Sustainability in Environment
ISSN 2470-637X (Print) ISSN 2470-6388 (Online)
Vol. 7, No. 3, 2022
www.scholink.org/ojs/index.php/se

Original Paper

Fishes in the Upstream Rheophilic Stretch of River Barak at Karong

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Received: July 16, 2022 Accepted: August 28, 2022 Online Published: September 1, 2022

doi:10.22158/se.v7n3p77 URL: http://dx.doi.org/10.22158/se.v7n3p77

Abstract

11 species of fishes belonging to 8 genera, 4 families and 3 Orders have been recorded. The cyprinids were the most abundant group. The contribution of cyprinids to the total fish collection depicts its highest (96.87 %) contribution in river Barak at Karong. Among the cyprinids, Barilius bendelisis and Crossocheilus burmanicus depicted the bulk of abundance (19.35 and 33.87 % respectively) in river Barak at Karong.

Keywords

River Barak, Karong, Fish, Habitat, North-East India hotspot

1. Introduction

Fish constitutes almost half of the total number of vertebrates on the earth. India is one of the mega biodiversity countries in the World (Mittermeier & Mittermeier, 1997); and, the North-Eastern (NE) in the Eastern Himalayan (EH) stretch has been identified as a hotspot of biodiversity by the World Conservation Monitoring Centre (WCMC, 1998). The hills and the undulating valleys of this region gives rise to a large number of torrential hill streams, which lead to big rivers that finally become part of the Ganga-Brahmaputra-Barak-Chindwin-Kolodyne-Gomati-Meghna system (Kar, 2003, 2007, 2013, 2019, 2021 a, b c).

The NE Region of India could be divided into five physiographic units, viz., the Assam Himalayas, the Brahmaputra valley, the Shillong plateau, the Barak valley and the South-East Hill region. However,

except the Barak and the Brahmaputra valleys in Assam, and the Imphal valley in Manipur, the rest of the region constituting > 65 % of the area, is covered with hills and mountains. Of these, Arunachal Pradesh occupies the maximum area (32.83 %) closely followed by Assam (30.75 %), Tripura (4.11 %), and so on.

2. Catchment and Hydro Topography of Barak Drainage

The Barak Sub-basin (22 32' N and 25 35' N latitude and 92° 15'E and 94° 18' E longitude) is one of the biggest in this region. It is endowed with enormous water resources and holds a great potential for all-round aquacultural development of this region.

The physiography of the district consists of small hillocks intervened by wide low valleys. The hillocks have NE-SW and NE-SSW trend near the Barail range and N-S trend towards south away from the Barail range. Notably, Sone Beel, the biggest "Beel" (wetland) in Assam is situated in between two hill ranges, viz., the Badarpur-Saraspur range and the Chowkirmukh-Dohalia range. A typical geomorphological feature is the tightfoldedness of the anticlines represented by hillocks having very high dips of the sedimentary beds.

Information obtained from ONGC and GSI (Personal communication) reveal that, Cachar represents a type area of Surma sediments exhibiting only Tertiary deposits (70 million years old) Investigations into the rock samples revealed that the hillocks around were, probably, formed after Tipam sedimentation. Incidentally, most of the wetlands in this region, including the massive Sone Beel, might had originated after the Dupitila sedimentation during the Mio-Pliocene period.

3. Review of Literature

There have been extensive studies on the Freshwater (FW) fishes of India, notably, Hamilton (1822), Day (1873,1878, 1885,1889), Shaw and Shebbeare (1937) Hora (1920), Misra (1959) Menon (1974, 1999), Dey (1973), Dey and Kar (1985, 1987, 1988, 1989 a, b, c, 1990 Jayaram (1981, 1999), Sen (1982), Sen (1985), Talwar and Jhingran (1991), Datta Munshi and Srivastava (2002), Nath and Dey (2000), Akan (2015), Kar and Dey (1992, 2000, 2002) Kar and Barbhuiya (2000 a, b; 2004) Kar et.al. (2002 a, b, c, 2003, 2020), Kar and Sen,(2007); Kar and Dimos (2020); Barman and Kar (2022); Kar (1984, 1985,1990, 1996, 1997, 1998 a, b, c; 1999 a, b; 2000 a, b, c, d, e, f, g, h; 2001a, b, c; 2002 a, b, c, d; 2003 a, b, c, d, e, f, g; 2004 a, b, c, d; 2005 a, b c, d, e, f; 2006 a, b; 2007 a, b, c, 2010 a , b; 2012 a, b, c; 2013 a, b; 2014, 2015, 2016, 2019, 2021 a, b, c). But many of them are concerned with Biodiversity, biology and aquaculture.; and, few on taxonomy

