



Review Article

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Unique Oxbow Wetlands in Assam, India



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Introduction

The water bodies under 'Lentic' category is said to form the 'Standing water series'. Although the name is 'standing water' the water in such bodies is in motion in different ways. Hence, 'standing water' does not necessarily mean 'static'. It simply means that water does not flow [1-3]. Until recently, many naturalists, including biologists, thought the lentic bodies (wetlands, lakes, etc.) to be much the same wherever they occur; because similarities are often found among different kinds of lentic bodies about their physico-chemical and biological features. Although a partial survival of this idea is still prevalent among many laymen; with the advent of limnology, it has been established that, lentic bodies as a class, manifest a most amazing physico-chemical and biological diversity. Further, as a partial indication of lentic bodies diversity, it could well be stated that lentic bodies could be large, medium or small; deep or shallow; protected or unprotected; with or without inlets and, outlets; fresh, brackish or salt; acidic, neutral or alkaline; hard, medium or soft; turbid or clear; surrounded by bogs, swamps, forest or open shore; high or low in dissolved content; with or without stagnant zones; with marl, muck, sand or clay bottoms; with or without vegetation beds; with high, medium or low biological productivity; young, mature or senescent; and, so on.

However, there could exist many imaginable intergrades within the various groups of characters mentioned above. The remarkable lentic bodies diversity is said to be the effect of multitudinous combinations of many of these characteristics mentioned above. In this connection, in contrast to a 'lake', a 'wetland' is a kind of lentic body whose depth generally does not exceed 6 m [1-3]. Standing waters occur in depressions or in basins, which are doomed from the moment they are formed. Eroded sediments and plant remain from the surrounding land are washed-in and settle at the bottom along with debris from the resident aquatic plants and animals. Gradually, the lake could get shallower until it becomes a 'wetland'. Wetlands are, thus, basically 'wet-lands' where the soil is saturated with water for some time during the year. According to IUCN (1970), wetlands

are areas of marsh, fen, etc., temporary, or permanent; natural or artificial mass of water, the depth of which generally does not exceed 6 m. Wetlands are areas which contain substantive amount of standing water and little flow.

Concomitant to above, a FW lake is a closed water body of FW which is surrounded by land on all sides. An oxbow type of lentic body (lake/wetland) is created when a river changes its course leading to isolation of a segment of the said river. A pond is a body of standing water which is too small to have a wave-swept beach. Swamps are wetlands with trees. Bogs and fens are vegetated low-lying areas. Bogs have outlets where water from rain runoff and springs flow away. Fens are basins fed by upwelling ground water. Marshes are usually wetlands dominated by a few species of plants, e.g., *Cyperus*, *Scirpus*, *Echinochloa*, *Cynodon*, etc.

Origin and Evolution of Wetlands

In the tropics, notably in India and in adjoining places, like Bangladesh, etc., wetlands are generally shallow depressions which could normally be in the form of a basin at the centre of hillocks on all sides; or could be abandoned segment of a river (oxbow wetland); or a shallow portion of a river course which is detached from the main river course during the dry season. Sometimes, wetlands in NE India, are formed due to tectonic activities. Further, some wetlands are small kettle holes; others are in the last stages of 'succession' which is triggered when aquatic plants produce organic matter faster than decomposing organisms can re-cycle it. The remains of the plant bodies gradually accumulate until no open water remains. In Assam, and in adjoining Tripura and Bangladesh, 3 kinds of wetlands are generally found. They are locally called as follows [1-3]:

- 'Beel': Perennial wetlands which contain water throughout the year.
- 'Haor': Seasonal wetlands which contain water only for some period of the year, particularly, during the rainy season. As such, they are also called 'floodplain wetlands'.

- 'Anua' : These are peculiar river-formed perennial oxbow-type wetlands which are generally formed due to change in river course and which may or may not retain connection with the original river.

Wetlands in North-East India

The North-Eastern (NE) region of India, a typically difficult topography with undulating terrains, however, provides enough potential for fish production which can supplement food requirement for the region and could provide answer to diminishing protein supply. Situated between 89-97° N Longitude and 20-30° E Latitude, the region encompasses a vast area of 2,55,083 sq. km out of total Indian area of 3.3. million sq. km. Comprising of eight provinces, viz., Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Tripura, and Sikkim. The lofty Himalayas proudly stands as sentinels to guard the northern and eastern frontiers. The Chittagong Hill tracts form a crescent on the south. The region's western mountains suddenly rise from the valleys in Bangladesh, leaving only a narrow strip which opens out to the Indian mainland.

The NE region of India displays diversities regarding topography, water resources, biota, climate, race, language, and culture; and the region harbours >100 tribes differing ethnologically yet sharing a common destiny. Besides lotic territories, the lentic water bodies having 0.72 x 10⁶ ha lake coverage in India, constitute great potential of fishery resources. The NE region is blessed with several lentic systems, locally called 'Beel, Haor, Anua, Hola, Doloni, Jalah, etc., which alone constitute c 81 % of the total lentic area (0.12 x 10⁶ ha) in Assam. These lentic systems are generally shallow and open, ranging in size from 35 to 3458.12 ha and with depth ranging from 0.25 to 3.0 m (in some, however, the maximum depth may exceed 6.0 m) at LSL. Further, in Assam, there are c 1392 number of wetlands having a total of c 22,896 number of fisheries of different categories; out of which, the number of registered wetlands is only 394 (30.38 %) covering an area of c 70,000 ha; of which, c 19,000 ha is in good condition; c 15,000 ha is in semi-derelict condition and c 35,000 ha is in derelict condition [1-3].

