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# Survey on aquatic macrophytes and physico-chemical quality of water from Satla Beel of Barishal district, Bangladesh

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**Abstract**
Preliminary taxonomic survey on aquatic plants of Satla Beel was conducted from May 2021 to August 2021. A complete of thirty aquatic plant species under twenty families was recorded from Satla Beel. Ecological habitats of hydrophyte species showed variations. The Study was conducted to estimate the diversity of aquatic macrophytes and the physico-chemical parameters of water from four different locations in study area. The chosen parameters were water depth, electric conductivity, pH, salinity, total dissolved solid (TDS), phosphate and dissolved oxygen (DO). Water depth fluctuated from 152 cm to 213 cm, conductivities ranged from 0.23 ms/cm to 0.29 ms/cm, pH scale ranged from 6.60 to 7.60, salinity ranged from 132 to 148 ppm and TDS from 349 ppm to 393 ppm. Mean DO and phosphate were recorded as 3.28 mg/L and 762.25 µg/L, respectively.

**Keywords:** Satla Beel, wetland, taxonomic survey, aquatic macrophytes, water quality

## Introduction
Bangladesh is one amongst the deltaic region countries in South-east Asia. In step with Akonda [1], nearly 7-8 million angular ditch of wetlands do exist in Bangladesh. These embrace rivers, haors, baors, beels, true lakes, artificial lakes, ponds, floodplains and reservoirs. They're enjoying vital role within the ecology of the country. Aquatic macrophytes play a crucial role in structuring communities in aquatic environments. Macrophytes colonize many various types of aquatic ecosystems, such as lakes, reservoirs, wetlands, streams, rivers, marine environments and even rapids and falls (e.g., family Podostomaceae). Bangladesh supports a lots of aquatic plant species due to her geomorphological location and also the presence of huge number of water bodies and flood plains.
The ground system of Bangladesh consists of over 700 rivers, streams, varied haors, baors, beels, seasonal and perennial flood plain etc [2]. Bangladesh could be a country of numerous wetlands. According to the definition of wetlands enunciated by the Ramsar convention has outlined as "areas of marsh, fen, peat land or water, whether or not natural or artificial, permanent or temporary, with water that's static or flowing, fresh, salt or salt, as well as areas of marine water the depth of that at low tides doesn't exceed six meters". So the term wetlands teams along a good vary of up country, coastal and marine habitats that share a variety of common options [3], regarding eighty percent of the country are often outlined as wetlands. Commonly rivers, Haors, Baors, Beels and Jheels are known as freshwater wetlands. A complete of 200-300 plant species in Bangladesh are considered to be ground species for all or a part of their life spans [4].
These aquatic plant species have the good potentialities in the sector of ecology, environment and economics. Unfortunately little attention was paid on the aquatic angiosperms of Bangladesh except Khan and Halim [5]. Lakes and surface water reservoirs are freshwater resources and provide innumerable benefits. Lakes are stagnant surface water bodies, receive and stores rain fall water. The physical and chemical characteristics of water are important parameters as they directly or indirectly affect its quality and consequently [6]. Increased anthropogenic activities in and around the water bodies destroy the aquatic ecosystems and ultimately the physico-chemical properties of water [7].

Satla beel has a unique vegetation style, predominantly occupied by different water lilies.However, there are also a large number of different aquatic macrophytes present in this wetland. A number of limnological and taxonomic surveys were conducted before on different natural wetlands of Bangladesh [8, 9, 10] but none of them encompassed this vast natural wetland. Moreover, the water quality of this wetland had not been studied before. So, our current research was aimed to survey the diversity of aquatic macrophytes and determination of physico-chemical properties of water from Satla beel.

## 2. Materials and Methods

### 2.1 Study site

Satla Beel is placed within the satla (village), satla (union) of Wazipur, Barishal, Bangladesh. The area of the beel is regarding two hundred acres which is sixty km far from Barishal town, Bangladesh. The beel is named "shaplar beel" because the total space of the beel is packed with shapla (water lilies).The study was conducted at Satla beel area Wazipur, Barishal throughout May 2021 to August 2021. The geo-location of Satla beel latitude ($22^0$ 55'3"N) and line of longitude ($90^0$ 4'35"E).