Concomitant to above, icthyofaunal composition of the NE region of India has elements of the Indo-gangetic region and, to some extent, elements of the Myanmarese and South-Chinese regions (Yadava & Chandra, 1994). But, not much works had been done on the fishes of NE India and the eastern Himalayan regions along with the habitat inventory parameters. Hora (1921a, b; 1930, 1936, 1937, 1938, 1939, 1940, 1941, 1943, 1951a,b,c; 1953) is said to be one of the pioneer workers on the

fishes of NE India. Subsequently, other workers, notably, Dey (1973) did significant works on the fishes of NE India. Ghosh and Lipton (1982) had revealed 172 species of fishes with reference to their economic importance. Sen (1985) portrayed 187 species of fishes from Assam and its environs. Sinha (1994) had compiled a list of 230 species of fishes from NE India. Nath and Dey (1997, 2000) had reported 131 species of fishes from the drainages in Arunachal Pradesh. Sen (1982, 2000) compiled a comprehensive list of 267 species of fishes from NE India. Moreover, Sen (2000) had opined that, out of the *c* 806 species of fishes inhabiting the freshwaters of India (Talwar & Jhingran, 1991), the NE region is represented by 267 species belonging to 114 genera under 38 families and 10 orders. This is *c* 33.13 % of the total Indian FW fishes. Of the 267 species, Cypriniformes dominates with *c* 145 species followed by Siluriformes (72), Perciformes (31), Clupeiformes (7), Anguilliformes (3), Cyprinodontiformes (3), Osteoglossiformes (2), Synbranchiformes (2), Syngnathiformes (1) and Tetraodontiformes (1). Further, Arun Kumar and Tombi Singh, H 1997 a,b; 1998 a, b, c; 1999; 2000 a, b; Arun Kumar 1999, 2000 a, b, c. d. e. f; Achom Darshan,*et .al.* (2015, 2019 a, b), Yumnam Ramananda, Waikhom Vishwanath (2014), Choudhury *et al.* (2019), Das and Achom (2017), Roni *et al. (*2017), Dishma and Vishwanath (2015), Bungdon and Waikhom Vishwanath (2013), had worked on the fishes in the water bodies in Manipur and elsewhere.

Kar (1984, 1985,1990, 1996, 1997, 1998 a, b, c; 1999 a, b; 2000 a, b, c, d, e, f, g, h; 2001a, b, c; 2002 a, b, c, d; 2003 a, b, c, d, e, f, g; 2004 a, b, c, d; 2005 a, b c, d, e, f; 2006 a, b; 2007 a, b, c, 2010 a , b; 2012 a, b, c; 2013 a, b; 2014, 2015, 2016, 2019, 2021 a, b, c) has been working on the Fishes and habitat parameters of the water bodies in Assam, Mizoram, Tripura, Manipur, Meghalaya, etc covering about 270 wetlands and 60 rivers

Notwithstanding the above, the CAMP (Conservation Assessment and Management Plan) workshop (Molur & Walker, 1998) made valuable contributions to the assessment of the status of certain ichthyospecies of NE India. Further, not much works have been done on the fishes of upstream region of River Barak, particularly, from the stretch from Lakhipur to Tipaimukh; except some preliminary works done by Nath (1988). And, therefore, the present communication is a humble exploratory attempt to portray the ichthyodiversity of the upstream stretch of river Barak with particular reference to Karong region situated in Senapati district of Manipur along Manipur-Nagaland border.

River is the basic storehouse of water to meet our country's demand for water for various uses. Indian continent is singularly blessed with unparalleled riverine resources, harbouring one of the richest fish wealth in the world. Out of *c* 2500 species of fishes occurring in India, *c* 450 species of fishes occur in the Indo-gangetic plains (Kar et al., 2002 c). Menon (1974) had listed 207 species of fishes from the Gangetic plains which belong to 29 families and 82 genera. According to another estimate, the Gangetic system alone harbours not less than 265 species of fishes (Yadava & Ravish Chandra, 1994),