Out of the total of 1392 wetlands in Assam, there are 290 oxbow wetlands ('Anua') covering an area of 5, 460.60 ha which constitutes approx.0.10 % of the total geographical area of the State and 9.27 % of the total area under wetlands. The smallest of them measures 5.0 ha while the largest one has 582.50 ha of water spread area. Highest number of oxbow wetlands are observed in Golaghat district (104) followed by Nagaon district (71) and Dhubri district (68). Maximum area of oxbow wetlands is in Morigaon district (2143.00 ha) followed by Nagaon (1746.00 ha) and Golaghat (1563.00 ha) districts. Some of the important wetlands under this category are Morikolong and Patoli beel in Nagaon district, Mer beel in Golaghat district and Guruajan in Morigaon district, the Anuas in Cachar district, etc. [1-3].

The Anuas

The 'Anua' (river-formed oxbow wetland) could be potential water bodies for pisciculture and aqua-sports. Some of the significant Anua are Baskandi Anua, Silghat Anua, Algapur Anua, Dugripar Anua, Satkarakandi Anua, Ramnagar Anua, Salchapra Anua, Fulbari Anua and Shibnarayanpur Anua [1-3]. An account of some of these is briefly given below:

Satkarakandi Anua

Satkarakandi Anua (92° 52' 41.6" E and 24° 45' 8.9" N; altitude, 20.73 m MSL) lies in the Sonai Revenue Circle in the Cachar district of Assam. The wetland is situated at c 15.5 km away from Silchar city. River Barak flows towards the northern side of the wetland. The villages Satkarakandi and Dhanehary are situated on the eastern shore of the Anua. The villages Barahali and Satkarakandirpar are situated towards the south and west of the wetland. The NE and western shores of the Anua are protected by earthen embankments about 4 m in height as a preventive measure against flood. The maximum L and B of the wetland were found to be c 1.75 km and 0.3 km respectively. The Anua was found to have an average depth of c 3.0 m at FSL. During monsoon, the Anua establishes connection with the river Barak through a channel on the northern side of the wetland which is, however, guarded by a sluice gate as a flood-mitigation measure.

The wetland was found to exhibit interesting trends in its physicochemical features of water. The average values of physico-chemical parameters of water were found to be, water temperature 26 °C, Turbidity 25.5. NTU, pH 5.7, DO 4.95 mg/l, FCO₂ 45.0 mg/l, TA 101 mg/l, conductivity 49 μ mhos/cm., PO₄ 0.406 mg/l, NO₃ 0.32 mg/l (Table 1). This wetland is a victim of acute eutrophication being infested by luxuriant population of *Eichhornia crassipes*. Other forms of Aquatic Macrophytes (AM) include *Lemna minor*, *Eleocharis acutangula*, *Scirpus eriophorum*, *Salvinia cucullata*, *Azolla pinnata*, *Ipomoea aquatica*, etc. The following genera/species of phytoplankton generally occur in this wetland, viz., *Nostoc*, *Oscillatoria*, *Anabaena*, *Microcystis*, *Ankistrodesmus*, *Chlorella*, *Closterium*, *Euglena*, *Ceratium*, *Cosmarium*, *Pinnularia*, *Navicula*, etc.

Studies revealed the occurrence of following genera/species of zooplankton: *Arcella* sp., *Brachionus* sp., *Lecane* sp., *Keratella* sp., *Filinia* sp., *Trichocerca* sp., *Daphnia* sp., *Moina* sp., *Alona* sp., *Chydorus* sp., *Dadaya* sp., *Cyclops* sp., *Diaptomus* sp., etc. Fish diversity recorded 32 valid ichthyospecies belonging to 16 families and 8 orders. Some of the fish species are *Notopterus notopterus*, *Gudusia chapra*, *Salmophasia bacaila*, *Amblypharyngodon mola*, *Osteobrama cotio cotio*, *Puntius chola*, *P. conchoniis*, *P. ticto*, *Botia dario*, *Mystus cavasius*, *M. vittatus*, *Ompok bimaculatus*, *Wallago attu*, *Clarias batrachus*, *Heteropneustes fossilis*, *Anabas testudineus*, *Xenentodon cancila*, *Channa punctatus*, *Trichogaster fasciatus*, *Chanda nama*, *Mastacembelus armatus*, *Macrognathus pancalus*, *M. aculeatus*, etc.

Table 1: Physico-chemical characteristics of water of oxbow Wetlands in Assam.

