ISSN: 2347-5129
IJFAS 2014; 2(3): 118-124

www.fisheriesjournal.com
Received: 28-11-2014
Accepted: 15-12-2014

Amal Kumar Patra
Department of Zoology, Ananda Chandra College, Jalpaiguri, West Bengal, India, 735101.

Tanmay Datta
Department of Zoology, Ananda Chandra College, Jalpaiguri, West Bengal, India, 735101.

Vaskar Das
Department of Zoology, Ananda Chandra College, Jalpaiguri, West Bengal, India, 735101.

Santanu Ghosh Dastidar
Department of Computer Science, Ananda Chandra College, Jalpaiguri, West Bengal, India, 735101.

Correspondence
Amal Kumar Patra
Department of Zoology, Ananda Chandra College, Jalpaiguri, West Bengal India, 735101.

Fin-fish diversity in Moraghat forest, a territorial forest of Jalpaiguri District, West Bengal, India

Amal Kumar Patra, Tanmay Datta, Vaskar Das and Santanu Ghosh Dastidar

Abstract
Fin-fish diversity at Moraghat forest of Jalpaiguri District, West Bengal was assessed from March, 2013 to August, 2014. The objective was to investigate the ichthyofauna composition in all the water bodies (lotic and lentic) of this forest. A total of sixty nine established species belonging to nine orders and twenty six families were recorded. Among the 69 species, thirty eight species were found under the order Cypriniformes, twelve species were found under the order Perciformes, eight species were found under the order Siluriformes, six species were found under the order Synbranchiformes and a single species was found under the order Osteoglossiformes, Anguilliformes, Beloniformes, Cyprinodontiformes and Tetraodontiformes each. This observation indicates that Cypriniformes is comparatively the most dominated order. Maximum number of species were sampled during monsoon and continued up to mid-post monsoon. Out of 69 Species River Nonai had 65 species belonging to 47 genera, followed by River Garati with 63 species belonging to 45 genera, Gossaihat wet land with 62 species belonging to 47 genera, pond of Khuttimari with 43 species belonging to 34 genera and lastly by pond of Totapara with 31 species belonging to 21 genera. It points out that Gossihat wet land, Nonai River and Garati River are more diversified than other two water bodies.

Keywords: Ichthyofauna, Fin-fish, Moraghat forest, Territorial forest.

1. Introduction
West Bengal, the nation's fourth-most populous state of India, lies between 20° 31' N and 27° 12' N latitude & 85° 50' E and 89° 52' E longitude and covering a geographic area of 88,752 km^2. It encompasses two broad natural regions: the Gangetic Plain in the south and the sub-Himalayan & Himalayan areas in the north. Total recorded forest land in this state is 11,879 km^2, of which 7,054 km^2 is Reserved Forest, 3,772 km^2 is Protected Forest and 1,053 km^2 is Unclassed State Forest (An area recorded as forest but not included in Reserved or Protected forest category) , thus constituting 13.38% of the geographical area of the state [1]. As per statistics, West Bengal possesses 20 districts that have been formed to take care of the administrative exigencies. River Ganga divides the state into two lopsided halves. Northern part of this river has seven districts which are called by a popular term “The North Bengal”.
Before partition, the Jalpaiguri District (established in 1869) was the largest district of North Bengal, covering an area 6,227 km^2 with a population size of 3,869,675 (as said by the census of 2011) and lies in the moist tropical zone. Total documented forest area of Jalpaiguri is 1,790 km^2 (28.75% of total state forest).
The forests of this district are predominately Sal with pockets of various other types-Evergreen Forest, Savannahs, Riverain forest and swamps. The main forests comprise of Semi-Moist-Deciduous vegetations. Some of the forests have been declared as National Park, Sanctuaries and Reserve Forests. The forests of Jalpaiguri bear their significance in the international context for providing shelter and protection to various species of wildlife included in the Red Data Book and appendices of CITES. Administrative units under forest directorate of West Bengal are territorial, wildlife social forestry, soil conservation and functional. The Moraghat forest range is a territorial forest of Jalpaiguri district and is located in close proximity to Gairkata. Total range area is 5511.37 hectors. This range is totally recommended for plantation of commercially important timber plants like Sal, Tick, Jarul etc. and Silviculture.

Considerable numbers of scientific research have been carried out on diverse aspects in different forests of northern West Bengal [2, 3, 4, 5, 6, 7, 8].

