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Diversity of aquatic macrophytes of Kapla beel (wetland) of Barpeta district, Assam, India

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ABSTRACT

The present study was conducted in Kapla beel to evaluate the macrophytic diversity of the wetland for a period of one year i.e. from October, 2013 to September, 2014. Kapla beel is a perennial freshwater wetland located at Barpeta district of western Assam at the global position between 26^0 $15^{//}$ N to 26^0 $30^{//}$ N latitude and 91^0 $0^{//}$ E to 91^0 15 E longitude. It covers an area of 91 hectares. Aquatic macrophytes were collected by using the methods as described by Raunkaier, (1934). During the present investigation total of 68 plant species belonging to 49 genus and 28 families were recorded from the wetland of the study site. The dominant family was Cyperaceae representing 12 species. Different diversity indices like Shannon-Weaver diversity index (Shannon and Weaver, 1964), Simpson diversity index (Simpson, 1949), Menhinick diversity index (Menhinick, 1965) and Concentration of dominance (Simpson, 1949) were calculated to show the plant communities structure of the wetland. Maximum values of Shannon- Weaver diversity index, Simpson diversity index and Menhinick diversity index were found during the summer season as it is active growth period of macrophytes whereas maximum concentration of dominance during the summer season reflects the dominance of few species due to high diversity of the macrophytes.

Key words: Wetland, Kapla beel, macrophytic diversity, diversity indices.

INTRODUCTION

Wetlands represent a combination of aquatic and terrestrial environment, in which the soil is seasonally or permanently covered by shallow water and the water table is close to or near the surface [1, 2]. The freshwater, perennial, large, lentic water bodies are commonly known as 'beel' in Assam [3]**.** The aquatic macrophyte are the important source of food, fodder, herbal medicine and domestic household materials. Macrophytes, as a component of freshwater ecosystems play an important roles in the structure and functioning of the aquatic ecosystems [4, 5]. Water plants, including macrophytes are universally recognized as important participants in the natural processes of water self-purification [6, 7].

Macrophytes are also play a major role in primary productivity of the aquatic ecosystem. Aquatic macrophytes use nutrient from the aquatic environment and thus influences water quality. It also controls water quality by exuding various organic and mineral components but and also act as an efficient accumulator of heavy metals [8, 9].

On a large scale, anthropogenic activities influence physical, chemical and biological processes of aquatic ecosystem and thereby causing decline and degradation of ecosystem services and also economic value of the wetland [10]. On the contrary, aquatic communities also reflect anthropogenic influence and are very useful to detect and assess human impacts [11]. Two factors i.e. number of species and importance values (number, biomass, productivity, and so on) of individuals, determine the species diversity of a community [12].

Several works relating to aquatic and wetland flora have been carried out by several workers in various parts of the country including India [13-24]. So far no study regarding the diversity of aquatic macrophytes of Kapla beel of Barpeta district of Assam have been done yet. Therefore, the present study has been carried out to find out the macrophytic diversity of the wetland.

Study Area:

The present study was carried out at Kapla beel of Barpeta district of western Assam at the global position between 26^0 $15^{//}$ N to 26^0 $30^{//}$ N latitude and 91^0 $0^{//}$ E to 91^0 $15^{//}$ E longitude. It covers an area of 91 hectares. The beel is surrounded by five villages around its adjacent areas namely Haldhibari and Kaldipathar in east, Barkapla Gaon in west, Kamarpara Gaon in north and Salmara Gaon in the south. Kapla beel is a community managed beel which is mainly used for fishing purposes through lessee by the "Mahalder" and thereby huge revenue have been collected from the beel annually. This wetland also plays an important role for the improvement of socioeconomic condition of the people living in its surrounding areas. The beel has an inlet on the eastern side of the beel i.e. connected with Chilla beel and Hablakhowa beel and has an outlet on western side of the beel.

