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# Ichthyofaunastic study and its anthropogenic stress on Bishan Nalah Rivulet of Barpeta, Assam

**Pradip Kumar Sarma[1], Gaurab Jyoti Kalita[2] and Nripendra Nath Sarma[3]**

[1]*P.G. Department of Zoology, Bajali College, Pathsala Assam*
[2]*Department of Wildlife & Biodiversity Conservation, North Orissa University*
[3]*Dr. Surjya Kanta Bhuyan Academy, Nalbari, Assam*

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**ABSTRACT**

*The present work was carried out in the rivulet Bishan Nalah of Barpeta District of Assam, which lies between 26° 28' 00" North latitude; 91° 10' 00" East longitudes , during the period of two consecutive years from December, 2012 to November, 2013. Altogether 85 species of fishes are diversified over 6 orders, 28 families and 55 genera. Dumping of garbage, drainage of sewage and waste product, construction of number of bridges, impeachment on both side of the bank, soil erosion, siltation, eutrophication, high infestation of macrophytes, over exploitation, operation of fishing gear and flow of effluents into the water bodies are the major factors for the declining of present fish diversity.*

**Keywords:** Eutrophication, Macrophytes, Infestation, Fish fauna, Riverine

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## INTRODUCTION

There has been drastic decline in the number of fish species, particularly the freshwater fishes, which are 10 times more likely to be threatened than their marine and brackish water counterparts [16]. Fishes are invariable living components of water bodies. These organisms are important food resource and good indicators of the ecological health of the waters they inhabit. However, the rich biodiversity within the freshwater fishes of the Indian region has been rapidly dwindling because of increasing degradation of inland water. The state of Assam has its one of the largest river drainage systems in India, the Brahmaputra river system and another is Barak drainage system. Both harbour innumerable rivers and rivulets with their variously diversified fish species, of which many of them are endemic to this region.

The perusal literatures on diversified fish fauna of India state that the various investigations conducted during past years, have not given much attention towards assessing the different fish habitat parameters influencing fish species diversity in the lotic freshwaters except the few investigations Arunachalam [1] , Acharjee*et al.*, [3] , Bhat [6] , Bagra*et al.*, [4] , Daimari*et al.*,[8] , Das [9] , Das *et al.*,[12] , Devi and Indra, [13] , Dutta *et al.*, [14] , *Froese et al.*, [16] , Johal*et al*, [22] , Kapoor *et al.*, [24] , Kar*et al.*,[23] , Lakra*et al.*,[26] , Molur and Walker,[27] , Sen [31] , Srivastava *et al.*,[33] , Sarkar *et al.*, [29] , Vass *et al.*,[35].

Number of researchers in recent years Das and Dutta [11], Goswami and Ali, [18], Islam *et al.*,[19], Baruah D. *et al*[5] have given different and fragmented figures in regards to availability of total number of fish species in Assam, which necessitate a consolidated updated list.

Considering the study of ichthyological diversity in a small rivulet with high anthropogenic stress, the present investigation draws an attention on the declining of fish population in Barpeta district which contribute a large number of ichthyofaunal diversity of the state. Besides 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 idea of this kind of investigation is probably the first in studied area and therefore it is utmost necessary to be carried out for evaluating the exact cause of depletion of its ichthyofaunal diversity. This communication is primarily aimed to compile the information generated by present author and previous workers on the occurrence of various fish species from the lotic systems of the Barpeta district of Assam.

## MATERIALS AND METHOD

***A) Location of Study area:*** The present work was carried out in the rivulet Bishan Nalah of Barpeta District of Assam, which lies between 26° 28′ 00″ North latitude; 91° 10′ 00″ East longitudes. The total catchment area 13 sq. Km. has varied water levels that depend on the seasons. The studied area has a foothill zone of general height about 500 M.S.L. and a meeting area into Kaldiya river of height about 150 M.S.L.