So far as fin-fish diversity in the forests of northern West Bengal is concerned, Mandal [9] reported twenty seven species from Gorumara National Park. Pramanik *et al.* [10] reported sixty species of animals (including vertebrate and invertebrate) in which fish contributed 30% share from Kulik Bird Sanctuary of Raiganj, North Dinajpur. However, this type of investigation has not been carried out in respect of Moraghat Forest. It is the preliminary report on fin-fish diversity of Moraghat forest.

2. Materials and Methods

2.1 Physiography of study area

The Moraghat forest range (latitude 26°47'28.04"N to 26°37'48.33"N, longitude 88°59'.57.38"E to 89°.00'.55.65"E and 473 to 267 ft. elevation.) has four beats i.e. Totapara, Khuttimari, Gossaihat and Sonakhali (Figure 1). For fin-fish diversity study, water bodies of the forest was demarcated by Google earth and Google Map software (Version-2013 and 2014). In the total forest range, five stations (Figure 2) were selected of which three are lentic and two are lotic water bodies. Monthly fish species were sampled from both the sites which have been designated as S_1 (Pond of Totapara beat), S_2 (Pond of Khuttimari beat), S_3 (Pond of Gossaihat beat), S_4 (Garati River which passes out through the forest) and S_5 (Nonai River which passes through the Sonakhali beat).

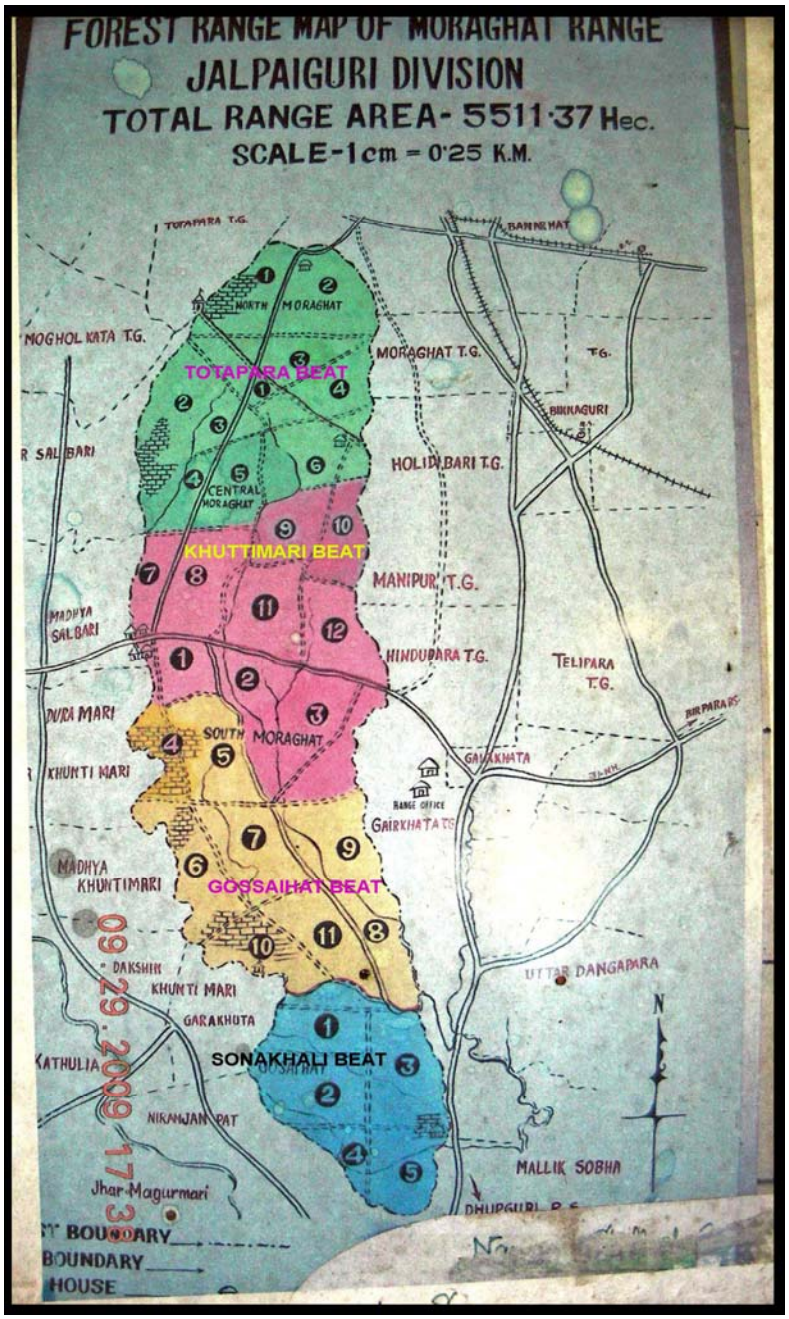

Fig 1: Map of Moraghat Forest Range showing its four Beats.

