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Original Article

Assessment of Aquatic Macrophyte Diversity and Water Quality from Jhanpa Baor in Jessore District, Bangladesh

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A B S T R A C T

Jhanpa Baor is a famous fresh water oxbow lake situated in Jessore district, Bangladesh. The physico-chemical parameters were analyzed from March 2021 to August 2021. Quadrates were ordered randomly and lengthening from boundary towards the lake center. The aquatic macrophytes found in each study site were listed species wise and the information was documented. A total number of 12 aquatic macrophytes were recorded from this area. The macrophytes were categorized into five morphological clusters as floating, submerged, free floating, floating creeper and emergent. The coverage of macrophytes near the periphery was higher than the central region of the lake. A number of physico-chemical analyses were conducted on the collected water samples, *viz*. pH (7.096 ± 0.06), electric conductivity (0.32 ± 0.01 mS/cm), temperature (32.14 ± 0.28 ºC), dissolved oxygen (0.692 ± 0.12 mg/L), salinity (156 ± 8.94 ppm), water depth (10.91 ± 2.58 m), transparency (31.64 ± 3.52 cm) and phosphate (171.6 ± 4.56 µg/L).

Introduction

Baor, the dead arm of a river in the Moribund Delta of the Ganges; also called oxbow lake. It appears as a saucer shaped depression (Banglapedia, 2004). Wetlands represent a mix of aquatic and terrestrial surroundings, within which the soil is seasonally or for good coated by shallow water and therefore the geological formation is on the brink of or near to the surface (Islam and Rahmani, 2008; Ramachandra *et al.*, 2003). The aquatic flora is the vital source of food, fodder, flavoring medication and domestic home materials. Macrophytes, as an element of freshwater ecosystems play a very important role within the formation and functioning of the native aquatic ecosystems (Pandit, 1984; Wetzel, 2001). Water plants, together with macrophytes are universally recognized as vital participants within the natural processes of water self-purification (Gayevskaya, 1966; Dembitsky *et al.*, 1992). Macrophytes also perform a crucial role in the primary productivity of the aquatic scheme. Aquatic macrophytes use nutrient from the aquatic surroundings and so influences water quality. It conjointly controls water quality by exuding varied organic associated mineral elements however and conjointly act as an economical accumulator of significant metals (Devlin, 1967; Chung and Jeng, 1974). On an oversized scale, anthropogenic activities influence physical, chemical and biological processes of aquatic scheme and thereby inflicting decline and degradation of scheme services and conjointly amount of the soil (Boyer and Polasky, 2004). On the contrary, aquatic communities conjointly mirror anthropogenic influence and square measure terribly helpful to notice and assess human impacts (Solak *et al.*, 2012). Two factors i.e. range of species and importance values (number, biomass, productivity) of individuals, determine the species diversity of a community (Odum, 1996). A number of limnological studies have been conducted on several freshwater bodies in Bangladesh but none of them encompasses the diversity of aquatic macrophyts in oxbow lakes (Khondker *et al*., 2012; Alfasane *et al*., 2013; Basak *et al*., 2015). So the present study was aimed to evaluate the diversity of aquatic macrophytes and water quality from a well-known oxbow lake called "Jhanpa Baor".

Materials and Methods

Study area

The study was performed in an oxbow lake named 'Jhanpa Baor' at Manirampur upazila of Jessore district, Bangladesh.

The Baor is the largest freshwater body in this region that is the de-functioned region of the river Kapotakhsho. It is covering a gross area of 605 acre (Banglapedia, 2004). The geo-location of study area is at latitude (22º58'52"N) and line of longitude (89º08'14"E).

Collection of aquatic macrophytes

Sampling of the aquatic plants from Jhanpa Baor was done during the monsoon (March 2021 to August 2021) as aquatic macrophytes flourish in this season. During the study period, sampling was conducted in every month from five predetermined stations. Samples of aquatic macrophytes were collected with the help of a boatman. Then each sample was packed in a transparent plastic bag and tagged with its native name, location and date of sampling. These neatly preserved samples then brought to the laboratory for additional identification. The identification of aquatic macrophytes was carried out with the assistance of various available literatures like journals, books, monographs and floras, especially the "Encyclopedia of Flora and Fauna of Bangladesh". The voucher specimens were preserved at the Herbarium of Department of Botany, University of Barishal.

Water sample collection and the physico-chemical analyses of water

For water quality assessment, 5 sampling sites were selected and the water samples were collected in the morning in between 9 am to 11am. For the sampling of lake water, a closed bottle was dipped into water at 0.7 to 0.9 m depth, and then it was opened beneath and closed again to bring it back on the surface. Chemical properties of water were determined using standard protocols in laboratory (Nagamani *et al.*, 2015). A variety of physico-chemical analyses were conducted on the collected water samples (Table 3) *i.e.* water depth, transparency, water temperature, pH, salinity, electric conductivity (EC), dissolved oxygen (DO) and phosphate.