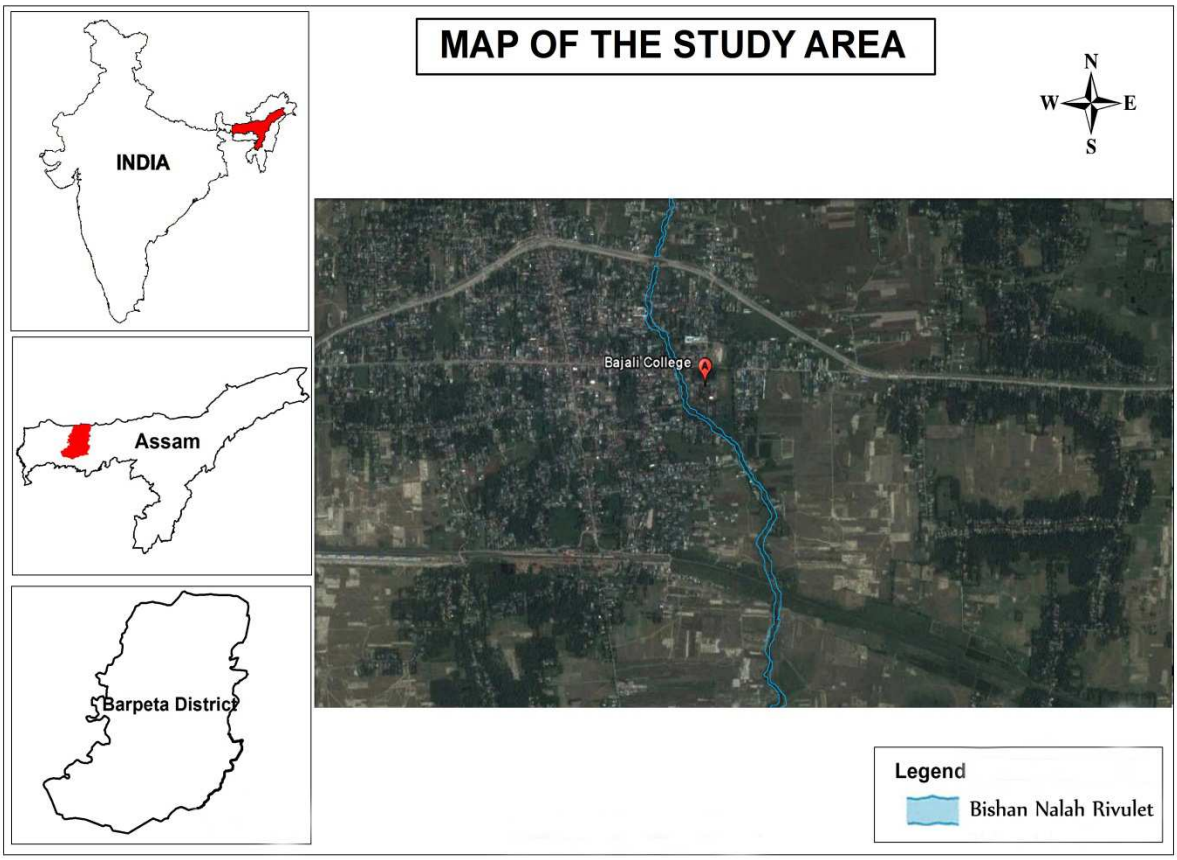


**Fig1: Location Map of Study Area**

***B)* Data collection and analysis**: The random sampling method with landing station approach was followed for collecting the fishes. Survey was conducted in different fish landing zone and the sampling was carried out four times in every month from December, 2012 to November, 2013. Survey was conducted in the early morning or evening because those hours all the freshmen and fish landing zone is much more active in other times in a day. Secondary data were also collected through observation and interview with fishermen through questionnaires. Fishermen personal Interviews were carried out to find out the fish types caught, fishing gear used and the fishing activities at the site. Fishes were caught by using different types of Gill nets, Cast nets, Drag nets, scop nets, bamboo traps and angling with the aid of local fishermen.Gill nets of mesh sizes used by fishermen include: 2½ inch, 3 inch, 3½, 4inch and 4½ and 5½ inch; cast nets of mesh size 7 x 7 mm and sweep nets o mesh size 5x5 mm (Appraisal). The samples were photographed, immediately prior to preservation as formalin decolorizes the fish colour on long preservation.

***C)* Preservation:** After photography fishes were directly placed in 10% formalin. Separated jar with label was used for preserving individual species and brought to the Fishery Science and Limnological Laboratory of the Bajali College, Pathsala, for identification. The specimens were identified following Day [10], Sen [30], Talwar and Jhingran [34] and Jayaram [21].

## RESULTS AND DISCUSSION

In the present context of study a detailed systematic enumerations are recorded in Table 1. The nomenclature of fish is based on Fishbase.org and the present status was checked in IUCN Red List Category [20]. The status of the fishes are based on the IUCN [20] and CAMP Report [7] 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.

