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A Study on fish and plankton diversity in Garjan beel of Kamrup district, Assam, India

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Abstract: Assam is recognized as one of the hotspots of freshwater fish diversity. Biodiversity and its conservation are regarded as one of the major issues of enabling sustainable use of natural resources. A survey was conducted on the Garjan beel of Kamrup district since March-2018 till February -2019. Its geographical location falls under latitude 26°13'5"N and 91°35'40"E. Primary data were collected by visiting the studied area twice a month. The local people and fishermans have been questioned and interviewed. The present investigation reveals fish diversity of 72 species belonging 22 families under 8 orders. 3 species are endangered (EN), 9 are vulnerable (VU), 1 species is near threatened (NT), 55 species are lower risk least concern (LRlc), and 4 are not evaluated (NE). Of these fish species 42.5 % are riverine fishes while the rest are species of lentic habitats and 40 species have indigenous ornamental value. Order cypriniformes is the most dominant group in the beel (30 species) and cyprinidae is the most species rich family (26 species). Among phytoplankton community total 33 species were recorded from 4 classes. Chlorophyceae have highest number of species (13). 36 species of zooplankton were found from 3 classes. Rotifera represents highest nos. of species (17 species). This wetland holds numbers of economically important fish species having high market value as live fish many of which have potential value as food and ornamental. Most of the fish species once dominant in the beel are now endangered. If properly managed in scientific lines, these water bodies can play a vital role in boosting rural economy.

Keywords: Freshwater, Wetland, Phytoplankton, Zooplankton, Conservation status, IUCN.

Introduction :

Wetlands are a group of ecosystems, which include lakes, estuaries, swamps, bogs, marshes and fences. Wetland ecosystems account for 6- 8.6 percent of the world's total land surface. Wetlands are areas of land where water covers the soil- all year or just at certain times of the year. The wetlands are sometimes described as "biological supermarkets" and "kidneys of the landscape". According to Mitsch and Gosselink1986, on the basis of the functions they perform in hydrologic and chemical cycles and also because they support all life forms through extensive food webs and biodiversity. According to Murkin and Wrubleski, (1988) wetland forms the basis of the environment for the aquatic food web of high-yielding animals. The floodplain of Brahmaputra and Barak river and their tributaries are full of types and sizes which are commonly called as *Beel*, reported by Sharma & Goswami (1988). These floodplain wetlands are either permanent or temporary water bodies associated with rivers, which constantly shift their beds especially in the potamon regimes.

Works on various aspects of limnology and productivity of *Beels* of Assam were studied by Bhuyan (1970), Pal & Singh (1983), Sharma & Hussain (1999), Sugunan & Bhattacharjee (2000) etc. Planktons are indicator of any aquatic ecosystem and play an important role in the tropic dynamics of aquatic ecosystem. Planktonic organisms have short life cycle with quickly and significantly compared to benthic or nektonic organisms. They comprise integral link to aquatic food webs contributing significantly to primary and secondary productivity as stated by Mir *et al.*, (2007). The seasonal succession among plankton can depict the trophic

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status of the aquatic habitat in relation to environmental factors. Works on ecology of phytoplankton as well as zooplankton in fresh water wetlands were documented by many workers like Rajkumar *et al*., (1994) Mukherjee and Pankajakshi (1995), Baruah and Das (1998). Besides Phytoplankton, Zooplankton are good indicators of changes in water quality as they respond quickly to changes in environmental quality. Zooplankton community plays an important role in the aquatic food chain and contributes significantly to the secondary productivity of freshwater ecosystem, described by Saikia and Das (2003) and helps in biomonitoring the freshwater ecosystem by Sinha (2001).

Study Area :

Garjan *beel* is situated on the northern part of Brahmaputra basin. The *beel* extends from 26°13'5"N to 26°18'5"N and 91°30'41"E to 91°35'40"E (Fig 1a & 1b). The beel is situated in Kamrup district of Assam and locally it is called as "Gaijan Bullutjan" *beel*. The *beel* itself comprises of 33 component *beels* covering a total area of about 678 hectares. The two tributaries of river Brahmaputra feeds the Gaijan *beel* called Lakhaitara and Boralia. Some small streams locally known as "jan" interlink the whole *beel* area to each other.