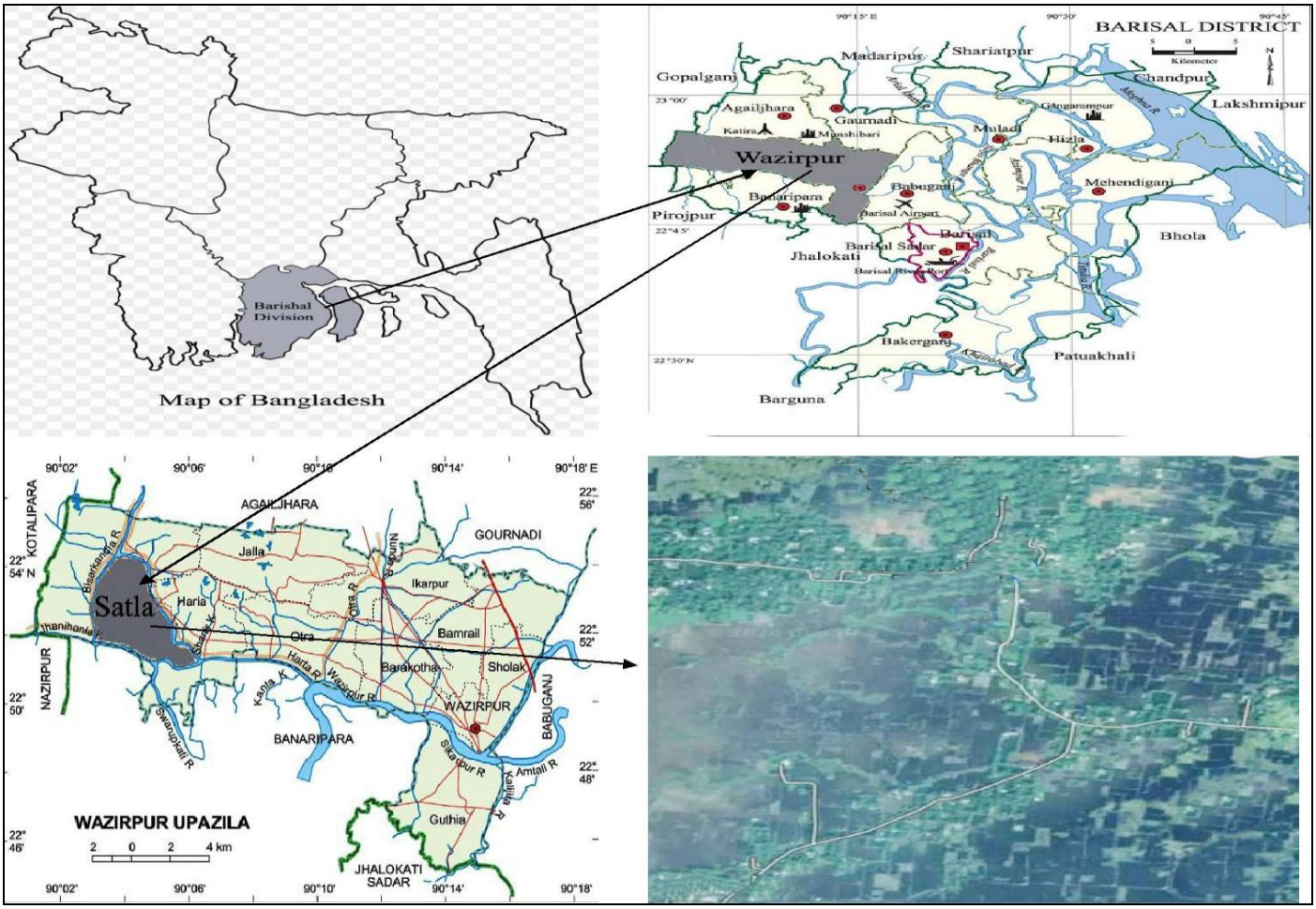


**Fig 1:** Maps showing the study area (Satla Beel, Wazirpur, Barishal, Bangladesh).

### 2.2 Collection of samples

Aquatic macrophytes samples were collected from the satla beel area. These samples were collected from numerous sites of the beel. These aquatic macrophytes were collected with facilitate of boatmen. Samples were manually collected from the sampling spots. Samples were brought to the MS laboratory of department of Botany, University of Barishal, Bangladesh immediately and preserved in 10% formalin for further classification and identification.

### 2.3 Water quality assessment

To study the physico-chemical properties of the water content, water samples were collected from the beel surface using a clean plastic bottles instrumentality. Samples were collected throughout morning hours in between 8.00 am to 10.00 am. The physical and chemical parameters were analyzed. The parameters were the water pH, electric conductivity, water colors, water depth, salinity, total dissolved solid and water temperature. The water temperature and color transparency were measured on spot. The remaining parameters were analyzed now when returning to Laboratory of Botany Department of Barishal University.

The water depth was measured employing a rope alongside a medium sized stone tied at one end of it and a meter tape. Transparency was measured using a secchi disc. Dissolved Oxygen (DO) of water was determined with the aid of DO30 portable dissolved oxygen meter. Water color was recorded