Sl No.	Water body	Temp. (°C) Water Air		Turbidity (NTU)	pH	DO mg/l	Free-CO ₂ (mg/l)	TA (mg/l)	Conductivity (µ mhos/cm)
1	Baskandi Anua	26	25	2	5.81	2.1	42	101	74
2	Silghat Anua	24	25	0.25	5.8	4.55	38	91	51
3	Algapur Anua	26	30	7	6.1	4.4	54	187	96
4	Ruparbala Anua	27	25	5	5.5	4.2	57	81	74
5	Dungripar Anua	26	24	<0.1	7.02	4.55	52	171	102
6	Satkarakandi Anua	26	23	25.5	5.7	4.95	45	101	49
7	Ram Nagar Anua	27	26	3	6.75	4.4	42	41	95
8	Salchakra Anua	27.6	30.6	18 TU	6				
9	Fulbari Anua	26	25	74.5	6.4	5.05	46	41	74
10	Sibnarayanpur Anua	27	25	<1.0	6.85	5.75	76	61	73

Fish Yield (FY) as Total landing of fish ranged from c 140-425 kg/ year; while the average annual fish landing was 255.44 kg. *Gudusia chapra* showed maximum fish yield (c 78 % of the total yield) followed by *Puntius ticto* (c 12 % of the total yield). The management aspects of Satkarakandi wetland revealed that the wetland suffers from various problems, like overgrowth of aquatic weeds, closure of feeding channels, unsustainable fishing, addition of domestic sewage, etc. These could be overcome by certain steps, like dewatering, opening of the feeding canals, sustained fishing, etc.

Baskandi Anua

This oxbow wetland (24° 48' 36" N and 92° 55' 22.7" E) lies in the Lakhimpur Sub-division of Cachar district in Assam. It is said to have been formed due to change of course of the River Barak [1-3]. The Anua is situated near the Manipur range of hills. Towards the east, lies the Manipur valley while the Silchar sub-division is situated in the west. The North Cachar Hills is situated towards the north and the province of Mizoram lies towards the south. The catchment soil is found to be mainly sandy loam. Rain is the main source of water for the Anua. This oxbow wetland also receives water from the surrounding catchment having human habitation. The catchment vegetation includes herbs, shrubs and trees including a lot of bamboos.

Baskandi Anua is situated about 20 km away from Silchar city along the NH 53 which connects Silchar with Imphal. The Silchar-Jiribam (Manipur) railway line passes near the wetland. The Rural Development Block HQ is at Baskandi. The length (L), breadth (B) and area (A) of Baskandi Anua respectively are 2.230 km, 205 m and 39.2 ha at FSL and 2.090 km, 190 m and 36.7 ha at DSL. The wetland basin tends to be deeper towards the southern side as compared to the northern. The Anua exhibits variable water level ranging from 0.25 m to 5.85 m at FSL (Jun-Sep) and from 0.14 m

to 4.12 m at DSL (Oct-Apr). 16 AM species have been recorded in Baskandi Anua. They belong to 6 free-floating (*Azolla pinnata*, *Eichhornia crassipes*, *Salvinia cucullata*, *Lemna minor*, *Pistia stratiotes*, *Wolfia* sp); 2 rooted submerged (*Hydrilla verticillata*, *Vallisneria spiralis*); 6 rooted with floating leaves (*Nymphaea nouchali*, *Nymphoides indicum*, *N.cristatum*, *Trapa bispinosa*, *Euryale ferox*, *Nelumbo nucifera*); and 2 rooted emergent (*Jussiaea repens*, *Muradania nudiflora*). Of these, 6 AM species were found to occur throughout the year. These are *Azolla pinnata*, *Eichhornia crassipes*, *Salvinia cucullata*, *Trapa bispinosa* and *Jussiaea repens*.

It has been observed that the AM start their seasonal cycle from the germination period in winter while emerging to a vegetative stage in summer and then to monsoon. This was followed by the flowering and fruiting during late monsoon and post-monsoon. Studies revealed wet AM biomass to be ranging from 4.4 to 11.4 kg/m². Wet biomass was observed to be higher during monsoon and post-monsoon reaching trough value during winter with a concomitant increasing trend during summer. Significant positive correlation of AM biomass with water temperature ($r= 0.1820$) has been recorded during the study period. Incidentally Baskandi Anua revealed usual values of Physico-chemical parameters of water (Table 1).

Studies revealed the occurrence of 49 forms of phytoplankton belonging to 48 genera under 26 families, 11 orders and 6 classes. The sequential analysis of abundance of phytoplanktonic groups, generally revealed Chlorophyceae (43.51 %) > Myxophyceae (34.78 %) > Bacillariophyceae (15.58 %) > Dinophyceae (4.47 %) > Euglenophyceae (1.14 %) > Chrysophyceae (0.52 %). Some of the abundant forms of phytoplankton are *Microcystis aeruginosa*, *Anabaena*, *Notoc*, *Oscillatoria*, *Chlorella*, *Volvox*, *Ankistrodesmus*, *Closterium*, *Cosmarium*, *Ceratium*, *Euglena*, *Phacus*, *Spirogyra*, *Diatoma*, *Fragillaria*, *Synedra*, *Gyrosigma*, *Navicula*, *Pinnularia*, etc.