Approximately, a total of 2500 species of fishes inhabit in India, out of which 930 are in fresh waters and belong to 326 genera, 99 families and 20 orders [34]**.** In the present study, altogether 85 species of fishes are diversified over 6 orders, 28 families and 55 genera. Among them, majority of fishes (35 species) belong to Cyprinidae followed by Bagridae and Sisoridae (5 species), Cobitidae and Channidae (4 species), Ambassidae (3 species), Belontidae (3 species) Mastacmbelidae (3 species), Psilorhynchidae (2 species), Schilbidae (2 species), Nandidae (2 species), Notopteridae (1 species), Anguillidae (1 species), Clupeidae (1 species), Balitoridae (1 species), Siluridae (1 species), Amblycepetidae (1 species), Claridae (1 species), Heteropneustidae (1 species), Chacidae (1 species), Oliridae (1 species), Belonidae (1 species), Aplochilidae (1 species), Symbranchidae (1 species), Chichlidae (1 species), Gobidae (1 species), Anabantidae (1 species), Tetradontidae (1 species) each. Emergence of some economically important exotic food fishes like *Hypothalmichthysmolitrix*, *Ctenopharyngodonidella*, *Puntius javanicus*, *Cyprinuscarpio*var. *communis*, *Cyprinuscarpio*var. *specularis*and *Oreochromismossambica*in high numbers during flood/monsoon season is very characteristic feature in the studied area. Many of these species are common to the Indian river system. Unfortunately, over the last few decades the riverine ecosystems have been subjected to intense anthropogenic pressure resulting in its degradation and habitat loss for the fishes. As a result, many riverine fish species have become highly endangered [29].The concern for the habitat degradation in India has at present been compounded by the impact of climatic change on these aquatic ecosystems [35].

Earlier, some economically important Indian Major Carps (IMC) fry and fingerlings of *Labeo rohita*, *Catla catla*and *Cirrhinus mrigala* were found in much abundance, but presently due to unwanted anthropogenic activities their number is very poor. For the other native fish species, there is immense scope in ornamental fish culture.The rivers in India harbour one of the richest fish genetics resources in the world [35]. Though there is an ample scope for fish and their habitat conservation in Assam, interestingly most of the lotic water bodies have been neglected so far in real scenario. The importance of state fisheries education in Assam is still neglected in fish resources sector in comparison to other part of the country. However, the ICAR Research Complex has initiated in various fields and has developed some technology in running water fish culture [28].

In the present context of study, it is noticed that dumping of garbage, drainage of sewage and waste product, setting of small scale factories near the bank, construction of number of bridges, impeachment on both side of the bank, soil erosion, siltation, eutrophication, high infestation of macrophytes, over exploitation, operation of fishing gear and flow of effluents into the water bodies are the major factors for the declining of present fish diversity in Bishan Nalah. During investigation, it reveals that pesticides which are used in the bank side of cultivated paddy fields also affecting the fish population in the rivulet. Earlier reports suggest that a drastic reduction in availability of the freshwater fishes in the North-Eastern region is due to destruction of habitat, over exploitation and other anthropogenic effects Dutta *et al*.,[15], Kottelat and Whitten [15].

Poisoning of water bodies with pesticides for trapping consumable fishes, might be considered as one of the most destructive methods which was in regular use by the fishermen of the district. Some other destructive methods were recorded during the investigation period, which were use of bleaching powder, use of gill nets (mesh size less than 1 cm), diversion of water bodies etc. Many types of river ecosystem have been lost and population of many riverine species have become highly fragmented due to human intervention [2].

The human activities damaging and degrading river system includes climate change, catchment land use change, river corridor engineering and in stream impacts [2]. In this context, the Barpeta district has been subjected to considerable human pressure due to developmental activities like urbanisation, simultaneous rise in population from other districts, road network, industrial activity, tourism, construction of residence on both side of river bank etc. Other kind of human activities for which studied freshwater resources are subjected to a declining trend may be mentioned in terms of pollution, such as, human bathing, cloth washing, cultural activities, and sewage disposal including open defecation, agriculture and deforestation in the catchment area. Human activities have severely affected the condition of freshwater in its ecosystem. Eutrophication which is one of the most prevalent problems leading to increased fish species mortality is also observed in various spots of the studied area.

