</i> (Ham-Buch,1822)	One spot barb	LRnt	LC	S
<i>P. ticto</i> (Ham-Buch,1822)	Ticto barb	LRnt	LC	S
<i>Rasbora daniconius</i> (Ham-Buch,1822)	Blackline rasbora	LRnt	LC	R

<i>R. rasbora</i> (Ham-Buch,1822)	Gangetic scissortail rasbora	NE	LC	R
<i>Riomas bola</i> (Ham-Buch,1822)	Indian Trout	VU	LC	R
<i>Salmostoma bacaila</i> (Ham-Buch,1822)	Large razorbelly minnow	LRlc	LC	C
<i>Systomus sarana</i> (Ham-Buch,1822)	Olive barb	VU	LC	R
Family : Psilorhynchidae				
<i>Psilorhynchus balitora</i> (Ham-Buch,1822)	Balitora minnow	NE	LC	S
<i>P. sucatio</i> (Ham-Buch,1822)	River stone carp	NE	LC	S
Family : Balitoridae				
<i>Acanthocobitis botia</i> (Ham-Buch,1822)	Striped loach	LRnt	LC	C
Family : Cobitidae				
<i>Botia dario</i> (Ham-Buch,1822)	Bengal loach	NE	LC	S
<i>B. rostrata</i> (Gunth,1868)	Gangetic loach	NE	VU	R
<i>Lepidocephalichthys annandalei</i> (Chau,1912)	Annandale loach	LRnt	LC	S
<i>L. guntea</i> (Ham-Buch,1822)	Guntea loach	NE	LC	C
<i>Canthophrys gongota</i> (Ham-Buch,1822)	Gongota loach	LRnt	LC	S
ORDER : SILURIFORMES				
Family : Bagridae				
<i>Mystus bleekeri</i> (Day,1877)	Days mystus	VU	LC	C
<i>M. cavasius</i> (Ham-Buch,1822)	Gangetic mystus	LRnt	LC	C
<i>M. tengara</i> (Ham-Buch,1822)	Tengara mystus	LRnt	LC	C
<i>M. vittatus</i> (Bloch,1794)	Stripped dwarf catfish	VU	LC	C
<i>Rita rita</i> (Ham,1822)	Rita	LRnt	LC	S
<i>Seperata aor</i> (Ham-Buch,1822)	Long-whiskered catfish	NE	LC	S
Family : Amblycipitidae				
<i>S. seenghala</i> (Sykes,1839)	Giant river catfish	NE	LC	S
<i>Amblyceps mangois</i> (Ham,1822)	Indian torrent catfish	LRnt	LC	S
Family : Siluridae				
<i>Ompak bimaculatus</i> (Bloch,1794)	Butter Catfish	EN	NT	C
<i>O. pabda</i> (Ham-Buch,1822)	Pabdah catfish	EN	NT	C
<i>O. pabo</i> (Ham-Buch,1822)	Pabo catfish	NE	NT	R
<i>Wallago attu</i> (Bloch&Schn,1801)	Wallago	LRnt	NT	C
Family : Schilbeidae				
<i>Ailia coila</i> (Ham-Buch,1822)	Gangetic ailia	VU	NT	C
<i>Ailiichthys punctata</i> (Day,1872)	Jamuna ailia	VU	DD	S
<i>Chupisoma garua</i> (Ham,1822)	Garua Bachcha	VU	LC	S
<i>Eutropiichthys vacha</i> (Ham,1822)	Batchwa vacha	EN	LC	S
<i>Neotropius atherinoides</i> (Bloch,1794)	Indian potasi	EN	LC	C
Family : Sisoridae				
<i>Bagarius bagarius</i> (Ham,1822)	Goonch	VU	NT	S
<i>Erethistes pussilus</i> (Muller&Trosce.,1849)		NE	LC	C
<i>Gagata cenia</i> (Ham,1822)	Indian gagata	NE	LC	S
<i>Hara hara</i> (Ham-Buch,1822)	Hara	NE	LC	S
<i>H. jerdoni</i> (Day,1870)	Sylhet hara	NE	LC	S
<i>Gogangra viridescens</i> (Day,1822)	Huddah nangra	LRnt	LC	C
Family : Olyridae				
<i>Olyra kempfi</i> (Chaudhuri,1912)		NE	LC	R
Family : Pangasiidae				
<i>Pangasius pangasius</i> (Ham,1822)	Pangas catfish	CR	LC	C
Family : Clariidae				
<i>Clarias magur</i> (Ham,1822)	Walking cat fish	VU	EN	C
<i>C. gariepinus</i> (Burchell,1822)*	North African catfish	NE	NE	S
Family : Heteropneustidae				
<i>Heteropneustes fossilis</i> (Bloch,1794)	Stinging catfish	VU	LC	C
Family : Chacidae				
<i>Chaca chaca</i> (Ham-Buch,1822)	Square head catfish	NE	LC	R
ORDER : ANGUILLIFORMES				