Studies revealed the occurrence of 33 forms of zooplankton belonging to 22 genera under 17 families, 7 orders and 4 classes. The sequential analysis of abundance of zooplanktonic groups, generally revealed Rotifera (64.41 %) > Copepoda (25.14 %) > Protozoa (7.34 %) > Cladocera (3.11 %). Some of the abundant zooplankton forms are *Arcella*, *Centropyxis*, *Brachionus*, *Keratella*, *Lecane*, *Trichocerca*, *Filinia*, *Daphnia*, *Ceriodaphnia*, *Simocephalus*, *Moina*, *Bosmina*, *Bosminopsis*, *Macrothrix*, *Alona*, *Pleuroxus*, *Chydorus*, *Dadaya*, *Cyclops*, *Diaptomus*, etc.

and 4 orders have been recorded in Baskandi Anua, viz., *Channa striata*, *Glossogobius giuris*, *Channa punctata*, *Gudusia chapra*, *Macrornathus aral*, *M. pancalus*, *Salmophasia bacaila*, *Badis badis*, *Chanda ranga*, *Puntius ticto*, *Rasbora daniconius*, *Amblypharyngodon mola*, *Puntius conchoni* (Table 2). *Gudusia chapra* depicted the highest fish yield (c 75% of the total yield) followed by *Puntius*, *Mystus*, *Amblypharyngodon*, etc. The yield has since declined during the decade beginning 2000 AD with *Gudusia chapra* showing depleting trend.

13 species of fishes belonging to 10 genera, 6 families

Table 2: Fish diversity of the Oxbow wetlands in Assam.

Fish Species	Rupairbala Anua	Baskandi Anua	Fulbari Anua	Sib Narayanpur Anua
<i>Pisodonophis boro</i> (Hamilton)	-	-	-	-
<i>Gudusia chapra</i> (Hamilton)	+	-	+	+
<i>Tenualosa ilisha</i> (Hamilton)	-	-	-	-
<i>Chitala chitala</i> (Hamilton)	-	-	-	-
<i>Notopterusnotopterus</i> (Pallas)	+	-	-	-
<i>Amblypharyngodon mola</i> (Hamilton)	+	+	-	-
<i>Aspidoparia morar</i> (Hamilton)	-	-	-	-
<i>Barilius bendelisis</i> (Hamilton)	-	-	-	-
<i>Osteobrama cotio</i> (Hamilton)	-	-	-	+
<i>Catla catla</i> (Hamilton)	-	-	-	+
<i>Cirrhinus mrigala</i> (Hamilton)	-	-	-	+
<i>Cirrhinus reba</i> (Hamilton)	-	-	-	-
<i>Chela laubuca</i> (Hamilton)	-	-	-	+
<i>Cyprinus carpio</i> Linnaeus	-	-	-	-
<i>Ctenopharyngodon idellus</i> (Valenciennes)	-	-	-	-
<i>Hypophthalmichthys molitrix</i> (Valenciennes)	-	-	-	-
<i>Devario devario</i> (Hamilton)	-	-	-	-
<i>Esomus danricus</i> (Hamilton)	-	-	-	+
<i>Labeo bata</i> (Hamilton)	-	-	-	-
<i>Labeo calbasu</i> (Hamilton)	-	-	-	-
<i>Labeo gonius</i> (Hamilton)	+	-	-	+
<i>Labeo nandina</i> (Hamilton)	-	-	-	-
<i>Labeo rohita</i> (Hamilton)	-	-	-	+
<i>Puntius chola</i> (Hamilton)	-	-	-	-
<i>Puntius conchoni</i> (Hamilton)	+	+	-	+
<i>Puntius sarana</i> (Hamilton)	-	-	-	-
<i>Puntius ticto</i> (Hamilton)	+	+	+	+
<i>Rasbora daniconius</i> (Hamilton)	-	+	-	-
<i>Bengana elanga</i> (Hamilton)	-	-	-	-
<i>Salmostoma bacaila</i> (Hamilton)	-	+	-	+
<i>Securicula gora</i> (Hamilton)	+	-	-	+
<i>Botia dario</i> (Hamilton)	+	-	-	-