**Table – 1 Systematic Enumeration of various ichthyofauna under different families with their conservation status in Bishan Nalah, Barpeta district, Assam**

| Order | Family | Name of the species | Conservation Status | |
|---|---|---|---|---|
| | | | IUCN 2013 | CAMP 1998 |
| **Osteoglossiformes** | Notopteridae | *Notopterus notopterus* (Pallas) | LC | LRnt |
| **Anguilliformes** | Anguillidae | *Anguilla bengalensis* (Gray& Hardwicke) | LC | EN |
| **Clupeiformes** | Clupeidae | *Gudusia chapra* (Ham-Buch) | LC | LRlc |
| **Cypriniformes** | Cyprinidae | *Salmostoma bacaila* (Ham-Buch) | LC | LRlc |
| | | *Aspidiparia morar* (Ham-Buch) | LC | LRnt |
| | | *Aspidoparia jaya* (Ham-Buch) | LC | VU |
| | | *Chela laubuca*(Ham-Buch) | LC | LRlc |
| | | *Chela atpar*(Ham-Buch) | LC | NE |
| | | *Esomus danricus* (Ham-Buch) | LC | LRlc |
| | | *Danio acquipinnatus*(McClelland) | NA | LRnt |
| | | *Danio devario* (Ham-Buch) | LC | LRnt |
| | | *Brachydanio rerio* (Ham-Buch) | LC | LRnt |
| | | *Resbora daniconius* (Ham-Buch) | LC | LRnt |
| | | *Amblypharyngodon mola* (Ham-Buch) | LC | LRlc |
| | | *Hypothalmichthysmolitrix*(Valenciennes)* | DD | NE |
| | | *Ctenopharyngodonidellus*(Valenciennes)* | LC | NE |
| | | *Cyprinuscarpio*var.*communis*(Linn.)* | NA | NE |
| | | *Cyprinuscarpio*var. *specularis*(Lacepede)* | NA | NE |
| | | *Osteobramacotio*(Ham-Buch) | LC | LRnt |
| | | *Chagunius chagunio* (Ham-Buch) | LC | NE |
| | | *Puntius javanicus*(Bleeker)* | LC | NE |
| | | *Puntius sophore* (Ham-Buch) | LC | LRnt |
| | | *Puntius conchonius* (Ham-Buch) | LC | VU |
| | | *Puntius ticto* (Ham-Buch) | LC | LRnt |
| | | *Puntius terio*(Ham-Buch) | LC | LRnt |
| | | *Puntius gelius* (Ham-Buch) | LC | NE |
| | | *Puntius chola* (Ham-Buch) | LC | VU |
| | | *Cyprinionsemiplotum*(McClelland) | VU | VU |
| | | *Cirrhinus mrigala* (Ham-Buch) | LC | LRnt |
| | | *Cirrhinus reba*(Ham-Buch) | LC | VU |
| | | *Catla catla*(Ham-Buch) | NA | VU |
| | | *Labeo bata* (Ham-Buch) | LC | LRnt |
| | | *Labeo boga*(Ham-Buch) | LC | LRnt |
| | | *Labeo calbasu* (Ham-Buch) | LC | LRnt |
| | | *Labeo dero*(Ham-Buch) | LC | VU |
| | | *Labeo dyocheilus*(McClelland) | LC | VU |
| | | *Labeo gonius*(Ham-Buch) | LC | LRnt |
| | | *Labeo rohita*(Ham-Buch) | LC | LRnt |
| | Psilorhynchidae | *Psilorhynchus balitora*(Ham-Buch) | LC | NE |
| | | *Psilorhynchus sucatio*(Ham-Buch) | LC | NE |
| | Balitoridae | *Acanthocobitis botia* (Ham-Buch) | NA | LRnt |
| | Cobitidae | *Botia dario* (Ham-Buch) | LC | NE |
| | | *Botia rostrata* (Gunthr) | VU | NE |
| | | *Canthophrys gongota* (Ham-Buch) | LC | LRnt |
| | | *Lepidocephalus guntea* (Ham-Buch) | LC | NE |
| **Siluriformes** | Bagridae | *Rita rita*(Ham-Buch) | LC | LRnt |
| | | *Mystus bleekeri*(Day) | LC | VU |
| | | *Mystus cavasius*(Ham-Buch) | LC | LRnt |
| | | *Mystus tengara* (Ham-Buch) | LC | NE |
| | | *Mystus vittatus* (Bl.) | NA | VU |
| | Siluridae | *Wallago attu* (Schneider) | NT | LRnt |
| | Schilbeidae | *Clupisomagarua*(Ham-Buch) | LC | VU |
| | | *Pseudutropius atherinoides* (Bl.) | LC | EN |
| | Amblycepetidae | *Amblycepsmangois*(Ham-Buch) | LC | LRnt |
| | Sisoridae | *Gagata cenia* (Ham-Buch) | LC | NE |
| | | *Nangraviridescens*(Ham-Buch) | NA | LRnt |
| | | *Erethistespusillus*(Mullller&Trochel) | LC | NE |
| | | *Hara hara*(Ham-Buch) | LC | NE |
| | | *Hara jerdoni*(Day) | LC | NE |
| | Claridae | *Clarias batrachus* (Linn) | LC | VU |
| | Heteropneustidae | *Heteropneustes fossilis* (Bl.) | LC | VU |
| | Chacidae | *Chaca chaca*(Ham-Buch) | LC | NE |
| | Oliridae | *Olyrakempi*(Choudhuri) | LC | NE |
| | Belonidae | *Xenentodon cancila*(Ham-Buch) | LC | LRnt |
| | Aplochilidae | *Aplochiluspunchax*(Ham-Buch) | NA | DD |
| | Symbranchidae | *Monopterus cuchia* (Ham-Buch) | LC | LRnt |
| **Perciformes** | Ambassidae | *Chanda nama* (Ham-Buch) | LC | NE |

