

Diversity of Aquatic Macrophytes of Sankar Beel (Wetland) of Golaghat District of Assam with Special Reference to Physicochemical Water Quality Parameters

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Received May 01, 2022; Revised June 03, 2022; Accepted June 16, 2022

Abstract The Sankar Beel (wetland) (N 26031'57.0936 and E 93053'0.0006) is considered to be one of the main wetlands of Golaghat serving as home to a wide range of plant and animal species. The aquatic macrophytes are the chief source of food, and fodder for the aquatic ecosystem of the Beel because of their diversity and abundance. Most of the aquatic macrophytes are naturally occurring, well adapted for their surroundings, and play an important role in balancing the ecosystem of the wetland. The aquatic macrophytes which are available can improve the quality of water by absorbing nutrients with their effective root systems and thus control the level of water pollution. Moreover, the wetland may be a good habitat for migratory birds also. However, the rapidly increasing human population, large-scale changes in land cover, and various urban development lead to wetland degradation and are considered to be a big challenge to the entire human community. Therefore necessary actions like conservation, preservation of the aquatic species, and development of the wetland are of utmost necessity to solve the problems.

Keywords: Sankar Beel, macrophytes, ecosystem, development, Golaghat

Cite This Article: Anima Kutum, Mridul Chetia, Chayanika Bordoloi, and S. P Saikia, "Diversity of Aquatic Macrophytes of Sankar Beel (Wetland) of Golaghat District of Assam with Special Reference to Physicochemical Water Quality Parameters." *Applied Ecology and Environmental Sciences*, vol. 10, no. 6 (2022): 394-398. doi: 10.12691/aees-10-6-9.

1. Introduction

In terms of human development and land use, wetlands have often been viewed as wastelands or areas with limited development potential. Historically wetlands have been drained or filled-in so that the land area could be "used for beneficial human purposes". The importance of wetlands has changed with time and they are now considered as some of the most important bio-diverse areas of the world and productive ecosystem where terrestrial and aquatic habitats converge. Wetlands are vital for human survival as they provide countless benefit to humanity ranging from fresh water supply, food and building materials, control of flood and erosion and biodiversity. The wetlands are reservoirs of many biologically diverse vegetation, aquatic macrophytes being one of them. Aquatic macrophytes refer to the macroscopic plants like angiosperms, ferns, mosses, liverworts, and some freshwater macro-algae that occur seasonally or permanently in wet environments [1]. These aquatic macrophytes may be classified into waterlogged,

aquatic, floating aquatic, growing aquatic, free-floating, and marshy are amphibious [2,3]. The aquatic macrophytes found in wetlands are the chief source of food, and fodder in the aquatic ecosystem because of their diversity and abundance. The aquatic macrophytes are abundantly found in the fresh water, perennial, large, lentic water bodies commonly known as beel in Assam [4]. Beel is a significant productive ecosystem that can successfully convert solar energy into organic carbon in the presence of rich nutrients available from natural sources. The investigations carried out by CIFRI showed that the rate of primary productivity through macrophyte and plankton phases from floodplain wetlands is many times higher than those reported from other inland open water ecosystems. Thus the growing fish in the suitable environment of the beel is an effective way of using natural resources for the betterment of man. The beel ecosystem is extraordinarily complex with wide temporal and spatial variations of many key parameters including depth, nature of catchment area or river basin, precipitation and duration of connection to the river, etc. Of their high nutrient status, warmer water regime, and rich sunshine, the beels of Assam are considered to be a

highly productive ecosystem. Many of them are passing through transient phases of eutrophication leading to weed choking (Bull. No.104, November 2000, CICFRI, West Bengal [10]). These water bodies are extremely rich in nutrients as reflected by rich organic carbon and high levels of available nitrogen and phosphorus in the soil. But, generally, the nutrients are locked up in the form of large aquatic plants, especially water hyacinth, which are not readily available as food for fish. Decaying weeds are the main source of organic detritus at the bottom which normally support good bottom macrofauna, comprising mainly molluscs. However, sometimes, excessive deposition of organic matter leads to anaerobic conditions. Similarly, due to the acidic nature of the soil-water interface, the release of nutrients from the soil to water is hampered (Bull. No.104, November 2000, CICFRI, West Bengal [10]).