<i>Lepidocephalichthys guntea</i> (Hamilton)	+	-	-	-
<i>Acanthocobitis botia</i> (Hamilton)	-	-	-	-
<i>Somileptes gongota</i> (Hamilton)	-	-	-	-
<i>Mystus bleekeri</i> (Day))	-	-	+	-
<i>Mystus cavasius</i> (Hamilton)	+	-	+	-
<i>Mystus corsula</i> (Hamilton)	-	-	-	-
<i>Mystus tengara</i> (Hamilton)	-	-	-	-
<i>Mystus vittatus</i> (Bloch)	-	-	-	-
<i>Sperata seenghala</i> (Sykes)	-	-	-	-
<i>Rita rita</i> (Hamilton)	-	-	-	+
<i>Ompok bimaculatus</i> (Bloch)	+	-	-	-
<i>Wallago attu</i> (Bloch and Schneider)	-	-	-	-
<i>Ailia coila</i> (Hamilton)	-	-	-	-
<i>Clupisoma atherinoides</i> (Hamilton)	-	-	-	-
<i>Clupisoma garua</i> (Hamilton)	-	-	-	+
<i>Eutropiichthys vacha</i> (Hamilton)	-	-	-	+
<i>Eutropiichthys murius</i> (Hamilton)	-	-	-	-
<i>Silonia silondia</i> (Hamilton)	-	-	-	-
<i>Pangasius pangasius</i> (Hamilton)	-	-	-	-
<i>Nangra nangra</i> (Hamilton)	-	-	-	-
<i>Glyptothorax telchitta</i> (Hamilton)	-	-	-	-
<i>Clarias batrachus</i> (Linnaeus)	-	-	-	+
<i>Heteropneustes fossilis</i> (Bloch)	-	-	-	-
<i>Chaca chaca</i> (Hamilton)	-	-	-	-
<i>Xenentodon cancila</i> (Hamilton)	+	-	-	+
<i>Aplocheilus panchax</i> (Hamilton)	+	-	-	-
<i>Channa orientalis</i> (Schneider)	-	-	-	-
<i>Channa marulius</i> (Hamilton)	-	+	-	-
<i>Channa punctatus</i> (Bloch)	-	+	+	-
<i>Channa striata</i> (Bloch)	-	+	-	-
<i>Amphipnous cuchia</i> (Hamilton)	-	-	-	+
<i>Parambassis baculis</i> (Hamilton)	+	-	-	-
<i>Parambassis ranga</i> (Hamilton)	+	+	+	-
<i>Chanda nama</i> (Hamilton)	+	-	-	+
<i>Badis badis</i> (Hamilton)	+	+	-	+
<i>Nandus nandus</i> (Hamilton)	-	-	-	-
<i>Oreochromis mossambica</i> (Peters)	+	-	-	-
<i>Rhinomugil corsula</i> (Hamilton)	-	-	-	-
<i>Sicamugil cascasia</i> (Hamilton)	-	-	-	-
<i>Glossogobius giuris</i> (Hamilton)	+	+	-	-
<i>Anabas testudineus</i> (Bloch)	+	-	-	-
<i>Colisa fasciatus</i>	+	-	-	-
<i>Colisa lalia</i> (Hamilton)	+	-	-	-

<i>Colisa sota</i> (Hamilton)	-	-	-	-
<i>Macrognaathus aral</i> (Bloch and Schneider)	-	+	-	-
<i>Macrognaathus pancalus</i> (Hamilton)	+	+	+	+
<i>Mastacembelus armatus</i> (Lacepede)	-	-	-	+
<i>Tetraodon cutcutia</i> (Hamilton)	+	-	-	-

Sibnarayanpur Anua

Sibnarayanpur Anua (24° 52' 51.8" N and 92° 38' 1.6" E) is an oxbow wetland which is situated at c 32 km from Silchar city. It lies within Katigora Revenue Circle in Cachar district of Assam. It has a L, B and A of c 1.7 km, 0.7 km and 53 ha respectively. The catchment soil is mostly loamy. At present, it seems to have a connection with river Banaimulla. Riparian vegetation is scanty. Riparian land use pattern involves human habitation, fishing, etc. The water of this anua displayed usual values of limnological parameters of its water (Table 1). AM included *Azolla pinnata*, *Cynodon dactylon*, *Echinochloa stagnina*, *Eichhornia crassipes*, *Eleocharis acutangula*, *Hygrorrhiza aristata*, *Ipomoea aquatica*, *Jussiaea repens*, *Nymphaea nouchali*, *Nymphoides cristatum*, *Nymphoides indicum*, *Oryza sativa*, *Salvinia cucullata*, *Trapa bispinosa*, *Vetiveria zizanioides*, *Polygonum flaccidum*, *Pistia* sp.

Plankton Consisted of forms like *Anabaena* sp., *Oscillatoria* sp., *Microcystis aeruginosa*, *Euglena* sp., *Ankistrodesmus* sp., *Cosmarium granatum*, *Volvox* sp., *Diatoma* sp., *Fragilaria* sp., *Gyrosigma* sp., *Synedra* sp., *Pinnularia* sp., *Navicula* sp., *Arcella* sp., *Brachionus* sp., *Keratella* sp., *Lecane* sp., *Trichocerca* sp., *Filinia* sp., *Daphnia* sp., *Alona* sp., *Bosmina* sp., *Bosminopsis* sp., *Chydorus* sp., *Simocephalus* sp., *Cyclops* sp., *Diaptomus* sp. Fish diversity portrayed by 22 species of fishes belonging to 21 genera, 10 families and 5 orders. The have been recorded in Sibnarayanpur Anua were *Gudusia chapra*, *Securicula gora*, *Salmophasia bacaila*, *Cirrhinus cirrhosus*, *Chela laubuca*, *Esomus danricus*, *Labeo rohita*, *Labeo gonius*, *Puntius ticto*, *P. conchoniis*, *Catla catla*, *Osteobrama cotio*, *Rita rita*, *Clupisoma garua*, *Eutropiichthys vacha*, *Clarias batrachus*, *Xenentodon cancila*, *Monopterusuchia*, *Macrognaathus pancalus*, *Mastacembelus armatus*, *Chanda nama*, *Badis badis* (Table 2). *Gudusia chapra* usually depicted the maximum fish yield (c 66.3 % of the total yield) followed by *Salmophasia bacaila* (c 27.2%).