| | | | | |
|---|---|---|---|---|
| | | *Parambasis ranga* (Ham-Buch) | LC | NE |
| | | *Parambasis baculis* (Ham-Buch) | NA | NE |
| | Nandidae | *Badis badis*(Ham-Buch) | LC | NE |
| | | *Nandus nandus*(Ham-Buch) | LC | LRnt |
| | Chichlidae | *Oreochromismosambicus*(Peter)* | NA | NE |
| | Gobidae | *Glossogobius giuris* (Ham-Buch) | LC | LRnt |
| | Anabantidae | *Anabas testudineus* (Bl.) | DD | VU |
| | Belontidae | *Trichogaster fasciatus* (Schneider) | NA | LRnt |
| | | *Trichogaster lalia*(Ham-Buch) | LC | NE |
| | | *Trichogaster chuna* (Ham-Buch) | LC | NE |
| | Channidae | *Channa punctatus* (Bl.) | NA | LRnt |
| | | *Channa gachua* (Bl. & Schneider) | LC | VU |
| | | *Channa striatus* (Bl.) | NA | LRlc |
| | | *Channa marulius* (Ham-Buch) | LC | LRnt |
| | Mastacembelidae | *Macrognathus pancalus* (Ham-Buch) | LC | LRnt |
| | | *Macrognathus aral* (Bl. & Schneider) | LC | LRnt |
| | | *Mastacembelus armatus* (Lacepede) | NA | NE |
| | Tetradontidae | *Tetraodon cutcutia* (Ham-Buch) | NA | LRnt |

*NB: LC-Least Concern, EN-Endangered, VU-Vulnerable, LRnt-Lower Risk near threatened, LRlc-Lower Risk least concern, DD-Data Deficient, NA-Not Assessed, NE- Not evaluated, NT- Near Threatened, *-Exotic Species*

Infrastructure development in the river bank is the primary source of threats for declining fish population. Flow reduction in the donor rivers and increased flow in the recipient rivers changes in the physical and chemical status of river water. Deposition of fine sediments from one river to another leads to the loss of fish habitats, such as gravel spawning beds for fishes and spread of alien fish species, diseases and their vectors Sharma *et al*., [32].Goswami and Ali [18] and Goswami *et al*.,.[17]. Besides the above factors, the over exploitation due to extensive use of explosive, bleaching powder and ichthyotoxic plants have brought a considerable changes in the natural riverine ecosystem of Himalayan region. Therefore, it is utmost necessary to take proper measures for managing and conserving such the lotic freshwater habitats of highly ichthyofaunal diversity with unwanted anthropogenic stress by implementing strict Laws and Act.