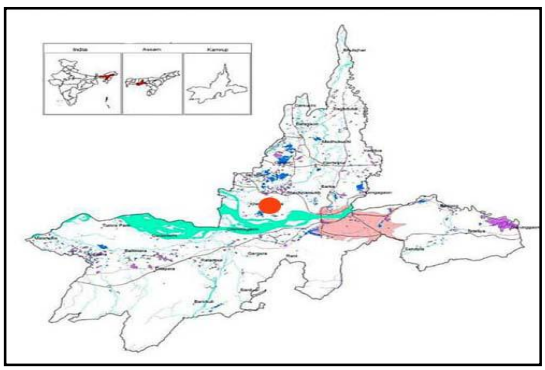


Fig 1: a &b. Map and pic showing the study area

Materials and Methods

Data collection was carried out in consistent manner from February-2018 till January -2019. Data analysis were done by visiting the *beel* itself on monthly basis and through questionnaire to the fishermen of the wetland having years of experience. Fishes were collected from the water body using locally available fishing gears from pre-selected sampling sites. Fishing gears and devices used during fishing operation were moving nets (*Dhekijal, Khewali jal etc* and *Drag nets* of various mesh sizes), different 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. Fishes were sorted out species wise using taxonomic keys by the method adopted by Talwar *et al.,*(1991), Jayaram (1999), Nath *et al.*(2000), Vishwanath *et al,(*2007). The latest scientific names of the fish species were used following Calacademy reports (2015). Fishes were photographed and preserved few individuals in 4% formalin for species representation. Further sorting of fish species were carried out into major group, intermediate group and minor group fishes. Fishes are categorized into threatened species based on IUCN Red List and CAMP (1998). Fishermen and native people were interviewed for information on species diversity. Fish catch statistics of commercially important species have been collected covering all the months of the year. Landing sites were visited once a week and data collected have been supplemented by direct enquiries from fishermen and fish traders. For phytoplankton study samples were collected from four sampling sites *viz.* North, south, east and west corner of the *beel.* The samples were collected monthly. Plankton samples were collected between 8.00 AM to 9.30 AM, at every selected sampling site. Plankton net of bolting silk no. 25 was used for sampling purpose. Samples were taken at mid stream 0.5 to 1m below the surface of water. Collected concentrated plankton samples (10 ml) were fixed and preserved in 5% formalin. Plankton samples were examined under high power microscope and identified. The

qualitative and quantitative estimation were done by taking samples in Sedgwick Rafter plankton counting cell following the methodology of Edmonson (1956) and Needam and Needham (1966).The phytoplankton's were recorded as unit cell per litre following Welch (1948).