counting on visual look. The conductivity was measured with the assistance of “Pocket Multiparameter” and recorded (HANNA Instruments, Romania; model: DiST4, HI98304). Hydrogen-ion-concentration (pH) of the water body was analyzed with the assistance of pH scale meter “Pocket Multiparameter” (HANNA Instruments, Romania; model: HI98108). Phosphate content of water was analyzed according to Hasan *et al.* [11].

### 2.4 Identification

For the identification, the samples were placed on a table for

straightforward distinction of vision. Identification was done solely eye observation.

## 3. Results and Discussion

### 3.1 Diversity of aquatic macrophytes

From the above observation, we can summarize that this study area is mainly occupied by emergent plant species (44%) followed by free floating (30%), floating anchored (10%), submerged (3%), floating creeper (13%) (Figure 2). Here, we can notice the percentage of submerged is very low (3%). This phenomenon is mainly occurred due to the presence of large leaves of water lilies (*Nymphaea* spp.) that covered most of water surface in the study area. The vegetation niche mainly heterogeneous or versatile occupied by different plant species with more or less same density. In comparison with artificial wetlands like Durgasagar lake [12], Satla Beel is richer in aquatic macrophyte diversity (Table 1). Probably this situation occurs as natural wetlands are greater in area and older in age than the artificial ones, they got more chance to enrich themselves with biodiversity.