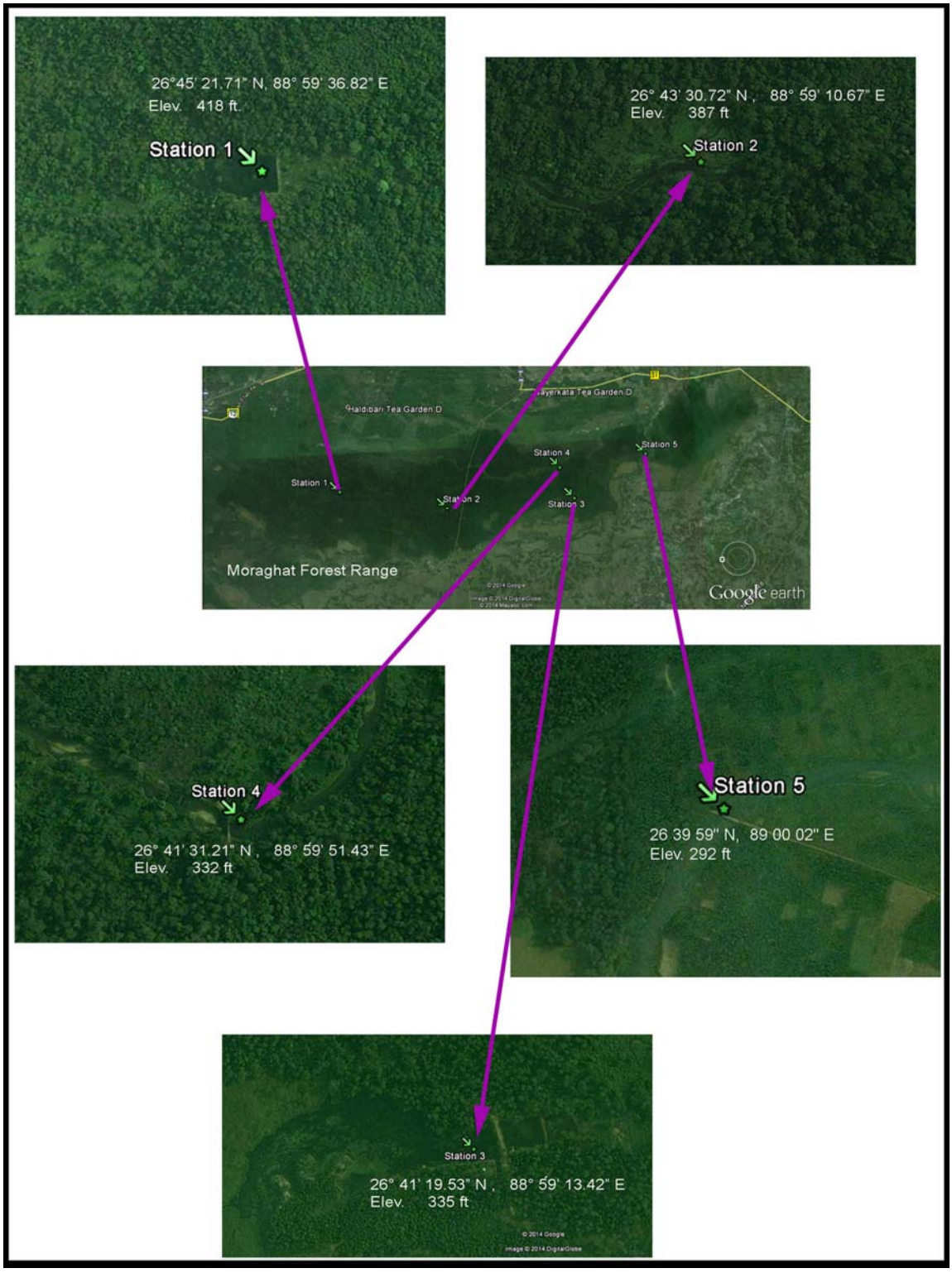

Fig 2: Image of Moraghat Forest showing five study sites (S_1 = Pond of Totapara beat, S_2 = Pond of Khuttimari beat, S_3 =Pond of Gossaihat beat, S_4 =Garati River and S_5 = Nonai River).