The aquatic macrophytes which are available can improve the quality of water by absorbing nutrients with their effective root systems and thus controls the pollution level of water. Moreover, the wetland may be a good habitat for migratory birds also. Several works relating to aquatic macrophytes have been carried out in various parts of the Assam by Baruah *et. al.*, [5], Saikia [6], Dutta [7], Dutta *et. al.*, [8]. But there is no report of systematic investigation of Sankar Beel, the main wetland of Golaghat of Assam till today. With the rapidly increasing human population, and large-scale change in land cover; various urban developments led to wetland degradation and are considered to be a big challenge to the entire human community. Therefore necessary actions like conservation, preservation of the aquatic species, and development of the wetland are of utmost necessity to solve the problems of Sankar beel. Considering all these things the following objectives have been taken for the present study.

1.1. Objectives

- * To study the diversity of aquatic macrophytes of Sankar Beel (Wetland) of the Golaghat district of Assam.
- * To analyze the water quality parameters and their correlation with the diversity of the macrophytes.
- * Action is taken for conservation and development of the study area.

2. Materials and Methods

2.1. Study Area

In Brahmaputra valley, there are about 342 beels located in Central Assam covering an area of 31,080 ha (approx.) followed by 352 beels in lower Assam and 376 beels in upper Assam covering an area of 29,000 ha and 23,000 ha (approx.) respectively. On the other hand, there are about 322 beels with a water cover of 8000 ha in three districts of Barak valley (Bull. No.104, November 2000, CICFRI, West Bengal). There are about 68 numbers of beels in the Golaghat district of Assam among which Sankar beel (study area) is located 26031'57.0936 N to 26033'8.586 N & 93053'0.0006 E to 93050'45.48516 E is a perennial freshwater wetland which has economic importance as well as plays an important role in maintaining the ecological balance of the wetland system. The beel is bounded by Bhulaguri mouja to the north, the Lurukighat to the south, Abarghat to the west, and Adhar hate to the east. Sankar beel is the original from Dhansiri rive of Golaghat. Dhanshri is the principal river, which originates from the Laisang peak of Nagaland. The length of the Sankar beel is 3km and the breadth is 400m. The total area of the beel is 30 ha. The Figure 1A shows the location map of Golaghat district of Assam.

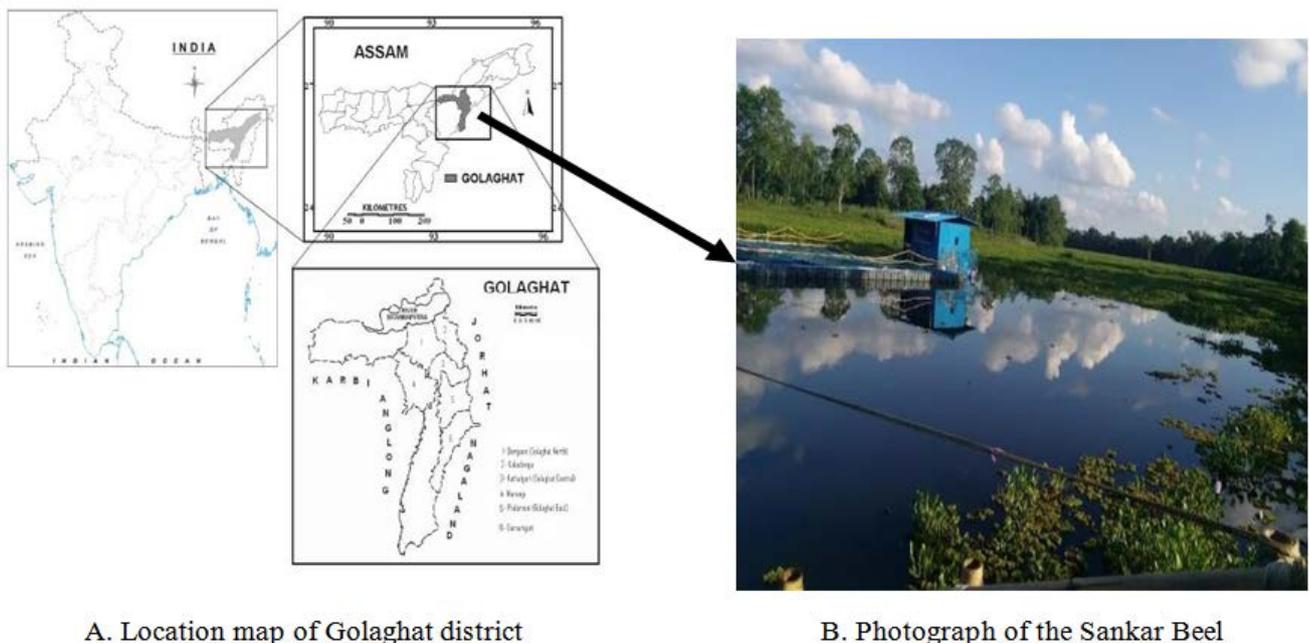


Figure 1.