**Table 1:** Aquatic macrophytes found in Satla Beel.

| Scientific Name | Local Name | Family | Life form | References |
|---|---|---|---|---|
| *Actinoscirpus grossus* (L. F.) Goetgh & D. A. Simpson | Kasuru, Kasari, Kesar | Cyperaceae | Emergent | Siddiqui *et al.*, 2007 [13] |
| *Alternanthera philoxeroides* (Mart.) Griseb. | Helencha, Malancha | Amaranthaceae | Emergent | Ahmed *et al.*, 2008 [14] |
| *Azolla pinnata* R. Br. | Khudipana | Azollaceae | Free floating | Siddiqui *et al.*, 2007 [13] |
| *Ceratopteris pterioides* (Hook.) Hiern. | Pani Dhekia | Parkeriaceae | Free floating | Siddiqui *et al.*, 2007 [13] |
| *Colocasia esculenta* (L.) Schott | Taro, Dasheen, Coco-yam | Araceae | Emergent | Siddiqui *et al.*, 2007 [13] |
| *Cyperus exaltatus* Retz. | Not known | Cyperaceae | Emergent | Siddiqui *et al.*, 2007 [13] |
| *Eichhornia crassipes* (Mart.) Solms | Kachoripana, Jarmuni | Pontederiaceae | Free floating | Ahmed *et al.*, 2008 [14] |
| *Enhydra fluctuans* Lour. | Helencha, Hingcha, Harhach | Asteraceae | Emergent | Ahmed *et al.*, 2008 [14] |
| *Hygroryza aristata* (Retz.)Nees | Jangil Dhan, Phutki | Poaceae | Floating creeper | Ahmed *et al.*, 2008 [14] |
| *Ipomoea aquatica* Forssk | Kolmi shak | Convolvulaceae | Floating creeper | Ahmed *et al.*, 2008 [14] |
| *Ipomoea fistulosa* Mart. ex Choisy | Dhol Kolmi | Convolvulaceae | Emergent | Ahmed *et al.*, 2008 [14] |
| *Lemna perpusilla* Torrey | Kutipana, Khudipana | Araceae | Free floating | Siddiqui *et al.*, 2007 [13] |
| *Ludwigia adscendens* (L.) Hara | Kesara-dum, Malcha, Mulsi | Onagraceae | Floating creeper | Ahmed *et al.*, 2009 [14] |
| *Ludwigia perennis* L. | Not known | Onagraceae | Emergent | Ahmed *et al.*, 2009 [14] |
| *Marsilea minuta* (L.) Mant. | Susni Shak | Marsileaceae | Floating creeper | Siddiqui *et al.*, 2007 [13] |
| *Monochoria hastata* (L.) Solms | Baranukha | Pontederiaceae | Emergent | Ahmed *et al.*, 2008 [14] |
| *Nymphaea nouchali* Burm. f. | Nil-shapla, Nilkomol, Nilpaddo | Nymphaeaceae | Floating anchored | Ahmed *et al.*, 2009 [14] |
| *Nymphaea rubra* Roxb. ex Andr. | Lal Shapla | Nymphaeaceae | Floatinganchored | Ahmed *et al.*, 2009 [14] |
| *Nymphoides hydrophylla* (Lour.) O. Kuntze | Not known | Menyanthaceae | Floating anchored | Ahmed *et al.*, 2009 [14] |
| *Persicaria hydropiper* (L.) Spach | Soto Biskatali | Polygonaceae | Emergent | Ahmed *et al.*, 2009 [14] |
| *Persicaria lapathifolia* (L.) S. F. Gray | Biskhatali | Polygonaceae | Emergent | Ahmed *et al.*, 2009 [14] |
| *Phyllanthus reticulatus* Poir. | Sitki | Phyllanthaceae | Emergent | Ahmed *et al.*, 2008 [14] |
| *Pistia stratiotes* L. | Topapana | Araceae | Free floating | Siddiqui *et al.*, 2007 [13] |
| *Ricciocarpus natans* (Linn.) Corda. | Not known | Ricciaceae | Free floating | Siddiqui *et al.*, 2007 [13] |
| *Salvinia cucullata* Roxb. | Indur kani | Salviniaceae | Free floating | Siddiqui *et al.*, 2007 [13] |
| *Salvinia molesta* Mitch. | Pani Dhekia | Salviniaceae | Free floating | Siddiqui *et al.*, 2007 [13] |
| *Salvinia natans* (Linn.) All. | Pani Dhekia | Salviniaceae | Free floating | Siddiqui *et al.*, 2007 [13] |
| *Sesbania sesban* (L.) Merr. | Dhoincha | Fabaceae | Emergent | Ahmed *et al.*, 2009 [14] |
| *Typha elephantina* Roxb. | Hogla | Typhaceae | Emergent | Ahmed *et al.*, 2008 [14] |
| *Utricularia stellaris* L. f. | Jhangi | Lentibulariaceae | Submerged | Ahmed *et al.*, 2009 [14] |

### 3.2 Physico -chemical parameters

Water depth fluctuated from 152 cm to 213 cm, conductivity ranged from 0.23 mS/cm to 0.29 mS/cm, pH scale ranged from 6.60 to 7.60, salinity ranged from 132 ppm to 148 ppm (Table 2). The water was slightly alkaline which is suitable for the succession of fresh water macrophytes. Hasan *et al.* [11] also found almost similar pH in a natural wetland but the transparency was very low. It might be occurred due to their high TDS value. The water depth is quite high while the secchi disc depth is comparatively low which terminates the growth of submerged aquatic flora. As compared to lakes from hilly areas like Bogakain [10] (154.32 µg/L), Satla beel possessed higher phosphate content (762.25 µg/L) that helps macrophytes to flourish in this wetland.