2.2 Fish Collection

The fish were sampled from five study sites by cast net (mesh size 6 mm. X 6 mm.), naphi jal (local contrivance, mesh size 5 mm. X 5 mm.), vessel net or khara jal (local contrivance, mesh size 6 mm. X 6 mm.), gill net (variable mesh sizes) and some others local contrivances. The color, color patterns, spots etc. were noted immediately after capture. The fish were killed by formalin solution containing one part commercial formalin (37-40% HCHO) + nine part glass distilled water and 7 gm Borax/liter [11]. All the fish were kept in this buffer formalin solution for 4-5 hours for proper fixation. The fish were identified by the standard literatures [12, 13, 14]. Their latest scientific names were compared with fish base. The study was carried out from March, 2013 to August, 2014.

3. Results

A total of sixty nine established species belonging to nine orders and twenty six families were recorded. Among the 69 species thirty eight species were found under the order Cypriniformes, twelve species were found under the order Perciformes, eight species were found under the order Siluriformes, six species were found under the order Synbranchiformes and a single species was found under the order Osteoglossiformes, Anguilliformes, Beloniformes, Cyprinodontiformes and Tetraodontiformes each. This observation indicates that Cypriniformes is the most dominated order in comparison with others (Table 1). Maximum number of species were sampled during monsoon and continued up to mid-post monsoon. Out of 69 species S_5 had 65 (94.2%) species belonging to 47 genera, followed by S_4 with 63 (91.3%) species belonging to 45 genera, S_3 with 62 (89.86%) species belonging to 47 genera, S_2 with 43(62.32%) species belonging to 34 genera and lastly by S_1 with 31(44.93%) species belonging to 21 genera (Table 2). Taxonomic diversity of fin-fish in three lentic and two lotic water bodies of Moraghat forest is presented in table 3.

Table 1: Comparison of Ichthyofauna of five water bodies in the Moraghat Forests.