Family : Anguillidae				
<i>Anguilla bengalensis</i> (Gray, 1831)	Indian mottled eel	NE	LC	C
Family : Ophichthidae				
<i>Pisodonophis boro</i> (Ham, 1822)	Rice-paddy eel	NE	LC	R
ORDER : CYPRINODONTIFORMES				
Family : Belonidae				
<i>Xenentodon cancila</i> (Ham-Buch,1822)	Freshwater garfish	LRnt	LC	S
Family : Aplocheilidae				
<i>Aplocheilus panchax</i> (Ham-Buch,1822)	Blue panchax	DD	LC	R
ORDER : SYMBRANCHIFORMES				
Family :Symbranchidae				
<i>Monopterus cuchia</i> (Ham-Buch,1822)	Gangetic mud eel	LRnt	LC	C
ORDER : PERCIFORMES				
Family : Ambassidae				
<i>Chanda nama</i> (Ham-Buch,1822)	Elongate glass-perchlet	NE	LC	C
<i>Parambassis ranga</i> (Ham-Buch,1822)	Indian glassy fish	NE	LC	C
<i>P. baculis</i> (Ham-Buch,1822)	Himalayan glassy perchlet	LRlc	LC	C
Family : Nandidae				
<i>Badis assamensis</i> (Ahl,1937)	Badis	NE	DD	S
<i>B. badis</i> (Ham-Buch,1822)	Badis	NE	LC	C
<i>Nandus nandus</i> (Ham-Buch,1822)	Gangetic leaf fish	LRnt	LC	S
Family : Gobidae				
<i>Glossogobius giuris</i> (Ham-Buch,1822)	Bar eyed goby	LRnt	LC	S
Family : Anabantidae				
<i>Anabas testudineus</i> (Bloch,1792)	Climbing perch	VU	DD	C
Family : Belontiidae				
<i>Trichogaster fasciatus</i> (Bl. & Schn,1801)	Banded gourami	LRnt	LC	C
<i>T. lalius</i> (Ham,1822)	Dwarf gourami	NE	LC	C
<i>T. labiosa</i> (Day,1877)	Thick lipped gourami	NE	LC	C
<i>T. chuna</i> (Ham-Buch,1822)	Honey gourami	NE	LC	C
Family : Cichlidae				
<i>Oreochromis mossambicus</i> (Peters,1852)*	Mozambique tilapia	NE	NT	S
Family : Channidae				
<i>Channa gachua</i> (Bl. & Schn,1822)	Dwarf snakehead	VU	LC	C
<i>C. marulius</i> (Ham-Buch,1822)	Great snakehead	LRnt	LC	R
<i>C. punctatus</i> (Bloch,1793)	Spotted snakehead	LRnt	LC	C
<i>C. stewartii</i> (Playfair,1867)	Assamese snakehead	NE	LC	S
<i>C. striatus</i> (Bloch,1793)	Stripped snakehead	LRlc	LC	S
<i>C. barca</i> (Ham-Buch, 1822)	Barca snakehead	NE	DD	R
Family :Mastacembelidae				
<i>Macrogathus aral</i> (Bl & Schn,1801)	One stripe spiny eel	LRnt	LC	C
<i>M. pancalus</i> (Ham-Buch, 1822)	Barred Spiny eel	LRnt	LC	C
<i>Mastacembelus armatus</i> (Lece,1800)	Zig-zag eel	NE	LC	S
ORDER : TETRADONTIFORMES				
Family : Tetradontidae				
<i>Tetradon cutcutia</i> (Ham-Buch, 1822)	Ocellated pufferfish	LRnt	LC	S
N.B. : EN - Endangered; CR - Critically Endangered; NE - Near Threatened; VU - Vulnerable; LRnt - Lower Risk near threatened; LRlc - Lower Risk least concern; LC - Least Concern; DD - Data Deficient; NE - Not Evaluated; C - Common; S - Scanty; R - Rare; * - Exotic				

Fig-1 : Graphical Representation of threat categories of fish species



Conservation of fish germplasm resources are not only important for sustainable fishery but it also helps in national development. Being a primary source of original fish germplasm, role of fisheries crucial for conservation of fish diversity.