Results and Discussion

Total 72 species of 22 families (under 8 orders) were identified during the study period. The maximum representation of the fish fauna of Garjan *beel* is order-Cypriniformes 42.48% N=30) followed by Siluriformes (21.22% N=18), [Fig 3](Perciformes (17.17% N=15), Synbranchiformes (4.4% N=4) Osteoglossiformes (2.2% N=2), Clupeiformes, Beloniformes and Tetradontiformes (each1.1%N=1). [Table 1 and Fig 2]. Out of these total 72 species family wise different species are-Notopteridae (2), Clupeidae (1), Cyprinidae (26), Nemacheilidae (1), Cobitidae (3), Siluridae (2), Bagridae (12), Sisoridae (1), Claridae (1), Heteropneustidae (1), Chacidae (1), Belonidae(1),Synbranchidae (1), Mastacembelidae (3), Ambassidae (3), Nandidae (1), Badidae (1), Gobiidae (1), Anabantidae (1), Osphronemidae(3), Channidae (5), Tetraodontidae (1). Cypriniformes is the most dominant group in the beel (30 species) and Cyprinidae is the most species rich family (26 species). *Salmostoma bacaila, Amblypharyngodon mola, Pethia ticto, Puntius sophore, Systomus sarana, Cirrhinus mrigala, Labeo gonius, Labeo rohita, Labeo bata, Lepidocephalichthys guntea, Wallago attu, Mystus cavasius, Mystus tengara, Macrognathus aral, Macrognathus pancalus, Anabas testudineus, Channa punctatus* are the most abundant and common species in Garjan *beel*. Emergence of high number exotic species like *Hypophthalmichthys molitrix, Hypophthalmichthys nobilis, Ctenopharyngodon idella, Cyprinus carpio* may be threat for indigenous species in near future. Species like *Chitala chitala, Notopterus notopterus, Barilius barila, Amblypharyngodon mola, Labeo gonius, Labeo calbasu, Ompok pabo, Wallago attu, Mystus cavasius, Bagarius bagarius, Anabas testudineus, Clarias batrachus, Heteropneustes fossilis* have high market value as food fish. Other species have high ornamental value around the globe. Abundance of fishes were observed during monsoon season and for that some exotic fishes, could be recorded from the study area, as these *beels* receive water from various feeder channels. In the present study, out of total collected fishes 3 species are endangered (EN), 9 are vulnerable (VU), 1 species is near threatened (NT), 55 species are lower risk least concern (LRlc), and 4 are not evaluated (NE) based on the workshop (CAMP 1998). Of these fish species 42.5 % are riverine fishes while the rest are species of lentic habitats. 40 species have indigenous ornamental value as reported by Sarma *et al.*(2007) from central Brahmaputra valley zone. Among phytoplankton community total 33 species were recorded from 4 classes (Table 2, Fig 4 & 5). Among them 13 species of Chlorophyceae, 12 species of Bacillariophyceae, 6 species of Myxophyceae and 2 species of Euglenophyceae were found. Chlorophyceae was found to be dominating one. Sugunan *et al.,* (2000) also reported that Chlorophyceae is a dominant component of phytoplankton in the *Beels* of Assam. Among zooplankton, 36 species were found from 3 classes. Rotifera represents highest nos. of species *viz.* 17 species. 10 species from Copepoda and 9 species from Cladocera were recorded. The dominant group was found to be Rotifera.

Table-1 : Fish diversity in Garjan beel

Order	Family	Species	IUCN status	Abundance
Osteoglossiformes	Notopteridae	*Chitala chitala (Hamilton, 1822)*	EN	+
		Notopterus notopterus (Pallas, 1769)	LRlc	++

Clupeiformes	Clupeidae	*Gudusia chapra (Hamilton, 1822)*	LRlc	++
Cypriniformes	Cyprinidae	*Hypophthalmichthys molitrix* (Valenciennes, 1844)	NE	+++
		Hypophthalmichthys nobilis (Richardson, 1845)	LRlc	+++
		Ctenopharyngodon idella (Valenciennes, 1844)	NE	+++
		Cyprinus carpio Linnaeus, 1758	VU	++
		Salmostoma bacaila (Hamilton)	LRlc	+++
		Cabdio morar (Hamilton, 1822)	LRlc	++
		Barilius barila (Hamilton, 1822	LRlc	++
		Laubuca laubuca (Hamilton, 1822)	LRlc	++
		Devario devario (McClelland, 1839)	LRlc	++
		Esomus danrica (Hamilton, 1822)	LRlc	++
		Amblypharyngodon mola (Hamilton, 1822)	LRlc	+++
		Chela cachius (Hamilton, 1822)	LRlc	++
		Puntius chola (Hamilton, 1822)	VU	+
		Pethia ticto (Hamilton, 1822)	LRlc	+++
		Puntius sophore (Hamilton, 1822)	LRlc	+++
		Puntius terio (Hamilton, 1822)	LRlc	++
		Pethia conchonius (Hamilton, 1822)	LRlc	++
		Systomus sarana (Hamilton, 1822)	LRlc	+++
		Putius puntio (Hamilton, 1822)	LRlc	++
		Cirrhinus mrigala (Hamilton, 1822)	LRlc	+++
		Cirrhinus reba (Hamilton, 1822)	LRlc	++
		Gibelion catla (Hamilton, 1822)	VU	+
		Labeo gonius (Hamilton, 1822)	LRlc	+++
		Labeo calbasu (Hamilton, 1822)	LRlc	++
		Labeo rohita (Hamilton, 1822)	LRlc	+++
		Labeo bata (Hamilton, 1822)	LRlc	+++
	Nemacheilidae	*Acanthocobitis botia* (Hamilton, 1822)	LRlc	++
	Cobitidae	*Botia dario* (Hamilton, 1822)	LRlc	++
		*Botia rostrata (*Gunther, 1868)	VU	+
		Lepidocephalichthys guntea (Hamilton, 1822)	LRlc	+++
Siluriformes	Siluridae	*Ompok pabo* (Hamilton, 1822)	NT	++
		Wallago attu (Bloch and Schneider, 1801)	LRlc	+++
	Bagridae	*Sperata aor* (Hamilton, 1822)	VU	+
		Sperata seenghala (Sykes, 1839)	LRlc	++
		Rita rita (Hamilton, 1822)	LRlc	++
		Mystus vittatus (Bloch, 1794)	VU	++
		Mystus cavasius (Hamilton, 1822)	LRlc	+++
		Mystus tengara (Ham.-Buch.)	NE	+++
		Mystus bleekeri (Day, 1877)	LRlc	++
		Batasio batasio (Hamilton, 1822)	LRlc	++
				+