Scientific Name	Vernacular Name	Station wise occurrence					Threat Status (Barman, 2007)
		S_1	S_2	S_3	S_4	S_5	
Order : Cypriniformes							
Devario devario (Hamilton, 1822)	Chep chela	-	-	-	+	+	NT
Devario regina (Fowler, 1934)	Chela	-	-	-	+	+	-
Devario annandalei (Chaudhuri, 1908)	Danio	-	-	+	+	+	-
Danio rerio (Hamilton, 1822)	Anju	-	+	+	+	+	-
Rasbora rasbora (Hamilton, 1822)	Dankoni/Darkani	+	+	+	+	+	-
Barilius vagra (Hamilton, 1822)	Kaksa/Khoksa	+	-	+	+	+	VUL
Barilius barna (Hamilton, 1822)	Chhipra	+	-	+	+	+	NT
Raiamas bola (Hamilton, 1822)	Bola	-	-	+	+	+	VUL
Barilius barila (Hamilton, 1822)	Caedra	-	-	-	+	+	VUL
Barilius bendelisis (Hamilton, 1807)	Jaya	-	-	+	+	+	NT
Esomus danricus (Hamilton, 1822)	Danrika, Dadhikha	+	+	+	+	+	NT
Amblypharyngodon mola (Hamilton, 1822)	Mourala, Morla	+	+	+	+	+	-
Cabdio morar (Hamilton, 1822)	Morar	-	+	+	+	+	-
Salmophasia phulo (Hamilton, 1822)	Chela	-	+	+	+	+	-
Pethia conchonius (Hamilton, 1822)	Kanchan punti	+	+	+	+	+	VUL
Puntius chola (Hamilton, 1822)	Mona punti	+	+	+	+	+	VUL
Pethia ticto (Hamilton, 1822)	Tinth punti	+	+	+	+	+	NT
Pethia shalynius (Yazdani & Talukdar, 1975)	Bhusandi punti	+	+	+	+	+	-
Systomus sarana (Hamilton, 1822)	Kurti, Sar punti	-	+	+	+	+	VUL
Puntius sophore (Hamilton, 1822)	Chaita punti	+	+	+	+	+	NT
Puntius puntio (Hamilton, 1822)	Puntio barb	+	+	+	+	+	-
Osteobrama cotio cotio (Hamilton, 1822)	Moua/Guderi	-	+	+	+	+	NT
Labeo rohita (Hamilton, 1822)	Rough	-	-	+	+	+	NT
Labeo gonius (Hamilton, 1822)	Kursa	-	-	+	+	+	NT
Labeo bata (Hamilton, 1822)	Bata	-	+	+	+	+	NT
Catla catla (Hamilton, 1822)	Katal	-	-	+	-	-	VUL
Cirrhinus reba (Hamilton, 1822)	Raig bata, Kharke bata	-	-	+	+	+	VUL
Cirrhinus mrigala (Hamilton, 1822)	Mrigal, Mirca	-	+	+	+	+	NT
Crossocheilus latius (Hamilton, 1822)	Kalagachi	-	-	+	+	+	-
Chagunius chagunio (Hamilton, 1822)	Chhaguni puti	-	+	+	+	+	VUL
Acanthocobitis botia (Hamilton, 1822)	Natwa	+	+	+	+	+	NT
Schistura savona (Hamilton, 1822)	Khorka	-	-	-	+	+	-
Lepidocephalichthys annandalei Chaudhuri, 1912	Gutum	+	-	+	+	+	NT
Lepidocephalichthys guntea (Hamilton, 1822)	Gutum	+	-	+	+	+	-
Canthophrys gongota (Hamilton, 1822)	Paya	-	-	+	+	+	NT
Psilorhynchus sucatio (Hamilton, 1822)	River stone carp	-	-	-	+	+	-
Neolissochilus hexagonolepis (McClelland, 1839)	Bhuluk/Bharkal	-	-	+	+	+	EN
Garra kempi Hora, 1921	Kusma	-	-	+	+	+	-
Order : Siluriformes							
Batasio tengana (Hamilton, 1822)	Tinkatia	-	-	+	+	+	-
Clarias batrachus (Linnaeus, 1758)	Magur	-	+	+	-	-	VUL
Heteropneustes fossilis (Bloch, 1794)	Singi	-	+	+	-	-	VUL
Mystus tengara (Hamilton, 1822)	Kalo Tengra	+	+	+	+	+	-
Amblyceps mangois (Hamilton, 1822)	Ban Magoor	-	-	-	+	+	NT
Chaca chaca (Hamilton, 1822)	Chega	-	-	+	+	+	-
Wallago attu (Bloch & Schneider, 1801)	Bowal	-	+	+	+	+	NT
Erethistoides montana Hora, 1950	Kurkati	-	-	-	+	+	END
Order : Perciformes							
Glossogobius giuris (Hamilton, 1822)	Bele	+	+	+	+	+	NT
Chanda nama (Hamilton, 1822)	Nama chanda	+	+	+	+	+	-
Parambassis ranga (Hamilton, 1822)	Ranga chanda	+	+	+	+	+	-
Trichogaster fasciata Bloch & Schneider, 1801	Khalisa	+	+	+	+	+	-
Nandus nandus (Hamilton, 1822)	Bheda	-	+	+	-	-	NT
Anabas testudineus (Bloch, 1792)	Koi	+	+	+	+	+	VUL

Badis badis (Hamilton, 1822)	Bot koi	+	+	+	+	+	-
Channa gachua (Hamilton, 1822)	Cheng	+	+	+	+	+	-
Channa stewartii (Playfair, 1867)	Dudu cheng	+	+	+	+	+	-
Channa marulius (Hamilton, 1822)	Sal	-	+	+	+	+	NT
Channa striata (Bloch, 1793)	Shol	+	+	+	+	+	
Channa punctata (Bloch, 1793)	Taki	+	+	+	+	+	NT
Order : Osteoglossiformes							
Notopterus notopterus (Pallas, 1769)	Falui	-	+	+	+	+	-
Order : Anguilliformes							
Anguilla bengalensis (Gray, 1831)	Banehara	+	+	+	+	+	EN
Order : Beloniformes							
Xenentodon cancila (Hamilton, 1822)	Kankela	-	+	+	+	+	NT
Order : Synbranchiformes							
Macrognathus aral (Bloch & Schneider, 1801)	Goichi	+	+	+	+	+	NT
Macrognathus pancalus Hamilton, 1822	Turi	+	+	+	+	+	NT
Mastacembelus armatus (Lacepède, 1800)	Bam or Bami	+	+	+	+	+	-
Monopterus cuchia (Hamilton, 1822)	Kuchia	+	+	+	+	+	NT
Microphis deocata (Hamilton, 1822)	Pipe fish	-	-	+	+	+	-
Ophisternon bengalense McClelland, 1844	Bamosh	-	+	+	-	+	-
Order : Cyprinodontiformes							
Aplocheilus panchax (Hamilton, 1822)	Panchax	+	+	+	+	+	-
Order : Tetraodontiformes							
Tetraodon cutcutia Hamilton, 1822	Patka	-	-	+	+	+	NT