**Table 2:** Physico-chemical parameters at different points of Satla beel.

| Point | Depth cm | Secchi depth cm | pH | DO mg/L | Electric Conductivity (EC) mS/cm | Total Dissolved Solids (TDS) ppm | Salinity ppm | Phosphate µg/L |
|---|---|---|---|---|---|---|---|---|
| Point-1 | 187 | 48 | 6.60 | 3.1 | 0.23 | 357 | 132 | 783 |
| Point-2 | 152 | 54 | 7.29 | 3.4 | 0.24 | 393 | 137 | 752 |
| Point-3 | 181 | 51 | 6.65 | 2.9 | 0.24 | 367 | 148 | 779 |
| Point-4 | 213 | 55 | 7.60 | 3.7 | 0.29 | 349 | 137 | 735 |
| Mean | 183.25 | 52 | 7.04 | 3.28 | 0.25 | 366.5 | 138.5 | 762.25 |
| SD | 12.52 | 1.58 | 0.25 | 0.18 | 0.01 | 9.57 | 3.38 | 11.4 |

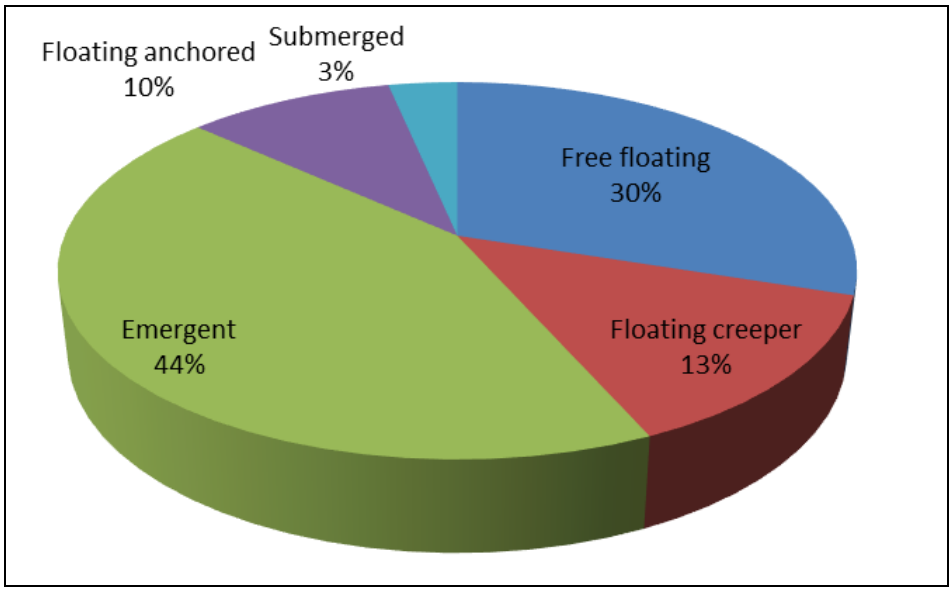


**Fig 2:** Habit of plant species found in study area.


**Fig 3:** Some Photos of Aquatic Macrophytes

## 4. Conclusion

Wetland is a rich source of floral diversity and it plays a vital role in global ecosystem. Due to the excessive exploitation of natural resources and continuous human intervention, it often leads to natural imbalance. Though the current status of Satla beel is quite satisfactory, the increasing number of tourists and extension of pisciculture possess a great threat to this wetland. So it is essential to take immediate and effective steps to conserve this natural ecosystem.

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