Fulbari Anua

Fulbari Anua (24° 51' 16.5" N and 92° 39' 11.9" E) is an oxbow wetland which is situated at c 46 km from Silchar city. It lies within Katigora Revenue Circle in Cachar district of Assam. The catchment soil is mostly loamy. Riparian vegetation is scanty. Riparian land use pattern involves human habitation, fishing, etc. AM included *Cynodon dactylon*, *Eichhornia crassipes*, *Hydrilla verticillata*, *Hygrorrhiza aristata*, *Ipomoea aquatica*, *Jussiaea repens*, *Nymphaea nouchali*, *Nymphoides cristatum*, *Nymphoides indicum*, *Salvinia cucullata*, *Trapa bispinosa*, *Polygonum flaccidum*, *Pistia* sp. Nevertheless, the water of this Oxbow wetland portrayed usual

values of ecological parameters.

Plankton consisted of forms like *Nostoc* sp., *Anabaena* sp., *Microcystis aeruginosa*, *Euglena* sp., *Ankistrodesmus* sp., *Cosmarium granatum*, *Stauroastrum* sp., *Volvox* sp., *Ceratium* sp., *Diatoma* sp., *Fragilaria* sp., *Gyrosigma* sp., *Synedra* sp., *Pinnularia* sp., *Navicula* sp., *Arcella* sp., *Brachionus* sp., *Keratella* sp., *Lecane* sp., *Trichocerca* sp., *Filinia* sp., *Daphnia* sp., *Ceriodaphnia* sp., *Alona* sp., *Bosmina* sp., *Chydorus* sp., *Scapholeberis* sp., *Simocephalus* sp., *Cyclops* sp., *Diaptomus* sp. Fish diversity portrayed 7 species of fishes belonging to 6 genera, 6 families and 6 orders, viz., *Gudusia chapra*, *Puntius ticto*, *Mystus cavasius*, *M. bleekeri*, *Macrognaathus pancalus*, *Parambassis ranga*, *Channa punctata* (Table 2). *Gudusia chapra* generally showed maximum fish yield (c 76 % of total yield) followed by *Puntius ticto* (c 21 %).

Rupairbali Anua

Rupairbali Anua (24° 47' 7.9" N and 92° 55' 23.5" E) is an oxbow wetland which is abandoned segment of river Barak situated at c 20 km from Silchar city. It lies within the jurisdiction of Sonai Revenue Circle in Cachar district of Assam. The catchment soil is mostly loamy. AM included *Azolla pinnata*, *Cynodon dactylon*, *Eichhornia crassipes*, *Hygrorrhiza aristata*, *Jussiaea repens*, *Nymphoides cristatum*, *Salvinia cucullata*, *Vetiveria zizanioides*, *Lemna* sp. However, the wetland is almost totally choked with *Eichhornia crassipes* due to very high level of eutrophication.

Plankton included forms like *Nostoc* sp., *Microcystis aeruginosa*, *Euglena* sp., *Pinnularia* sp., *Navicula* sp., *Arcella* sp., *Brachionus* sp., *Daphnia* sp., *Ceriodaphnia* sp., *Bosmina* sp., *Chydorus* sp., *Cyclops* sp., *Diaptomus* sp. Incidentally, the water of this anua depicted usual values of physico-chemical parameters (Table 1). Fish diversity is portrayed by 24 species of fishes belonging to 21 genera, 15 families and 9 orders have been recorded in this Anua. These are as follows:

Gudusia chapra, *Notopterus notopterus*, *Amblypharyngodon mola*, *Labeo gonius*, *Puntius conchoniis*, *Puntius ticto*, *Securicula gora*, *Botia dario*, *Lepidocephalichthys guntea*, *Mystus cavasius*, *Ompok bimaculatus*, *Xenentodon cancila*, *Aplocheilus panchax*, *Parambassis* sp., *Parambassis ranga*, *Chanda nama*, *Badis badis*, *Oreochromis mossambica*, *Glossogobius giuris*, *Anabas testudineus*, *Trichogaster fasciata*, *Trichogaster lalius*, *Macrognaathus pancalus*, *Tetraodon cutcutia* (Table 2). *Gudusia chapra* usually showed the highest fish yield (c 73% of the total yield) followed by *Puntius*, *Badis*, *Mystus*, etc.

Algapur Anua

Algapur Anua (24° 46' 37.8" N and 92° 53' 31" E.) is an oxbow wetland, as an abandoned segment of river Barak, is situated at c 18 km from Silchar city. The catchment soil is mostly silty loam. Riparian vegetation is scanty. Riparian land use pattern involves human habitation, fishing, etc. The water of this anua displayed usual values of limnological parameters of its water (Table 1). AM included *Alternanthera sessilis*, *Cynodon dactylon*, *Eichhornia crassipes*, *Hydrilla verticillata*, *Hygrorhiza aristata*, *Jussiaea repens*, *Nymphaea nouchali*, *Nymphoides cristatum*, *Salvinia cucullata*, *Trapa bispinosa*, *Polygonum flaccidum*, *Lemna* sp., *Pistia* sp.