The depth of water was determined using a rope attached to a medium sized stone at one end and a meter tape. Transparency of water was determined using a secchi disc. Water temperature was measured using a digital Centigrade thermometer (Milwaukee; model: TH310). The electric conductivity was evaluated with a digital "EC Tester" and recorded (HANNA, Romania; model: DiST4, HI98304). The pH of water samples was measured using a digital pH meter (HANNA, Romania; model: pHep$^+$, HI98108). DO of water samples were recorded using a portable Dissolved oxygen tester (Clean Instruments; model: DO30). The phosphate content of water was measured following the protocol of Hasan *et al.*, 2021.

Result and discussion

A total number of 12 aquatic macrophytes belonging to 9 families (Figure 2) were collected from Jhanpa Beel (Table 1). *Alternanthera philoxeroides* was accounted dominant among the identified macrophytes. Fig 3 illustrated the combination of aquatic macrophytes under divergent plant categories as 2 rooted floating species, 6 emergent species, 4 free floating species and 1 floating creeper species. It was most conspicuous that no submerged aquatic macrophyte was collected from the study area. Two possible reasons behind this situation may be low transparency of water and excessive grazing by fisheries.

Diversity of Species among the stations depicted (Table 2) that *Alternanthera philoxeroides* and *Eichhornia crassipes* were grown in all the stations. *Alternanthera philoxeroides*, popularly known as alligator weed, is a perennial herb that occurs in many parts of the world, infesting on various freshwater habitats along with many terrestrial habitats too. In favorable condition, the aquatic form of the plant possesses a serious problem to the waterways and agricultural fields. In terrestrial form, *Alternanthera philoxeroides* forms a dense mat with a massive underground root system. It is extremely expensive and cumbersome to control *Alternanthera philoxeroides* (GISD, 2020). The basic mode of population increment in *E. crassipes* is vegetative (Center and Spencer, 1981). Under appropriate environment, water hyacinths can double their numbers within 1 to 3 weeks (Edwards and Musil, 1975; Gopal, 1987). The suitable condition for the proliferation of water hyacinth includes warm and moist weather (28–30°C), neutral pH, intense light and nutrient-rich water (Methy *et al.*, 1990). Growth rate is directly proportional to the nutrient composition (Gopal, 1987). Basically the concentration of N and P have direct positive effects on the biomass accumulation of water hyacinth (Gossett and Norris, 1971; Reddy *et al.*, 1989).

The physico-chemical characteristics of water samples are presented in Table 3. The range of water temperature laid between 31.9 and 32.6°C with an average value of 32.14°C. The minimum and maximum values of electric conductivity were estimated as 0.31 mS/cm and 0.33 mS/cm, respectively. The range of pH was from 7.00 to 7.17. The values of DO ranged between 0.55 and 0.82 mg/L with an average value of 0.692 mg/L. TDS values in the study site ranged between 152 ppm and 171 ppm with an average value of 157 ppm. The estimated values of phosphate content laid between 166 µg/L and 176 µg/L with an average value of 171.6 µg/L.

Table 1. List of Aquatic macrophytes found in the study site during the survey period.

Scientific Name	Family	Local Name	Life form	References
Eclipta prostrata (L.) L.	Asteraceae	Kesuti	Emergent	Ahmed *et al.*, 2008.
Enhydra fluctuans DC.	Asteraceae	Helencha	Emergent	Ahmed *et al.*, 2008.
Alternanthera philoxeroides (Mart.) Griseb.	Amaranthaceae	MalanchaShak	Emergent	Ahmed *et al.*, 2008.
Ludwigia adscendens (L.) H. Hara	Onagraceae	Mulsi	Rooted floating	Ahmed *et al.*, 2009.
Eichhornia crassipes (Mart.) Solms	Pontederiaceae	Kachoripana	Free floating	Ahmed *et al.*, 2008.
Lemna perpusilla Torr	Lemnaceae	Kutipana	Free floating	Siddiqui *et al.*, 2007.
Ipomoea aquatica Forssk	Convolvulaceae	KalmiShak	Rooted floating	Ahmed *et al.*, 2008.
Lippia alba (Mill.) N.E.Br. ex Briton et P.Wilson	Verbenaceae	Pichas-lakri	Emergent	Ahmed *et al.*, 2009.
Ipomoea fistulosa Mart. ex Choisy	Convolvulaceae	Dholkolmi	Emergent	Ahmed *et al.*, 2008.
Monochoria hastata (L.) Solms	Pontederiaceae	Baranukha	Free floating	Ahmed *et al.*, 2008.
Persicaria lapathifolia (L.) Delarbre	Polygonaceae	Bishkatali	Emergent	Ahmed *et al.*, 2009.
Commelina benghalensis L.	Commelinaceae	Kanchira	Floating creeper	Siddiqui *et al.*, 2007.