4. River Barak

The river Barak originates from Japvo peak in Nagaland (*c*3353.65m MSL), and flows through Karong village in Senapati district of Manipur along the Manipur-Nagaland border. It, then, flows through a tortuous course in Manipur, passes through places like, Tamenglong, Tipaimukh (at the junction of Manipur and Mizoram where the proposed Barak Dam was to be constructed), Zilthaw, Patpuihmun, Sartuinek, Khantoum, Thingpuikuol, Teulien, Kangrengdahar, Jaisuo, Khangbor, Chandikhal, Ankhasuo, Tupidahar, Chotrikhal, Jhakradahar; Tuisuolein, B. Huon Veng, Gilgal, Fulertal, etc.; and, entering the Cachar district in the southern part of Assam, it forms the Barak valley; through which it flows along a serpentine course. After traversing through a stretch of *c* 532 km from its origin, the River Barak bifurcates into two branches, viz.., the Surma and the Kushiara at village Harinagar (Haritikar) at the Indo-Bangladesh border. Then, after flowing a short spell along the Indo-Bangla border, both these rivers flow into Bangladesh to join the Meghna basin before entering the Bay of Bengal. Barak has a number of tributaries joining it on both north and south banks, viz., Jiri, Chiri, Madhura, Jatinga, (north bank tributaries) and Sonai, Rukni, Dhaleswari, Ghagra (south bank tributaries). In addition to these, the River Shingla and the River Longai, both originating from the Mizo Hills, join the River Kushiara in Barak valley, the former flowing via Sone Beel , the biggest wetland in Assam. Also, the River Baleshwar joins River Surma in Barak valley.

Incidentally, Barak is a 4^{th} order river situated between the geographical ordinates N 24^{o} 47’ 12.9” and E 93^{o} 2’ 9.1”. Its altitude was found to vary from 17-43 m MSL in our different study sites within the Barak valley region of Assam (Kar, 2003 a, 2005 a; Kar et al., 2002 a).

5. Methodology

General survey of the Fish Biodiversity was done using standard procedures (Armontrout, 1990). Also, NBFGR Manual (2000) was consulted for studying the habitat parameters Headwater to downstream studies were based on River Continuum Concept (Vannote et al., 1980). Spatial heterogeneity of river channel across small to large spatial scales (Forman & Godran, 1980), longitudinal (upstream vs downstream) and lateral (stream margin/mid-channel) dimensions were studied.

Fish samples were collected through experimental fishing using caste nets (dia.3.7 m and 1.0 m), gill nets (vertical height 1.0 m- 1.5 m; length 100 m -150 m), drag nets (vertical height 2.0 m), triangular scoop nets (vertical height 1.0 m) and a variety of traps. Camouflaging technique was also used to catch the fishes (Jhingran, 1991). Fishes have been preserved at first in concentrated formaldehyde in the field itself and then in 40 % formalin. Fishes have been identified after standard literature (Day, 1878, 1889; Shaw & Shebbeare, 1937; Misra, 1959; Menon, 1974, 1999; Talwar & Jhingran, 1991; Jayaram (1981, 1999, 2010). Fishbase.org was also consulted. Yield statistics were extrapolated (Dey & Kar, 1990; Kar, 1990) from daily catch statistics recorded at the landing stations (FAO, 1974) while the trend and cyclic variations were constructed by applying 12 months moving average method (Coxton & Cowden, 1950; Kar & Dey, 2000). Physico-chemical characteristics of water were analysed after

APHA (1995).

6. Results and Discussion

Habitat inventory of the River Barak at Karong in Senapati district has been displayed in Table 1. The Table revealed colluvial type of valley segment in the true hill stream stretch of Barak at Karong region. This type of valley segment makes the habitat colonisable for the rheophilic fishes, most of which have developed adhesive apparatus on the ventral surface of the body in order to withstand the fast torrent of the rivers. Further, colluvial valley segment provides a diversity of micro-habitats. The fish covers in the Barak river have been found to be mostly of turbulence and depth types, the former ranging from 2-15 %. The total cover had been found to range from trace (< 5%) to moderate (5-20 %) during the surveyed period. Fish cover also includes the overhanging vegetation. The substrate type in the hilly portion of the river Barak at Karong is found to be dominated by gravels, cobbles, boulders and bedrocks. It is mesoriparian; and, the riparian vegetation at Karong site vary from herbs, shrubs to trees. Signs of erosion had been visible.