Plankton included forms like *Nostoc* sp., *Spirogyra* sp., *Microcystis aeruginosa*, *Euglena* sp., *Ankistrodesmus* sp., *Clostridium* sp., *Cosmarium granatum*, *Volvox* sp., *Fragilaria* sp., *Gyrosigma* sp., *Synedra* sp., *Pinnularia* sp., *Navicula* sp., *Arcella* sp., *Brachionus* sp., *Keratella* sp., *Lecane* sp., *Filinia* sp., *Daphnia* sp., *Ceriodaphnia* sp., *Chydorus* sp., *Macrothrix* sp., *Cyclops* sp., *Diaptomus* sp.

Fish diversity is depicted by ichthyospecies like *Gudusia chapra*, *Amblypharyngodon mola*, *Puntius ticto*, *Botia dario*, *Lepidocephalichthys guntea*, *Mystus vittatus*, *Xenentodon cancila*, *Channa punctata*, *Badis badis*, *Anabas testudineus*, *Macrogathus aral*, *Macrogathus pancalus*. *Gudusia chapra* usually showed maximum Fish yield (c 52 % of the total yield) followed by *Puntius ticto* (c 18 %).

Silghat Anua

Silghat Anua (24° 47' 45.5" N and 92° 54' 27.1" E) is an oxbow wetland which is situated at c 15 km from Silchar city. The catchment soil is mostly loamy. Riparian vegetation is scanty. Riparian land use pattern involves human habitation, fishing, etc. AM included forms like *Alternanthera sessilis*, *Cynodon dactylon*, *Eichhornia crassipes*, *Hygrorhiza aristata*, *Jussiaea repens*, *Nymphoides indicum*, *Oryza sativa*, *Salvinia cucullata*, *Trapa bispinosa*, *Polygonum flaccidum*, *Lemna* sp.

Plankton included forms like *Nostoc* sp., *Microcystis aeruginosa*, *Euglena* sp., *Ankistrodesmus* sp., *Cosmarium granatum*, *Volvox* sp., *Ceratium* sp., *Synedra* sp., *Pinnularia* sp., *Navicula* sp., *Arcella* sp., *Brachionus* sp., *Keratella* sp., *Lecane* sp., *Filinia* sp., *Daphnia* sp., *Ceriodaphnia* sp., *Chydorus* sp., *Macrothrix* sp., *Cyclops* sp., *Diaptomus* sp. Incidentally, the water of this anua depicted usual values of physico-chemical parameters.

Fish diversity portrayed by *Gudusia chapra*, *Amblypharyngodon mola*, *Puntius ticto*, *Salmophasia bacaila*, *Mystus vittatus*, *Channa punctata*, *Badis badis*, *Anabas testudineus*, *Trichogaster lalius*, *Macrogathus aral*.

Gudusia chapra usually showed maximum fish yield (c 59 % of total yield) followed by *Puntius ticto* (c 26 %).

Dungripar Anua

Dungripar Anua (24° 44' 40.9" N and 92° 54' 53.0" E) is an

oxbow wetland (also being an abandoned segment of river Barak). It is situated at c 20 km from Silchar city. The catchment soil is mostly loamy. Riparian vegetation is scanty. Riparian land use pattern involves human habitation, fishing, etc. Incidentally, the water of this anua depicted almost a usual pattern of physico-chemical parameters (Table 1). AM included forms like *Alternanthera sessilis*, *Cynodon dactylon*, *Eichhornia crassipes*, *Hygrorhiza aristata*, *Jussiaea repens*, *Nymphoides indicum*, *Salvinia cucullata*, *Trapa bispinosa*, *Polygonum flaccidum*, *Lemna* sp.

Plankton included forms like *Nostoc* sp., *Microcystis aeruginosa*, *Euglena* sp., *Ankistrodesmus* sp., *Volvox* sp., *Synedra* sp., *Pinnularia* sp., *Navicula* sp., *Brachionus* sp., *Keratella* sp., *Lecane* sp., *Trichocerca* sp., *Filinia* sp., *Daphnia* sp., *Ceriodaphnia* sp., *Alona* sp., *Chydorus* sp., *Scapholeberis* sp., *Simocephalus* sp., *Cyclops* sp., *Diaptomus* sp.

Fish diversity portrayed by *Gudusia chapra*, *Amblypharyngodon mola*, *Puntius ticto*, *Salmophasia bacaila*, *Mystus vittatus*, *Channa punctata*, *Badis badis*, *Trichogaster lalius*, *Macrogathus aral*. *Gudusia chapra* generally depicted maximum fish yield (c 78 % of the total yield) followed by *Puntius ticto* (c 12 %), and so on.

Ramnagar Anua

Ramnagar Anua (N 24° 49' 54.2" E 92° 45' 50.7") is an oxbow wetland which is situated at c 5 km from Silchar city. The catchment soil is mostly loamy. Riparian vegetation is scanty. Riparian land use pattern involves habitation, fishing, etc. It is notable here that, the water of this anua depicted usual values of physico-chemical parameters (Table 1). AM included *Alternanthera sessilis*, *Cynodon dactylon*, *Eichhornia crassipes*, *Eleocharis acutangula*, *Hygrorhiza aristata*, *Jussiaea repens*, *Nymphoides indicum*, *Salvinia cucullata*, *Trapa bispinosa*, *Polygonum flaccidum*, *Lemna* sp.