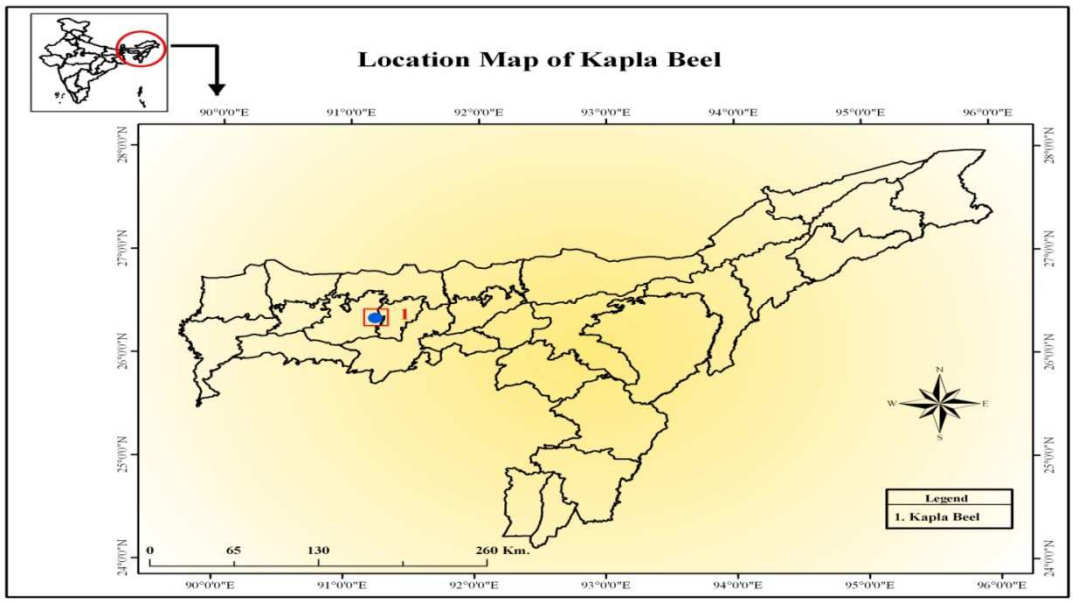

Figure: Location map of study area

The outlet of Kapla beel meet the river Brahmaputra on the southern side of the beel. Unfortunately, the outlet of the beel gradually became narrow due to various natural and anthropogenic activities. The luxuriant growth of invasive *Eichhornia crassipes* and their gradual death and decay as well as encroachment in nearby the outlet channel is responsible for the blockage of the outlet channel of the wetland.

MATERIALS AND METHODS

Collection and analysis of aquatic macrophytes of the wetland of the study site:

During the present study monthly surveys were carried out for collecting aquatic macrophytes by using quadrat method as described by earlier worker [25]. The aquatic plants were collected and they were photographed, packed in the plastic bags for making dry herbarium or kept in the bottles filled with 70% formalin aceto alcohol (FAA) and taken to the laboratory for further identification. Blotting papers & old newspapers were used for the preservation of the specimens. Newspapers were changed from time to time. The fully dried specimens were poisoned and then mounted on the herbarium sheet by following usual laboratory techniques [26]**.** The aquatic plants were identified as belonging to families and species by consulting the herbarium of department of Botany, Gauhati University, Guwahati.

The diversity indices of aquatic macrophytes have been calculated by using the following formulas:

a. The Shannon and Weaver diversity index (*H* ') is calculated by using the formula given by [27].

$$H' = - \Sigma \, pi \log pi$$

Where, pi = the proportion of importance value of the ith species (pi = ni / N, ni is the importance value of ith species and N is the importance value of all the species).

b. Simpson diversity index (D) is calculated by using the formula given by [28].

$$D = \Sigma (Pi)^2$$

Where, pi = the proportion of important value of the ith species (pi =ni / N, ni is the importance value of ith species and N is the importance value of all the species).

c. Menhinick diversity index (d) is calculated by using the formula given by [29]

$$d = S/\sqrt{N}$$

where, S=Total number of species, and N =Total number of individuals of all the species.

d. Concentration of dominance (*Cd*) is calculated by using the formula given by [28]

$$Cd = (Ni/N)^2$$

where, Ni = Proportion of individuals belonging to the ith species, N = Total number of individuals.