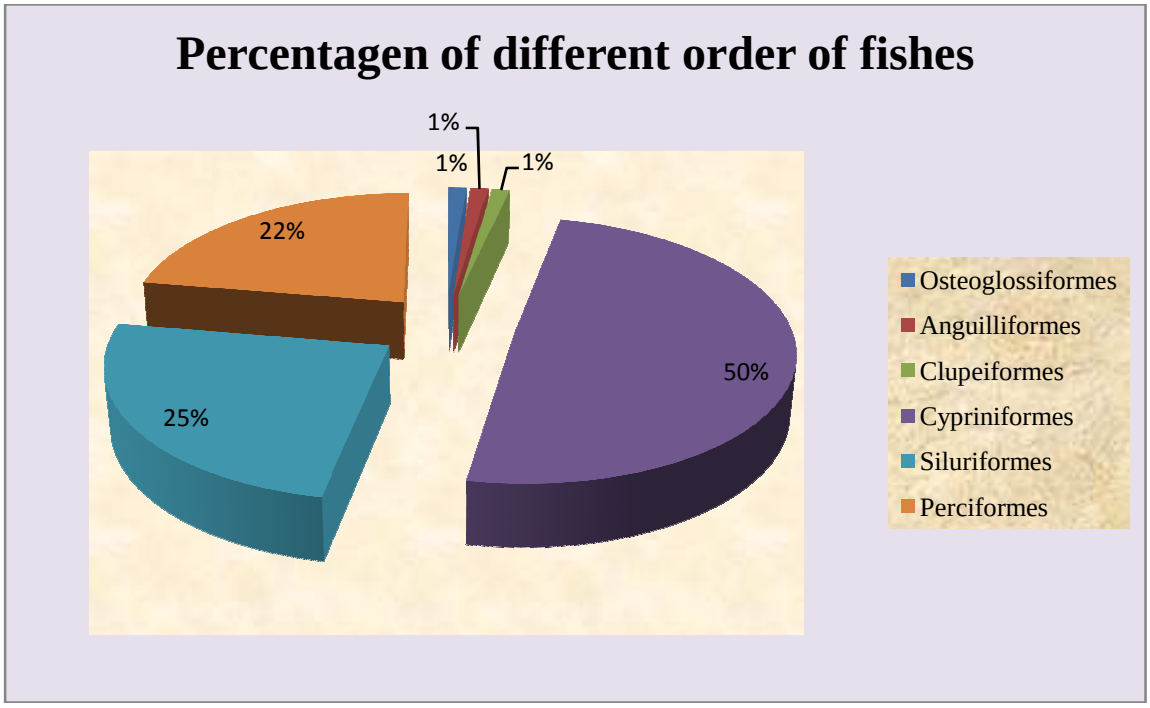


**Fig: 2. Percentage of different orders of Ichthyospecies from Bishan Nalah Rivulet**

**Evaluation of Ichthyospecies IUCN 2013 and CAMP, 1998 Status:**

During evaluation, it was found out of these 85 ichthyospecies 2.35% considered as EN (Endangered criteria), 17.64% considered as VU (Vulnerable criteria), 38.82% considered as LRnt (Lower Risk near threatened criteria), 7.05% considered as LRlc (Lower Risk least concern criteria), 1.17% considered as DD (Data Deficientcriteria) and 32.7% considered as NE (Not Evaluated criteria) as per **CAMP**, 1998 Status. And according to **IUCN 2013** status it was find that out of these 85 ichthyospecies 76.47% considered as LC ( Least Concern Criteria), 2.35% considered

as VU (Vulnerable criteria), 17.64% considered as NA (Not Assessed criteria), 2.35% considered as DD (Data Deficient criteria) and 1.17% considered as NT (Near Threatened criteria)