2.2. Collection of Samples and the Analysis

A random sampling method was applied for the collection of samples of aquatic macrophytes of the Sankar Beel and the identification of the macrophytes has been carried out by consulting with the state flora of the region such as Flora of Assam, vol. 1-5 [9] and using digital herbaria. A total of 10 aquatic macrophytes found in Sankar Beel of Golaghat district of Assam have been recorded among which *Eichhornia crassipes* (Mart.) S.L., *Salvinia molesta* Mitcheel., *Colocasia esculenta* L. are dominating species. The whole process takes almost 1 year of study from January 2020 to December 2021. Water samples of the beel were collected by following the standard procedure of Environmental Protection (Water) Policy, 2009- Monitoring and Sample Manual, Physical

and Chemical Assessment, Version: June 2018. The Water quality parameters like temperature, pH, Total Hardness (TH), Ammonia, Nitrate, Arsenic, Fluoride, salinity, TDS, DO, turbidity and COD, etc. were analysed for the present study following standards procedures of APHA [11] and Trevedy and Goel [12].

3. Results

A total of 10 aquatic macrophytes found in Sankar Beel of Golaghat district of Assam have been recorded among which *Eichhornia crassipes* (Mart.) S.L., *Salvinia molesta* Mitcheel., *Colocasia esculenta* (L.) Vent are dominating species. The Table 1 shows the description of the aquatic macrophytes of Sankar Beel collected and identified so far.

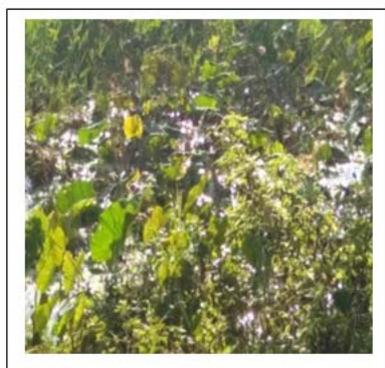
Table 1. THE LIST OF DOMINANT AQUATIC MACROPHYTES SPECIES OF SANKAR BEEL OF GOLAGHAT

Sl no	Scientific name	Family	Local name	Habitat	Life Form
1	<i>Colocasia esculenta</i> L.	Araceae	Kola kochu	Perennial	SM
2	<i>Alpinia allughas</i> (Retz.)Rosc.	Zingiberaceae	Tora	Perennial	SM
3	<i>Alternanthera philoxeroides</i> (Mar) Griseb.	Amaranthaceae	Helesi sak	Perennial	EA
4	<i>Ceratopteris thalictroides</i> Brobn	Perkariaceae	Pani dhekia	Annual	SS
5	<i>Eichhornia crassipes</i> (Mart.) S.L.	Pontederiaceae	Bihmeteka	Perennial	FF
6	<i>Nymphaea nouchali</i> Burm.f.	Nymphaeaceae	Rongabhet	Perennial	RFL
7	<i>Pistia stratiotes</i> L.	Araceae	Borpuni	Annual	FF
8	<i>Polygonum hydropipper</i> L.	Polygonaceae	Pothura bihlongni	Annual	EA
9	<i>Salvinia molesta</i> Mitcheel	Salviniaceae	Puni	Annual	FF
10	<i>Xanthium strumarium</i> L.	Asteraceae	Agora	Perennial	SM

SM=Swampy and Marshy, EA= Emergent Anchored, FF= Free Floating, RFL= Rooted with Floating Leaved, SA= Submerged Anchored, SS= Submerged Suspended.



Salvinia molesta Mitcheel



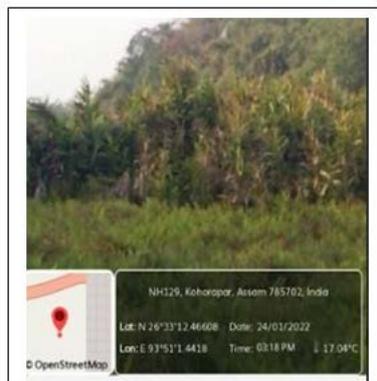
Alocasia indica (Lour) Koch



Ipomoea carnea Jace.