Table 2. Species diversity in Jhanpa Baor by different study sites.

Scientific Name	Site-1	Site-2	Site-3	Site-4	Site-5
Eclipta alba	+	–	–	–	–
Enhydra fluctuans	–	–	+	–	–
Alternanthera philoxeroides	+	+	+	+	+
Ludwigia adscendens	+	–	–	–	+
Eichhornia crassipes	+	+	+	+	+
Lemna perpusilla	–	–	+	–	+
Ipomoea aquatic	+	+	–	–	–
Lippia alba	–	–	–	–	+
Ipomoea fistulosa	+	–	+	–	–
Monochoria hastata	–	–	+	+	–
Persicaria lapathifolia	–	+	–	–	–
Commelina benghalensis	–	–	+	–	–

+ = present, – = absent

Table 3. Water quality parameters in different sampling sites throughout the period of study.

Parameters	Site-1	Site-2	Site-3	Site-4	Site-5	Mean	± SD
Temperature (°C)	32	32.2	32.6	31.9	32	32.14	0.28
EC (mS/cm)	0.33	0.32	0.32	0.32	0.31	0.32	0.01
TDS (ppm)	171	156	152	154	152	157	8
pH	7.17	7.11	7.08	7.12	7	7.096	0.06
Salinity (ppm)	170	150	150	150	160	156	8.94
Water Depth (meter)	10	8	10.5	15.05	11	10.91	2.58
Transparency (cm)	33.02	28.08	33.02	36.09	28	31.642	3.52
DO (mg/L)	0.82	0.67	0.81	0.55	0.61	0.692	0.12
Phosphate (µg/L)	176	172	168	176	166	171.6	4.56

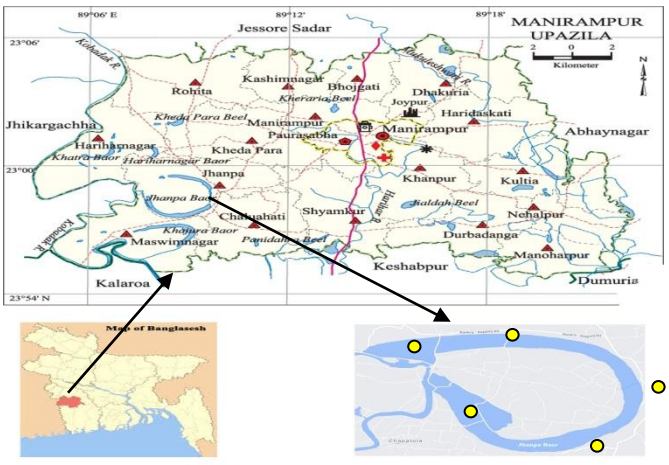

Figure 1. Map of the study area.

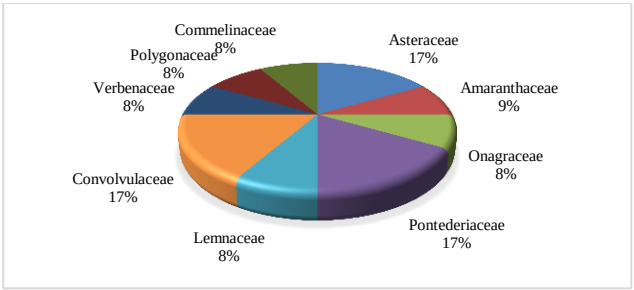

Figure 2. Composition of family in the study area.

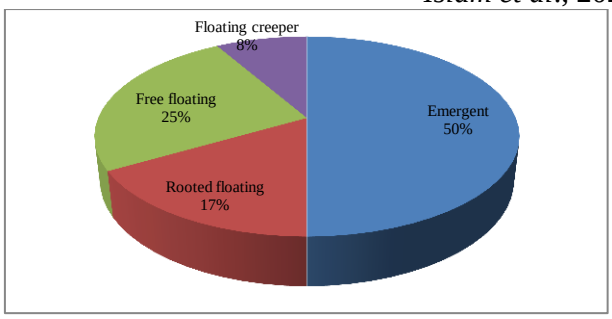

Figure 3. Life form of aquatic macrophytes.

Conclusion

Based on the above results it can be concluded that the baor possesses low diversity of aquatic macrophytes. However during the current study, it has been found that due to natural and anthropogenic activities along with the negligence of concerned Govt. authorities, the process of gradual degradation is getting worse in the Baor region. Therefore proper conservation measures should be taken to conserve the floral diversity and existence of this important baor.

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References

Ahmed ZU, Hassan MA, Begum ZNT, Khondker M, Kabir SMH, Ahmad M, Ahmed ATA, Rahman AKA, Haque EU (2008-2009). Encyclopedia of flora and fauna of Bangladesh, Angiosperms. Vol. 6-12. Asiatic Society of Bangladesh, Dhaka, Bangladesh.