'+'= Present, '-'= Absent, NT = Near Threatened, VUL = Vulnerable, END = Endemic, EN = Endangered

Table 2: Stationwise Ichthyofauna sampled in the Moraghat forest

Taxa	**Water bodies**					
	Lotic				**Lentic**	
	S_1	S_2	S_3		S_4	S_5
Family	14	19	23		23	23
Genus	21	34	47		45	47
Species	31	43	62		63	65

Table 3: Taxonomic diversity of Ichthyofauna in the two lotic and three lentic systems of Moraghat Forest.

Family	**Water bodies**										
	Lentic							**Lotic**			
	S_1		S_2		S_3			S_4		S_5	
	Gen.	Sp.	Gen	Sp.	Gen.	Sp.		Gen.	Sp.	Gen.	Sp.
Ambassidae	2	2	2	2	2	2		2	2	2	2
Amblycipitidae	-	-	-	-	-	-		1	1	1	1
Anguillidae	1	1	1	1	1	1		1	1	1	1
Anabantidae	1	1	1	1	1	1		1	1	1	1
Aplocheilidae	1	1	1	1	1	1		1	1	1	1
Bagridae	1	1	1	1	2	2		2	2	2	2
Badidae	1	1	1	1	1	1		1	1	1	1
Belonidae	–	–	1	1	1	1		1	1	1	1
Channidae	1	4	1	5	1	5		1	5	1	5
Chacidae	–	–	–	–	1	1		1	1	1	1
Clariidae	–	–	1	1	1	1		–	–	–	–
Cyprinidae	6	11	13	17	20	29		18	30	19	31
Cobitidae	1	2	–	–	2	3		2	3	2	3
Erethistidae	–	–	–	–	–	–		1	1	1	1
Gobiidae	1	1	1	1	1	1		1	1	1	1
Heteropneustidae	–	–	1	1	1	1		–	–	–	–
Mastacembelidae	2	3	2	3	2	3		2	3	2	3
Nandidae	–	–	1	1	1	1		–	–	–	–
Nemacheilidae	1	1	1	1	1	1		2	2	2	2
Notopteridae	–	–	1	1	1	1		1	1	1	1
Osphronemidae	1	1	1	1	1	1		1	1	1	1
Psilorhynchidae	–	–	–	–	–	–		1	1	1	1
Siluridae	–	–	1	1	1	1		1	1	1	1
Synbranchidae	1	1	2	2	2	2		1	1	2	2
Syngnathidae	–	–	–	–	1	1		1	1	1	1
Tetraodontidae	–	–	–	–	1	1		1	1	1	1

Gen. = Genus, Sp. = Species

In Cypriniformes, the total 38 species belong to 25 genera, 4 sub-families and 4 families were recorded. An analysis of the taxonomic composition of Cypriniformes suggests Cyprinidae to be the most dominant family with 32 (84.21%) representative species. Cobitidae is the next dominant family having three species (7.895%). Whereas family Psilorhynchidae represents two species (5.26%) and Nemacheilidae family has single representative (2.63%) and is a less dominated family.

In Perciformes, the total 12 species belong to 8 genera, 2 sub-families and 7 families were identified. An analysis of the taxonomic composition of Perciformes suggests Channidae to be the most dominant family with 5 (41.67%) representatives. Ambassidae, the next dominant family, has two representatives (16.66%).Whereas, the family Gobiidae, Osphronemidae, Nandidae, Ananbantidae and Badidae are the three families each having single species representation (Total-41.67%) and are less dominated families.