Nymphaea nouchali Burm



Alpinia allughas (Retz.) Rosc.



Road side view of the Beel

Figure 2. Photographs of different dominating species of aquatic macrophytes of Sankar Beel of Golaghat

The [Figure 2](#) shows the photographs of different dominating species of aquatic macrophytes of Sankar Beel of Golaghat of Assam that identified and recorded during our study.

Table 2. RESULTS OF WATER QUALITY PARAMETERS OF SANKAR BEEL

Sl No.	Parameters	Concentration range in ppm except pH and Turbidity
1.	Temperature (°C)	18-28
2.	Turbidity (NTU)	8-30
3.	pH	6.5-8.5
4.	DO	4.0-12.4
5.	T Alkalinity (TA)	20.0 to 210.0
6.	Total Hardness (TH)	90.0-298
7.	Ammonia	0.05-3.0
8.	Nitrate	1.0-5.0
9.	Arsenic	0.0
10.	Fluoride	0.0
11.	COD	75-100.0

The water quality parameters selected for analysis were temperature, pH, Total Hardness (TH), Ammonia, Nitrate, Arsenic, Fluoride, salinity, TDS, DO, turbidity and COD, etc. Temperature of the water samples were recorded with the help of digital thermometer, pH of the water samples were analysed by Pocket pH meter during the time of collection of the water samples. Total hardness of the samples were analysed by the method of titration. The ammonia, nitrate contents of the water samples were determined by using Kits purchased from HiMedia Laboratories Pvt. Ltd. Arsenic and fluoride contents of the samples were determined by using Testing Kits purchased from HiMedia Laboratories Pvt. Ltd. The salinity, TDS, DO, Turbidity were analysed by using standard water

testing kit. COD of the samples were analysed by using COD digester available in the laboratory of the Chemistry department of the College. The water quality profile of the Sankar Beel of Golaghat of Assam is given in [Table 2](#). The graphical representation of concentration of different water quality parameters was shown in bar diagram. From investigation, it is observed that in the floodplain wetlands, the quality of water is influenced mainly by the inflow of water from the connecting rivers, and local catchment areas as well as by the metabolic processes of plants and animals living within the water body.

The water temperature of the beels ranged from 18 to 28 degrees centigrade. Analysis reveals that water of the beel in the monsoon session (June -September) is turbid while the rest of the time especially in the winter session (November-February) water is slight to moderately transparent. In general, turbidity in beel water was mainly due to silt and organic debris carried by the run-off waters. The pH of the water samples of the beel was recorded at 6.5 to 8.5 and which was influenced mainly by basin soil and by aquatic vegetation. The dissolved oxygen level of water of Sankar beel was observed at ranges from 4.0 to 12.4 ppm which is within the optimal range for the growth of fishes. The analysis showed that concentrations of total alkalinity and total hardness of water samples of Sankar Beel ranged from 20 to 210 ppm and 90 to 298 ppm respectively. The concentration of ammonia and nitrate in the water samples of Sankar beel was recorded to be 0.05 to 3.0 ppm and 1.0 to 5.0 ppm respectively. No arsenic and fluoride were detected in water samples of Sankar beel which is a very good sign of no arsenic and fluoride toxicity because a few people used the beel water for drinking and other purposes. The chemical oxygen demand was found to range from 75 to 100ppm. The [Figure 3](#) shows the graphical representation of different water quality parameters of the beel.