Alfasane MA, Ullah MS, Khondker M (2013). Limnology of Lake Rainkhyongkain of Bangladesh with a New Record of *Marchantia polymorpha* L. var. *aquatic*a Nees. Bangladesh J Bot 42(2): 223-229.

Banglapedia (2004). National Encyclopedia of Bangladesh (1st edition). Asiatic Society of Bangladesh, Dhaka, Bangladesh. Retrieved from www.banglapedia.org.

Basak SK, Ali MM, Islam MS, Shaha PR (2015). Aquatic weeds of Haor area in Kishoregonj district, Bangladesh: Availability, Threat and Management Approaches. IJFAS 2(6): 151-156.

Boyer T, Polasky S (2004). Valuing Urban Wetlands: A Review of Non- Market Valuation Studies. Wetlands 24 (4): 744-755.

Center TD, Spencer NR (1981). The phenology and growth of water hyacinth (*Eichhornia crassipes* Mart.) Solms in a eutrophic North central Florida lake. Aquat Bot 10: 1–32.

Chung IH, Jeng SS (1974). Bulletin of the Institute of Zoology. Academy of Science 13: 69-73.

Dembitsky VM, Rozentsvet OA, Zhuicova US (1992). Fatty acid and phospholipids from lichens of the order Leconorales. Phytochemistry 31:851-853.

Devlin RM (1967). Plant Physiology. Reinhold, New York. pp. 564.

Edwards D, Musil CJ (1975). *Eichhornia crassipes* in South Africa: General review. Afr J Aquat Sci 1: 23–27.

Gayevskaya NS (1966). The Role of Freshwater Plants in Animal Nutrition *Nymphoides*. Nauka, Moscow, 327.

GISD - Global Invasive Species Database (2020). Species profile: *Alternanthera philoxeroides*. Retrieved from http://www.iucngisd.org/gisd/species.php?sc=763

Gopal B (1987). Water Hyacinth (Aquatic Plant Studies). Elsevier, Amsterdam, 471.

Gossett DR and Norris WE Jr (1971). Relationship between nutrient availability and content of nitrogen and phosphorous in tissues of the aquatic macrophyte, *Eichhornia crassipes* (Mart.) Solms. Hydrobiologia 38: 15–28.

Hasan MM, Islam MT, Laskar MAR, Sultana T (2021). Distribution and diversity of aquatic macrophytes and the assessment of physico-chemical parameters of Dakatia beel in Khulna disrtict, Bangladesh. AJMBR 7(2): 118-125.

Islam MZ, Rahmani AR (2008). Existing and potential Ramsar sites in India. Indian Bird Conservation Network, Bombay Natural History Society, Birdlife International and Royal Society for the Protection of Birds, Oxford University Press.

Khondker M, Alfasane MA, Gani MA, Islam MS (2012). Limnological notes on Ramsagar, Dinajpur, Bangladesh. Bangladesh J Bot 41(1): 119-121.

Methy M, Alpert P, Roy J (1990). Effects of light quality and quantity on growth of the clonal plant *Eichhornia crassipes*. Oecologia 84: 265–271.

Nagamani C, Saraswathidevi C, Shalini A (2015). Physico-chemical analysis of water samples. Int J Sci Eng Res 6(1): 2149-2155.

Odum EP (1996). Fundamentals of ecology (3rd edition). Natraj publishers, Dehradun, India, 574.

Pandit AK (1984). Role of macrophytes in the aquatic ecosystem and management of fresh water resources. J Environ Manage 18: 73-78.

Ramachandra TV, Ahalya N, Payne M (2003). Status of Varthur lake: Opportunities for restoration and sustainable management, Technical report 102. Centre for Ecological Sciences, Indian Institute of Science, Bangalore.

Reddy KR, Agami M, Tucker JC (1989). Influence of nitrogen supply rates on growth and nutrient storage by water hyacinth (*Eichhornia crassipes*) plants. Aquat Bot 36: 33–43.

Siddiqui KU, Islam MA, Ahmed ZU, Begum ZNT, Hasan MA, Khondker M, Rahman MM, Kabir SMS, Ahmad M, Ahmed ATA, Rahman AKA, Haque EU (2007). Encyclopedia of flora and fauna of Bangladesh (Bryophytes, Pyeridophytes, Gymnosperms), Vol 5. Asiatic Society of Bangladesh, Dhaka, Bangladesh.

Solak CN, Barinova S, Acs E, Dayioglu H (2012). Diversity and ecology of diatoms from Felent creek (Sakarya river basin), Turkey. Turk J Bot 36: 191-203.

Wetzel RG (2001). Limnology (3rd edition). Academic Press, Elsevier, San Diego.