Information about the habit and habitat of these fish species is scarce and are based mainly on the present study. Data about the reproductive period, sites of breeding, feeding, etc., is scanty. According to our field observations, there is difference in habitat preference within the species in many families. Young fishes are generally found to prefer benthic zone of the rivers while the adults tend to live in different types of niches (Smith, 1994). The *Garra* spp and the balitorids have been generally found in the fast flowing rheophilic stretch. Sections of the river not having much aquatic macrophytes revealed abundance of fishes. The food of the adults generally consist of herbivorous items with occasional carnivorous components. The gut contents revealed the occurrence of mainly phytoplankton food with zooplankton encountered only occasionally.

The study (Kar, 2003a) further revealed that, almost all the cyprinid species are generally distributed in pools, pool edges, backwater pools, riffles and riffle edges. Runs and cascades have been found to be least preferred habitats by the cyprinids. The edges of the run habitats have been found to be inhabited mainly by *Chanda nama, Puntius conchonius* and *Esomus danricus* in river Barak

Macro- and micro-habitats combine to form the total habitat available for organisms. Macro-habitats control the general pattern of species distribution and abundance which governs the flow of energy through the system. In our study, the riparian cover, substrate type and habitat volume were found to be associated with fish density. Incidentally, habitat volume is generally considered as an important attribute in determining species diversity as observed in river Barak . Low habitat volume is generally linked with low species diversity. These findings support that habitat volume is a major determinant in fish assemblage. Cyprinids are generally and largely recorded from pool habitats. Conversely, riffle and cascade-dwelling species include fishes like *Glyptothora x telchitta,* etc.

In addition to the above, some specific information regarding the river Barak is given below:

In river Barak, population of Large Growing Fishes (LGF), e.g., *Labeo rohita, Cirrhinus mrigala,* etc.,

appeared to have declined due to overfishing, siltation of the river bed and lack of fish cover. Even the population of *Bagarius bagarius, Sperata seenghala* have dwindled as compared to earlier days. Fishes like *Neolissochilus hexagonolepis, Devario aequipinnatus, Nangra nangra, Botia dario, Barilius barila* were found to occur in the little upstream region of the river where the water current in the river is faster. Forms like *Glyptothorax telchitta, Nemacheilus multifasciatus, Garra gotyla gotyla* were found to occur in the more upstream regions having boulders and cobbles in the substratum. Nevertheless, these strongly rheophilic fishes are sometimes swept into the downstream region of the river (Kar, 2005 a).

Geographical information of River Barak at Karong has been presented in Table 2.

Estimation revealed that the catchment area of Barak from its origin upto Village Harinagar in India is *c* 25086 km^2; while, including Myanmar, the total catchment area is 41723 km^2. In fact, the catchment of Barak sub-basin starts from a place situated at an elevation of > 2331 m MSL in the southern slopes of the lofty Patkai ranges around the village Karong along the Manipur-Nagaland border.

The systematic list of fish species collected from River Barak at Karong has been portrayed in Table 3. 11 species of fishes belonging to 8 genera, 4 families and 3 Orders have been recorded. It indicated that, out of the total fish speices recorded, the cyprinids were the most abundant group. Altogether, 62 number of cyprinid fishes have been collected from river Barak at Karong. The contribution of cyprinids to the total fish collection depicts its highest (96.87 %) contribution in river Barak at Karong. (Table 3). Ccontribution by the Cypriniformes at Karong (Table 3). Among the cyprinids, *Barilius bendelisis* and *Crossocheilus burmanicus* depicted the bulk of abundance (19.35 and 33.87 % respectively) in river Barak at Karong (Table 3).

Collection point-wise distribution of the number of Orders, Families, Genera and Species of fishes in the different stretches of River Barak have been presented in Table 4. It reflected rich diversity of fishes in river Barak at Karong.

Conservation Status (as per IUCN) of the sampled fish species collected from river Barak at Karong has been presented in Table 5. It showed that, only one species, *viz., Opsarius bendelisis* is endangered. On the other hand, species like, *Barilius bakeri, Crossocheilus burmanicus, Garra naganensis,* and *Schistura vinciguerrae* are of least concern. Concomitantly, *Danio naganensis* has been considered as vulnerable. *Neolissochilus hexagonolepis* has been assessed as near threatened; while, *Glyptothorax telchitta* and *Mastacembelus armatus* have been assessed as threatened. Last but not the least status of *B. shacra* could possibly be not confirmed as it is data deficient. Also, the status of *Schistura carletoni* has not been assessed (IUCN, 1988).