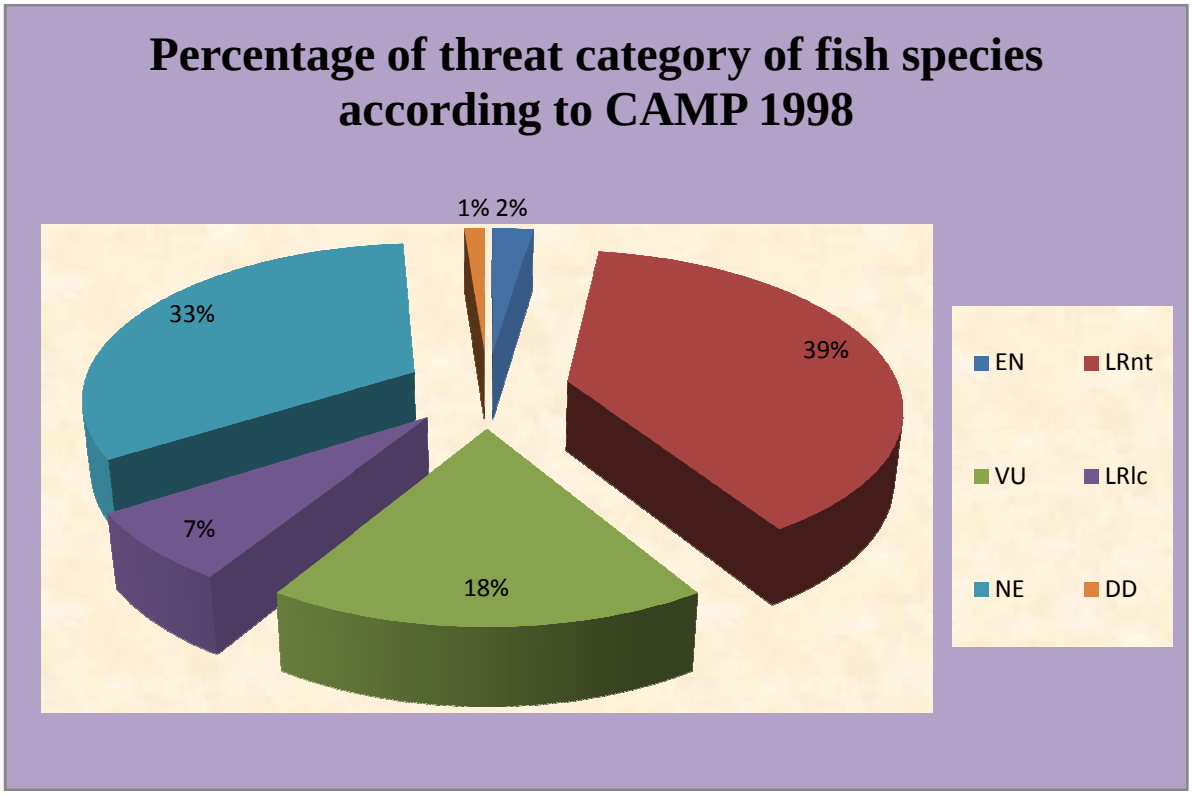


**Fig: 3. Percentage of threat category (CAMP report, 1998) of Ichthyospecies from Bishan Nalah Rivulet**

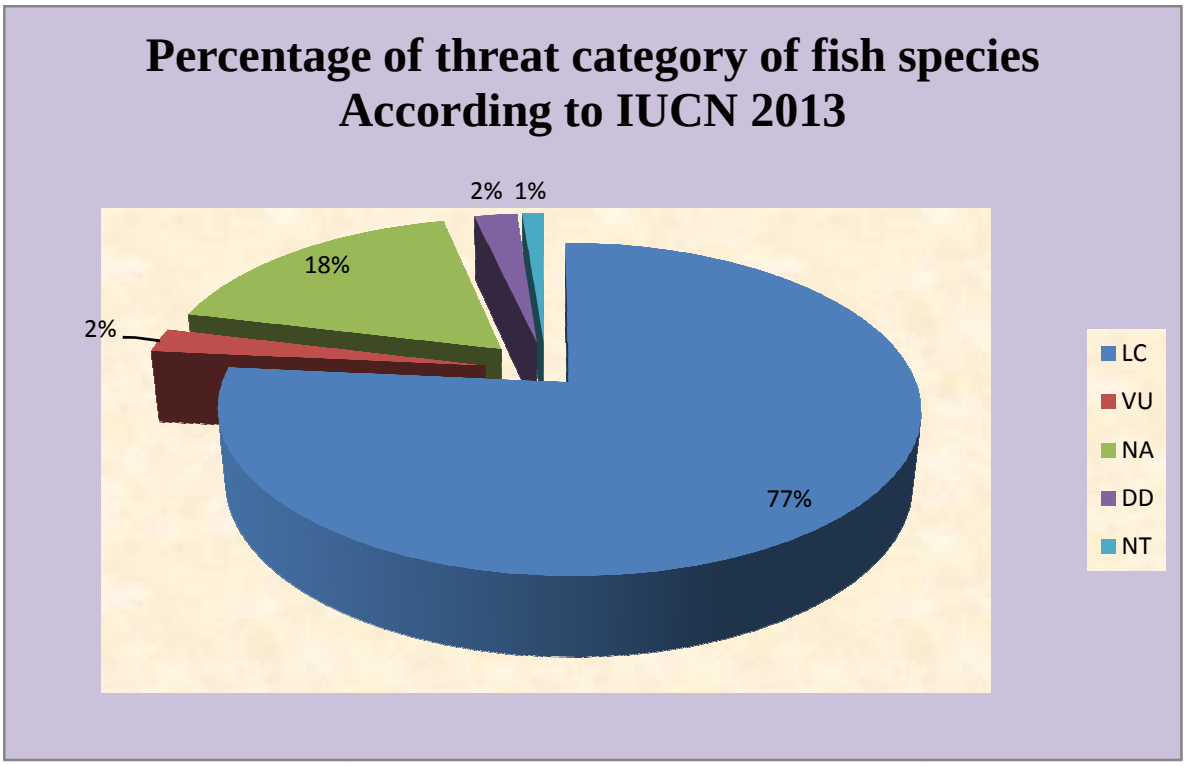


**Fig: 4. Percentage of threat category (IUCN 2013) of Ichthyospecies from Bishan Nalah Rivulet**


**Plate: 1*Notopterus notopterus***

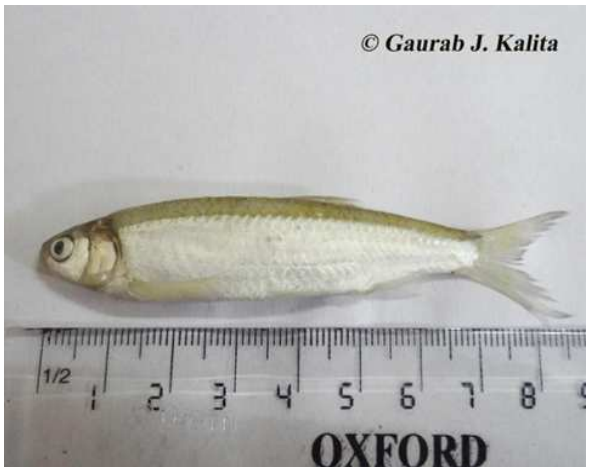


**Plate: 2 *Aspidoparia jaya***


**Plate: 3 *Brachydanio rerio***


**Plate: 4 *Puntius conchonius***


**Plate: 5 *Botia derio***


**Plate: 6 *Rita rita***


**Plate: 7*Wallago attu***


**Plate: 8 Chaca*chaca***


**Plate: 9 *Xenentodon cancila***

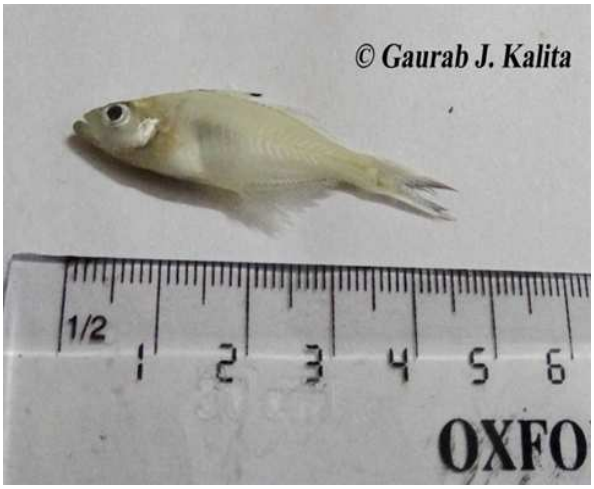


**Plate: 10 *Chanda nama***


**Plate: 11 *Parambassis baculis***


**Plate: 12 *Glossogobius giuris***

**Plate 1-12: Photographs of different ichthyospecies recorded during the study period**

## CONCLUSION

Assam is endowed with massive water resources in the form of streams, rivers and floodplain lakes. These aquatic system have high potential of ichthyofaunal resources if managed properly. Enforcing protective legislation and adopting pisciculture practices can conserve the fast decline ichthyofaunal population, particularly classified and

non-classified ichthyofauna. For replenishing the depleted population of vulnerable ichthyofauna natural and artificial propagation is required. Development of appropriate rational strategies of management and exploitation of ichthyofaunal population would help to realise the real potential of ichthyofauna from the lotic water bodies.

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