		Clupisoma garua (Hamilton, 1822)	LRlc	++
		Eutropiichthys vacha (Hamilton, 1822)	LRlc	+++
		Eutropiichthys murius (Hamilton, 1822)	LRlc	++
	Sisoridae	*Bagarius bagarius* (Hamilton, 1822)	LRlc	++
	Claridae	*Clarias batrachus* (Linnaeus, 1758)	EN	+
	Heteropneustidae	*Heteropneustes fossilis* (Bloch, 1794)	LRlc	++
	Chacidae	*Chaca chaca* (Hamilton, 1822)	EN	+
Beloniformes	Belonidae	*Xenentodon cancila* (Hamilton, 1822)	LRlc	++
Synbranchiformes	Synbranchidae	*Monopterus cuchia* (Hamilton, 1822)	LRlc	++
	Mastacembelidae	*Macrognathus aral* (Bloch and Schneider, 1801)	LRlc	+++
		Macrognathus pancalus Hamilton, 1822	LRlc	+++
		Mastacembelus armatus (Lacepede, 1800)	LRlc	++
Perchiformes	Ambassidae	*Chanda nama (*Hamilton, 1822)	LRlc	++
		Parambassis lala (Hamilton, 1822)	LRlc	+++
		Parambassis ranga (Hamilton, 1822)	LRlc	++
	Nandidae	*Nandus nandus* (Hamilton, 1822)	LRlc	++
	Badidae	*Badis badis* (Hamilton, 1822)	VU	+
	Gobiidae	*Glossogobius giuris* (Hamilton, 1822)	LRlc	++
	Anabantidae	*Anabas testudineus* (Bloch, 1792)	LRlc	+++
	Osphronemidae	*Trichogaster fasciata (*Bloch and Schneider, 1801)	LRlc	+++
		Trichogaster lalius (Hamilton, 1822)	LRlc	++
		Trichogaster sota (Hamilton, 1822)	LRlc	++
	Channidae	*Channa gachua* (Hamilton 1822)	LRlc	++
		Channa punctatus (Bloch, 1793)	LRlc	+++
		Channa striatus (Bloch, 1793)	LRlc	++
		Channa marulius (Bloch, 1793)	LRlc	++
		Channa orientalis (Bloch, 1793)	VU	+
Tetraodontiformes	Tetraodontidae	*Leiodon cutcutia (*Hamilton, 1822)	NE	++

Table-2 : Plankton diversity in Garjan beel

Phytoplankton		Zooplankton	
Class	Species	Class	Species
	Chlamydomonas sp.		*Brachionus sp.*
	Chlorella sp.		*Platyias sp.*
	Oedogonium sp.		*Keratella sp.*