Plankton consisted of forms like *Anabaena* sp., *Oscillatoria* sp., *Microcystis aeruginosa*, *Euglena* sp., *Ankistrodesmus* sp., *Cosmarium granatum*, *Volvox* sp., *Synedra* sp., *Pinnularia* sp., *Navicula* sp., *Arcella* sp., *Brachionus* sp., *Keratella* sp., *Lecane* sp., *Trichocerca* sp., *Filinia* sp., *Alona* sp., *Chydorus* sp., *Macrothrix* sp., *Simocephalus* sp., *Diaptomus* sp.

Fish diversity portrayed by ichthyospecies like *Gudusia chapra*, *Amblypharyngodon mola*, *Puntius ticto*, *Salmophasia bacaila*, *Lepidocephalichthys guntea*, *Mystus bleekeri*, *Clarias batrachus*, *Xenentodon cancila*, *Channa punctata*, *Badis badis*, *Anabas testudineus*, *Trichogaster lalius*, *Macrogathus aral*, *Macrogathus pancalus*. *Gudusia chapra* usually depicted maximum fish yield (c 82 % of total yield) followed by *Puntius ticto* (c 6 %).

Salchakra Anua

Salchakra Anua (24° 49' 26.3" N and 92° 39' 55.5" E) is an oxbow wetland situated at c 18 km from Silchar city. The catchment soil is mostly loamy. Riparian vegetation is scanty. Riparian land use pattern involves human habitation, fishing, etc. Incidentally, the water of this anua depicted usual values

of physico-chemical parameters (Table 1). AM included *Azolla pinnata*, *Cynodon dactylon*, *Eichhornia crassipes*, *Trapa bispinosa*, *Oryza sativa*, *Hydrilla verticillata*, *Vallisneria spiralis*, *Nymphoides indicum*, *Nymphaea nouchali*.

Plankton included *Nostoc* sp., *Volvox* sp., *Gyrosigma* sp., *Synedra* sp., *Pinnularia* sp., *Navicula* sp., *Centropyxis* sp., *Brachionus* sp., *Keratella* sp., *Lecane* sp., *Trichocerca* sp., *Filinia* sp., *Daphnia* sp., *Alona* sp., *Bosmina* sp., *Cyclops* sp., *Diaptomus* sp.

Fish diversity portrayed by ichthyol species like *Gudusia chapra*, *Amblypharyngodon mola*, *Puntius chola*, *Salmophasia bacaila*, *Mystus vittatus*, *Badis badis*, *Anabas testudineus*, *Trichogaster lalius*, *Macrornathus aral*, *Mastacembelus armatus* *Gudusia chapra* usually showed maximum fish yield (c 62 % of the total yield) followed by *Puntius* (c 18 %).

Discussion

These typical oxbow wetlands (locally called 'Anua') situated in the North-East region of India are unique lentic systems, potentially very much significant for : (a) Aquaculture; (b) Water storage and supply to human habitation; (c) Aqua sports and Aqua tourism; and (d) Flood mitigation (which is sometimes a recurring event in this part of the globe). These potential aquatic systems could also serve as excellent sites of 'aquatic sanctuary' in the event of fast depletion of coveted aquatic biodiversity. The potentials and problems associated with these oxbow wetlands ('Anua') have been well portrayed in Table 3. Incidentally, the fishes of these oxbow wetlands had since been affected by the *hithetto* unknown virulent fish disease called the Epizootic Ulcerative Syndrome (EUS), which had been sweeping the freshwater fishes of the earth unhindered, unimpeded, and unabated semi-globally since the 1970s causing colossal loss to the fish biodiversity [4].

Table 3: Potentials and problems of the Anua (oxbow wetlands) in Assam.

Name	Potentials	Problems
Baskandi Anua	Potential site for IMC culture	Weeds
Algapur Anua	Potential site for IMC culture	Weeds
Silghat Anua	Potential site for IMC culture	Weeds
Rupairbala Anua	Potential site for IMC culture	Weeds
Dungripar Anua	Potential site for IMC culture	Weeds
Satkarakandi Anua	Potential site for IMC culture	Weeds
Ram Nagar Anua	Potential site for IMC culture	Weeds
Salchapra Anua	Potential site for IMC culture	Not much weeds, less problematic
Fulbari Anua	Potential site for IMC culture	Not much weeds, less problematic
Sibnarayanpur	Potential site for IMC culture	Not much weeds, less problematic

References

- Kar D (2007) Fundamentals of Limnology and Aquaculture Biotechnology. In: Daya Publishing House, New Delhi, India.
- Kar D (2013) Wetlands and Lakes of the World. In: Springer, London.
- Kar Devashish (2019) Wetland's diversity and their fishes in Assam, India. *Transylvanian Review of Systematical and Ecological Research* 21(3): 47-80.
- Kar D (2015) Epizootic Ulcerative Fish Disease Syndrome. In: Elsevier, Academic Press, USA.



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