In Siluriformes, the total 8 species belong to 8 genera and 7 families were identified. An analysis of the taxonomic composition of Siluriformes suggests Bagridae to be the most dominant family with 2 (25%) representative species occurring in that forest. Whereas, the family Siluridae, Claridae, Heteropneustidae, Amblycepitidae, Chacidae and Erethistidae are the other six families each having single species representation (Total-75%) and are less dominated families.

In Synbranchiformes, the total 6 species belong to 5 genera and 3 families were identified. An analysis of the taxonomic composition of Synbranchiformes suggests Mastacembelidae to be the most dominant family with 3 (50%) representative species occurring in that forest. Synbranchidae, the next dominant family, has two representatives (33.33%).Whereas, the family Syngnathidae represents single species (Total-16.67%) and is the less dominated family.

4. Discussions

Aquatic biota is broadly classified into five major categories viz; plankton, nekton, periphyton, benthos and neuston. Fish are the representative of nekton. It is estimated that freshwater fish make up more than 6% of the world's annual animal protein supplies for humans [15]. It is the major and often the only source of animal protein for low income families [16]. They take critical role in regulating food web dynamics and nutrient balances, carbon flux and sediment processes. They also take energetic role in active links between ecosystems, act as bioindicators, give early warning signals etc. Few of them have great role in biological control of mosquito borne diseases [17, 18]. From these viewpoints ichthyofauna are most essential to recommend any area for biodiversity conservation. Since there is no known data regarding the fin-fish diversity of Moraghat forest was available, we planned to build up the first inventory, through one and half year long assessment. During our entire survey, we listed 69 species that are mentioned in table 2. There are total twenty seven species belonging to 19 genera and 12 families which are common to all the sampling stations during the sampling periods of monsoon to mid-post monsoon and hence can be considered as migratory as well as evenly distributed representatives. Their migration occur during monsoon when all lotic and lentic systems mingle together due to heavy rainfall causing flood. The threat status and endemism of fish are assigned from IUCN Red List. According to IUCN Red List, 61 species are Lest Concern (LC), 3 are Data Deficient (DD), 3 are Near Threatened (NT), one is Vulnerable (VU), and last one is Not Evaluated (NV). In respect of West Bengal, 25 species are Near Threatened (NT), 12 species are Vulnerable, 2 species are Endangered (EN) and there is only one species *Erethistoides montana* (Local name-Kurkati) which is an endemic specie [19]. *Amblyceps mangois* (local name Ban Magoor) is distributed along the foothills of Himalayas from Kangra Valley of Himachal Pradesh to Assam of India [14]. This species has also reported from different rivers of northern West Bengal [20, 21]. It has obtained from S_4 and S_5 stations, and indicates its predilections to live into lotic system. Compare with the report of Mandal [9] and Pramanik *et al.* [10], it can easily said that Moraghat forest has richest ichthyofauna than Gorumara national park and Kulik Bird Sanctuary, Raiganj, North Dinajpur. On the basis of number of species occurrence at lentic system, S_3 is more diversified than other two. It may be due to the depth of water body and impact of local people. During peak summer the water volume gradually decline and finally dried up at S_1 and S_2. S_1 & S_2 are incessantly affected by local people where as S_3 has exception. Forest department has demarcated it as a tourist spot and they provide the special protection for conservation of this wet land. A number of representatives like *Devario annandalei*, *Raiamas bola*, *Canthophrys gongota*, *Microphis deocata and Tetraodon cutcutia* are obtained from S_3, S_4 and S_5. As the wet land (S_3) is connected by few small water channels of S_4 and S_5, theses fish species some time may migrate towards wet land. Further ecological and genetical studies are needed for proper investigation of their adaptive radiation.

5. Conclusion

The knowledge of ichthyofaunal diversity, their present threat status, role in ecosystem and human economy are prerequisites for adopting the proper conservation strategies of fish fauna. Till date it is unfortunate that the Moraghat Forest of Jalpaiguri District has not received any attention from the ichthyological aspects. The report gains importance of this forest for conservation strategy of threat wild life.

6. Acknowledgement

We are indebted to University Grants Commission (UGC) for providing research grant [MRP Ref No-F.PSW-74/12-13 (ERO)]; to the DFO of Moraghat Forest, Jalpaiguri for giving permission to study this research work, to the Principal, Ananda Chandra College for providing us research laboratory of zoology department and others administrative help and to Prof. S. K. Chakraborty, Department of Zoology, Vidyasagar University for his suggestions and continuous encouragement.