Chlorophyceae	*Spirogyra sp.*	Rotifera	*Anuraeopsis sp.*
	Ulothrix sp.		*Euchlanis sp.*
	Volvox sp.		*Mytilina sp.*
	Pandorina,		*Trichotria sp.*
	Dinobryon sp.		*Lepadella sp.*
	Eudorina sp.		*Lecane sp.*
	Microspora sp.		*Monommata sp.*
	Zygnema sp.		*Trichocerca sp.*
	Ceratium sp.		*Polyarthra sp.*
	Botryococcus sp.		*Testudinella sp.*
Cyanophyceae	*Anabaena sp.*		*Sinantherina sp.*
	Microcystis sp.		*Conochilus sp.*
	Nostoc sp.		*Hexarthra sp.*
	Oscillatoria sp.		*Rotaria sp.*
	Rivularia sp.	Cladocera	*Bosmina sp.*
	Spirulina sp.		*Alonella sp.*
Bacillariophyceae	*Cyclotella sp.*		*Chydorus sp.*
	Cymbella sp.		*Biapertura sp.*
	Fragillaria		*Scapholeberis sp.*
	Navicula sp.		*Simocephalus sp.*
	Nitzchia sp.		*Moina sp.*
	Pinnularia sp.		*Graptoleberis sp.*
	Synedra sp.		*Daphnia sp.*
	Tabellaria sp.	Copepoda	*Mesocyclops sp.*
	Diatom sp.		*Cyclops sp.*
	Surirella sp.		*Nauplii sp.*
	Cocconeis sp.		*Neodiaptomus sp.*
	Eunotia sp.		*Melosira sp.*
Euglenophyceae	*Euglena sp.*		*Navicula sp.*
	Phacus sp.		*Synedra sp.*
			Tabellaria sp.
			Cocconeis sp.
			Eunotia sp.

Fig 4 : Phytoplankton diversity in *Beel*

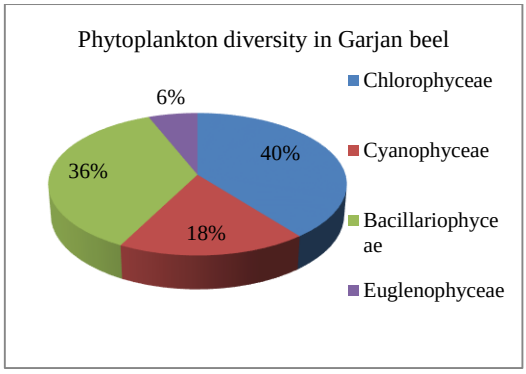
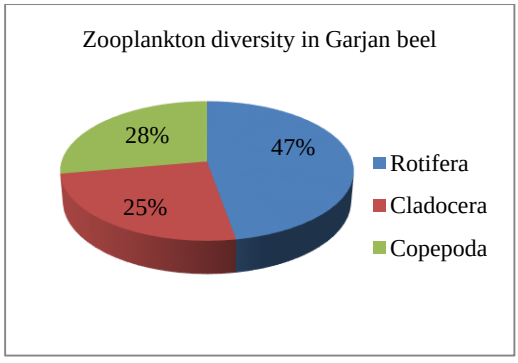


Fig 5 : Zooplankton diversity in *Beel*



Conclusion :

Garjan *beel,* one of the highly productive flood plain wetlands of Assam. *Beels* are socio-culturally associated with the native people. They are the sources of water for agriculture, food in the form of fish, edible aquatic flora and molluscans. It harbours a wide variety of indigenous ornamental fishes. The Garjan *beel* supports other biological resources such as invertebrates and aquatic flora. The ornamental fish diversity of Garjan *beel* is dominated by indigenous fishes. Pre-monsoon and monsoon season shows higher abundance in the phytoplankton diversity of the *beel.* Increasing habitat loss, change in ecological condition of the *beels*, anthropogenic pressure, erratic monsoon, flash flood are some of the causes of decline in fish diversity in Garjan *beel* which once use to be famous for fish diversity as well as abundance.

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