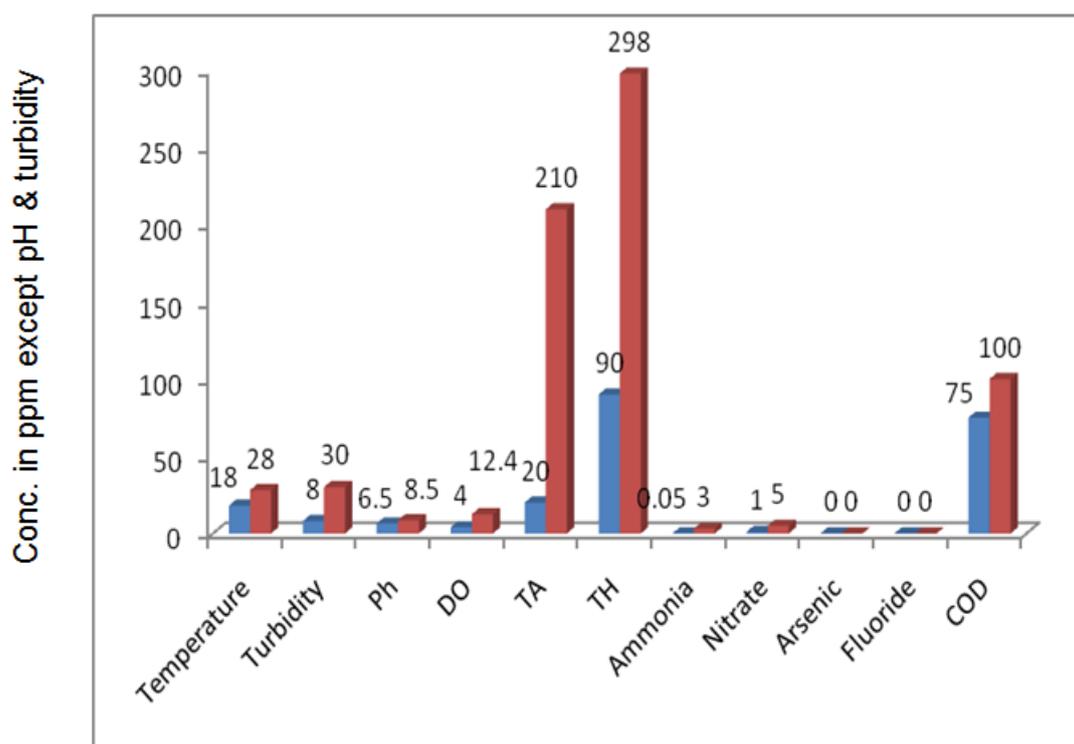


Figure 3. Graphical representation of water quality parameters of Sankar Beel

4. Discussion

The overall water quality of the beel was fair with some deterioration during summer. The study also indicated a slight gradual deterioration of beel every year during summer and post-monsoon. Planning for better management of the beel should be of utmost importance for its sustenance. Biotic communities of beel, thus adapt themselves to spatial and temporal fluctuation leading to a high degree of floral and faunal diversity. Phytoplanktons bearing photosynthetic pigments make use of the rich inorganic nutrients available in the beel ecosystem and synthesize organic matter. Thus, they form the base of the ecological pyramid. Zooplankton, on the other hand, lives on the huge reserve of organic matter of plants or animal origin, both in live and dead form (detritus). Thus, zooplankton is the secondary producer linking the phytoplankton with the communities occupying higher trophic levels. Zooplanktons in beels play a vital role in making efficient use of dead and living organic matter. Both zoo and phytoplankton form direct food and thereby sustain a substantial portion of planktivorous fishery of beel resources.

5. Conclusion

The wetlands which were once considered as wastelands, now receive special protection both from state and public due to their natural function and utilization for the benefits of mankind. Ramsar Convention which came into force in 1975 is one such initiatives which aims at the conservation of wetlands and preservation of their ecological characters. The present study also aims at the conservation and development of Sankar beel which is one of the biologically rich wetlands of Golaghat district of Assam. The results of this analysis reveal that maximum values of the diversity of macrophytes were found during the summer season of the study period. It may be due to the luxuriant growth of the macrophytes due to the availability of water along with the nutrients leached from the catchment areas of the wetland during the summer season. During the winter season diversity of macrophytes was found to decrease due to the scarcity of water levels of the wetland as well as the removal of aquatic macrophytes by the fishermen communities living surrounding the wetland areas for fishing purposes. Based on the above results it can be concluded that the wetland of the Sankar beel showed a high diversity of macrophytes during the summer season. A large part of the beel is now covered by water hyacinth. The influence of anthropogenic disturbances such as intensive fishing activities, settlements, and permanent agriculture which are steadily encroaching on the beel and the extent of the

marsh vegetations affect the species biodiversity of Sankar beel. The biologically diverse beel of Golaghat of Assam supports many aquatic and terrestrial species, including some globally threatened species. At the same time this beel is important to the livelihood of the local population as it provides opportunities for fishing and collection of other wetland biological resources. As a consequence, the quality of water of the beel is very important both economically and environmentally. Therefore proper conservation measures should be taken for sustainable livelihood and existence of this beel.

Acknowledgements

The author is very thankful to the head of the department, department of Chemistry, Debraj Roy College, Golaghat, Assam for giving the laboratory facilities for analyzing the selected water quality parameters for water samples of the wetland.

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