It is noticed that, the people of Assam prefer fish to other animal protein and particularly fresh fish is valued high in comparison with fish imported from other states. The human activities damaging and degrading river system includes climate change, catchment land use change, river corridor engineering and stream impacts¹. The district Barpeta has been subjected to considerable human pressure due to developmental activities such urbanization, simultaneous rise in population from other district, road network, industrial activities, tourism, construction of residence on both side of river bank etc. Other kind of human activities for which studied freshwater resources are subjected to declining trend may be due to in terms of pollution such as human bathing, cultural activities, cloth washing and sewage disposal including open defecation, agriculture, poisoning of water bodies with pesticides for trapping consumable fishes and deforestation in the catchment area. Human activities have severely affected condition freshwater in its ecosystem. These are significant cause by which not only the adults of edible size are killed but all stages of fish life are destroyed and the natural habitat of fish is also polluted. The pollution of the river by flash floods, soil erosion, landslides, siltation and deposition of fine sediments from one river to another leads to the loss of fish habitats and have also been responsible for the depletion of the fish fauna (Arthington and Welcomme¹, Sharma *et al.*,²² Goswami, *et al.*⁷). Besides the above factor, overfishing, dynamiting, rampant killing of brood fishes, spawn, fry, fingerlings and juveniles violating Fishery Laws and Act, use of bleaching powder and ichthyotoxic plants in the shallow breeding grounds of the river were assessed to be responsible for declining trend of fishery in the Kaldia river. Pesticides washing from agricultural, sand mining have also been created detrimental environment for fish life in the river.

The gene pool of unique fish germplasm diversity in river Kaldia of lower Brahmaputra valley of Assam is a valuable endowment of nature. The fish germplasm resources in the studied river plays an important role on surrounding population in general and local rural fishermen community in particular. In contrary to this, the river is facing ever increasing stresses such as the killing of the juvenile and brood fishes, which is a great concern of the natural fish stock. Therefore, the present study indicates that to save this diversity, there is an urgent need for conservation of the fish denizens to conserve the productivity potential of the river through promulgation of fisheries legislation in future.

CONCLUSION

Though there is an ample scope for fish and their habitat conservation in Assam, interestingly most water bodies have been neglected so far in real scenario. Thus, some steps and awareness programme is needed to educate people about the importance of the river, its biodiversity and fish productivity. Due to the richness of diversity fish have high potential value to generate employment opportunities in rural areas. Moreover unemployed as well as employed people also adopt fishing as livelihood.