Table 1. Habitat Inventory of the River Barak at Karong in Senapati District in Manipur (1)

Water body	Coll Date	Stgc Pt No	Stgc Pt Name	Lat	Long	Reach type	Valley segment	Fall	Cascade	Riffle, pool
River Barak	26 10 2004	1	Karong	N 25o 18' 24.7"	E 94o 2' 48"	Regime	Colluvial	Fall	Cascade	Riffle, pol,

Table 1. Habitat Inventory of the River Barak at Karong in Senapati District in Manipur (2)

Run, sheet	Bed rock	Boulder	Cobbles, Gravels	Fines	Overhanging Vegetation	Riparian vegetation	Riparian Land use pattern
Run, Sheet	Bedrocks	Boulders	Cobbles, Gravels	Fines	Mainly trees; Saccharum spp, bamboos	Mainly trees; bamboos	Human Habitation

Table 2. Geographical Information of River Barak at Karong

River name	Collection site	Geographical Position (Lat Long)	Altitude (m MSL)	Date of Collection	Number of Species Collected
River Barak	Karong, R Barak at Karong,Coll 26 10 2004,Manipur	$25^{o}18'$ 24.7" N 94^{o} 2' 48 " E	1018 m MSL	26-10-2004	10

Table 3. The Systematic List of Fish Species Collected from River Barak at Karong

River name	Order	Family	Sub-family	Genus	Fish Species No.	Fish Species	No. of fishes Under each species	Date of Collection
River Barak at	Cyprinif-ormes	Cyprinid-ae	Danio-ninae	*Barili-us* Hamilton	1	*Barilius bendelisis*	12	26 10 2004

Karong,Manipur						(Hamilton-Buchanan)		
					2	*Barilius bakeri* (Day)	5	26 10 2004
					3	*Barilius shacra* (Hamilton-Buchanan)	6	26 10 2004
			Garrinae	*Crossocheilus* Kuhl van Hasselt	1	*Crossocheilus burmanicus* (Hora)	21	26 10 2004
				Garra Hamilton Buchanan	1	*Garra naganensis* Hora, 1921	2	26 10 2004
			Danioninae	*Danio* Hamilton	1	*Danio naganensis* (Chaudhuri)	7	26 10 2004
			Cyprininae	*Neolissochilus*Rainboth	1	*Neolissochilus hexagonolepis* (McClelland)	1	26 10 2004
		Balitoridae	Nemacheilinae	*Schistura* McClelland	1	*Schistura vinciguerrae (Hora)*	3	26 10 2004
					2	*Schistura carletoni (Fowler)*	5	26 10 2004
	Siluriformes	Sisoridae		*Glyptothorax* Blyth	1	*Glyptothorax telchitta telchitta* (Hamilton-Buchanan)	1	26 10 2004
	Synbranchiformes	Mastacembelidae	Mastacembelinae	*Mastacembelus* Scopoli	1	*Mastacembelus armatus*(Lacepede)	1	26 10 2004

Table 4. Collection Point-Wise Distribution of the Number of Orders, Families, Genera and Species of Fishes in the Different Stretches of River Barak

River Barak at Karong

Sl No.	Collection Point name	No. of Order-s	No. of Familie-s	No. of Genera	No. of Fish Species	Date of Collection	Number of Speies Collected	Fish Identified by ZSI
1	River Barak at Karong,	3	4	8	11	24 10 2004		

Manipur

Table 5. Status of Some Fish Species in River Barak at Karong

Sl No.	Fish Species	IUCN Conservation-n Status
1	***Opsarius bendelisis*** (Hamilton, 1807).	Endangered
2	*Barilius bakeri* (Day)	Least Concern
3	*Barilius shacra* (Hamilton-Buchanan)	Data deficient
4	*Crossocheilus burmanicus* (Hora)	Least concern
5	*Danio naganensis* (Chaudhuri)	Vulnerable
6	*Garra naganensis* Hora, 1921	Least Concern
7	*Neolissochilus hexagonolepis (*McClelland)	Near threatened
8	*Schistura vinciguerrae (Hora)*	Least concern
9	*Schistura carletoni (Fowler)*	Not assessed
10	*Glyptothorax telchitta telchitta* (Hamilton-Buchanan)	Threatened
11	*Mastacembelus armatus* (Lacepede)	Threatened

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