7. References

1. State Forest Report. Government of West Bengal, Directorate of Forests, Office of the Principal Chief Conservator of Forests and Head of Forests Force, Aranya Bhaban, Salt Lake, Kolkata, 2011-2012.
2. Biswas GG, Das D, Mukhopadhyay A. Richness of mammalian species in the higher elevations of Neora Valley National Park. Zoos' Print 1999; 14(4):10-12.
3. Chakraborty S, Basu V, Sen P, Nandy H. Report on the status of Wild dog–*Cuon alpinus* (Pallas) in Neora Valley National Park, District: Darjeeling, West Bengal. Society for Environment, Nature and Sustainable Ecosystems (SENSE), Kolkata 2008a, 28.
4. Chakraborty S, Dey P, Tripathi S, Jana S, Dey A. Report on the status of Clouded leopard *Neofelis nebulosa* (Griffith) and Hodgson's flying squirrel *Petaurista magnificus* (Hodgson) in Neora Valley National Park,

Darjeeling, WestBengal. Nature, Environment and Wildlife Society (NEWS), Kolkata, 2008b, 52.
5. Majumdar NC, Krishna B, Biswas MC. Vegetation of the Neora and adjacent regions in Kalimpong Forest Division, WestBengal. Journal of Economic and Taxonomic Botany 1984; 5(5):1013-1025.
6. Mallick JK. Past and present status of the Indian Tiger in northern West Bengal, India: an overview. Journal of Threatened Taxa 2010a; 2(3):739-952.
7. Mallick JK. Neora Valley - a new short-listed world heritage site. Tiger paper 2010b; 37(3):12-16.
8. Singhal N, Mukhopadhyay A. Management Plan of Neora Valley National Park, West Bengal. Wildlife Circle, Govt. of West Bengal, 1998; 159.
9. Mandal S. Wild Fauna of Gorumara National Park, Jalpaiguri, West Bengal. Intas Polivet 2007; 8(1):257-261.
10. Pramanik AK, Santra KB, Manna CK. Abundance and Diversity of Plants and Animals in the Kulik Bird Sanctuary, Raiganj, West Bengal, India. J Biodiversity 2010; 1(1):13-17.
11. Jayaram KC. The freshwater fishes of India, Pakistan, Bangladesh, Burma and Sri Lanka - a hand book. Zoological Survey of India 1981; iii + 1-475, Pls. 1-13.
12. Jayaram KC. The fresh water fishes of the Indian region. Narendra Publishing House, New Delhi 1999; i-xxvii + 1-551, Pls. XVIII.
13. Jayaram KC. Catfishes of India. Narendra Publishing House, Delhi 2006; i-xxii + 1-383, Pls. 11.
14. Talwar PK, Jhingran AG. Inland Fishes of India and Adjacent Countries (Vol. I & II). Oxford & IBH Pub New Delhi, 1991, 1158.
15. FAO. The state of world Aquaculture and Fisheries 2006. Food and Agriculture Organization of the United Nations. Fisheries and Aquaculture Department, Rome, Italy, 2007.
16. Briones M, Dey MM, Ahmed M. The future for fish in the food and livelihoods of the poor in Asia. World Fish Center Quarterly 2004; 27(3-4):48-50.
17. Chandra G, Bhattacharjee I, Chatterjee SN, Ghosh A. Mosquito control by larvivorous fish. Indian J Med Res 2008; 127:13-27.
18. Patra AK, Das V, Guha P. Mosquito control using *Badis badis* (Hamilton, 1822) [Teleostei: Perciformes] in ground water (domestic well): Preliminary findings of a laboratory trial. Int J Fishery Aquatic Studies 2014; 2(1): 131-133.
19. Barman RP. A review of the fresh water fish fauna of West Bengal, India with suggestions for conservation of the threatened and endemic species. Records of the Zoological Survey of India, Occasional Paper 2007; 263: 1–48.
20. Chakraborty T, Bhattacharjee S. The Ichthyofaunal Diversity in the Freshwater of South Dinajpur District of West Bengal, India. J Bombay Nat His Soc 2008; 105(3):292-298.
21. Patra AK. Catfish (Teleostei: Siluriformes) Diversity in Karala River of Jalpaiguri District, West Bengal, India. Journal of Threatened Taxa 2011; 3(3):1610-1614.