REFERENCES

1. Arthington, A.H. and Welcomme, R.L. The condition of large river systems of the world. In: Voigtlander C.W. (ed.) *Proceeding of the world fisheries congress*. IBH Publishing, New Delhi and Oxford, 44-75pp. (1995)
2. Biswas, S.P. and Baruah, S. Ecohydrology and fisheries of the upper Brahmaputra basin. *The Environmentalist*, **22**: 119-131 (2002)
3. Biswas, B.K. and Sugunan, V.G. Fish Diversity of Brahmaputra river system in Assam, India. *Journal of Inland Fish Soc. India* **40(1)**: 23-31 (2008)
4. CAMP: Report of the Workshop on 'Conservation Assessment and Management Plan (CAMP)' for freshwater fishes of India. Zoo Outreach Organisation and NBFGR, Lucknow, 22-26 September, 1997, 156p. (1998)
5. Das, B. and Sharma, S. Ichthyofaunal diversity of river Jamuna, Karbi Anglong, Assam, India. *The Clarion*, **1(1)**: 65-69 (2012)
6. Dutta, A. Choudhury, M. and Acharjee, B. Natural and Anthropogenic hazards in cage and pen aquaculture systems in North-east India. In: Natural and Anthropogenic Hazards on Fish and Fisheries. Ed. Umesh C. Goswami, Narendra Publishing House, Delhi. 263-270pp.(2007)
7. Goswami, U.C., Basistha, S.K., Bora, D., Shyamkumar, K., Saikia, B. and Changsan, K. : Fish diversity of North East India, inclusive of the Himalayan and Indo Burma biodiversity hotspots zones : A checklist on their taxonomic status, economic importance, geographical distribution, present status and prevailing threats. *International Journal of Biodiversity and Conservation*, **4(15)** : 592-613.(2012)
8. Ghose, S.K. and Lipton, A.P. : Ichthyofauna of the NEH Region with special reference to their economic importance, ICAR Research Complex, NEH Region, Shillong. *Spl. Bulletin*, **1**: 119-126. (1982)
9. IUCN: IUCN Red List of Threatened Species. Version 2013.2 <www.iucnredlist.org>Downloaded on 22.12.2013
10. Jayaram, K.C.: The fresh water fishes of Indian region. New Delhi, Narendra Publishing House, pp.551. (2013)
11. Jhingran, V.G. : Fish and Fisheries of India (3rd Ed.), Hindustan Publishing Corporation, Delhi, 463.(1991)
12. Kar, D. : Fundamentals of Limnology and Aquaculture Biotechnology. New Delhi, Daya Publishing House.(2007)
13. Kottelat, M. and Whitten, T. : Freshwater biodiversity in Asia with special reference to fish. World Bank Tech. Paper No.343. *The World Bank*, Washington DC, 17-22.(1996)
14. Motwani, M.P., Jayaram, K.C. and Sehgal, K.L. : Fish and fisheries of Brahmaputra river system, Assam. 1. Fish fauna with observation on their zoogeographical significance. *Tropical Ecology*, **3** (1 and 2): 17-43.(1962)
15. Pandey, A.K. Baruah, A. and Biswas, S.P. On the ornamental fish fauna in the Brahmaputra drainage system. *Indian J. Fish.*, **45(1)**: 95-97 (1998)
16. Saha, S. and Bordoloi, S. *Journal of Threatened Taxa*. **1(4)**: 240-242 (2009)
17. Sarma, D. Das, J. Bhattacharyya, R.C. and Dutta, A. Ichthyofaunal Diversity of Lower Reaches of the Brahmaputra River, Assam. *International J. of Applied Biology and Pharmaceutical Technology*. **3(2)**: 126-130 (2012)

18. Sarma, P.K. Kalita, G.J. and Sarma, N.N. Ichthyofaunistic study and its anthropogenic stress on Bishan Nalah Rivulet of Barpeta, Assam. *J. of Applied Science Research*, **5(5)**: 50-59 (2014)
19. Sarkar, U.K. and Ponniah, A.G. Evaluation of North East Indian fishes for their potential as cultivable, sport and ornamental fishes along their conservation and endemic status. pp. 11-30. In Ponniah, A.G. and Sarkar, U.K. (eds.). *Fish Biodiversity of North East India*. NBFGR, NATP Publ. **2**: 228 pp.(2000)
20. Sen, T.K. The fish fauna of Assam and the neighbouring North-eastern states of India. *Rec. Zool. Surv. India. Occ. Pap.* **64**: 1-216 (1985)
21. Sen, N. Occurrence, distribution and status of diversified fish fauna of North East India. Pp. 31-48. In Ponniah, A.G. and Sarkar, U.K. (eds.). *Fish Biodiversity of North East India*. NBFGR, NATP Pub. **2**: 228 pp (2000)
22. Sharma, S. and Das, B. Global warming, climate change and its impact on fish diversity of Assam. In: Proc. Int. Sem. on Climate change, Global warming and NE India: Regional perspectives, ERD Foundation, Guwahati-29 (2010)
23. Sinha, M. Threatened Coldwater Fishes of North-Eastern Region of India, pp 173-176. In: *Threatened Fishes of India*. Natcon Publication No. 4,UP, India (1994)
24. Talwar, P.K. and Jhingran, A.G. Inland fishes of India and adjacent countries, Vol.I&II. New Delhi: Oxford and IBH Co. Pvt Ltd. (1991)