RESULTS AND DISCUSSION

During the present study, 68 macrophytic species belonging to 49 genera and 28 families have been reported from the wetland of the study sites. The dominant families were Cyperaceae representing 12 species. This is followed by Asteraceae and Poaceae (6 species each), Nympheaceae, Onagraceae and Polygonaceae (4 species each), Amaranthaceae, Pontederiaceae, Hydrocharitaceae and Scrophulariaceae (3 species each), Lemnaceae and Convolvulaceae (2 species each) whereas sixteen families represents 1 species each. (Table: 1)

Table: Aquatic macrophytes of the wetland of the study site recorded during the study period: (H= Herb, Cl= Climber, A= Annual, P=Perennial)

Sl no.	Name of the plant species	Family	Habit	Life span
1	*Achyranthus aspera* L.	Amaranthaceae	H	p
2	*Alternanthera philoxeroides* (Mart) Griseb.	Amaranthaceae	H	P
3	*Alpinia allughas* (Retz.) Rosc.	Zinziberaceae	H	P
4	*Amaranthus viridis* L.	Amaranthaceae	H	P
5	*Aponogeton natans* (L.) Engl. & Krause.	Aponogetaceae	H	A
6	*Centella asiatica* (L.) Urban	Apiaceae	H	A
7	*Ceratophyllum demersum* L.	Ceratophyllaceae	H	P
8	*Carex baccans* L.	Asteraceae	H	A
9	*Cyperus compactus* Retz.	Cyperaceae	H	A
10	*C. compressus* L.	Cyperaceae	H	A
11	*C. difformis* L.	Cyperaceae	H	A
12	*C. diffusus* Vahl.	Cyperaceae	H	A
13	*C. iria* L.	Cyperaceae	H	A
14	*C. rotundus* L.	Cyperaceae	H	A
15	*C. digitatus* Roxb. Var. bountii.	Cyperaceae	H	A
16	*C. marina* L.	Cyperaceae	H	A
17	*Diplazium esculentum* (Retz) Sw.	Dryopteridaceae	H	A
18	*Eclipta prostrata* L.	Asteraceae	H	A
19	*Eichhornia crassipes* (Mart) Solms.	Pontederiaceae	H	P
20	*Enhydra fluctuans* Lour.	Asteraceae	H	A
21	*Euphorbia hirta* L.	Euphorbiaceae	H	P
22	*Euryale ferox* Salisb.	Nymphaeaceae	H	A
23	*Fimbristylis bisumbellata* (Forssk.) Bubani	Cyperaceae	H	A
24	*Grangia maderaspatana* (L.) Poir.	Asteraceae	H	P
25	*Hygroryza aristata* Nees.	Poaceae	H	A
26	*Hymenachne acutigluma* (Steud) Gillil.	Poaceae	H	A
27	*H. assamica* Hitch	Poaceae	H	A
28	*Hydrilla verticillata* (L. f) Royle	Hydrocharitaceae	H	A
29	*Ipomoea aquatica* Forsk.	Convolvulaceae	Cl	A
30	*I. carnea* Jace.	Convolvulaceae	H	P
31	*Kyllinga brevifolia* Rottb.	Cyperaceae	H	A
32	*Lippia javanica* (Burm.f) Spreng.	Verbenaceae	H	P
33	*Leersia hexandra* SW.	Poaceae	H	A
34	*Lemna perpusilla* Torr.	Lemnaceae	H	A
35	*Limnophila heterophylla* (Roxb.) Benth	Scrophulariaceae	H	A
36	*L. indica* (L.) Druce	Scrophulariaceae	H	A
37	*L. sessiliflora* (Vuhl) Bl.	Scrophulariaceae	H	A
38	*Ludwigia adscendens* (L.) Hara	Onagraceae	H	P

39	*L. octavalis* (Jacquin) Raven	Onagraceae	H	P
40	*L. perennis* L.	Onagraceae	H	P
41	*L. prostrata* Roxb.	Onagracea	H	P
42	*Mikania mycrantha* Willd.	Asteraceae	Cl	A
43	*Monochoria hastata* (L.) Solms	Pontederiaceae	H	P
44	*M. vaginalis* (Burm f.) Presl.	Pontederaceae	H	P
45	*Myriophyllum tuberculatum* Roxb.	Haloragaceae	H	P
46	*Nelumbo nucifera* Gaertn.	Nymphaeaceae.	H	A
47	*Nymphaea nouchali* Burm. f.	Nymphaeaceae	H	A
48	*N. pubescens* Willd.	Nymphaeaceae	H	A
49	*Oryza rufipogon* Griff.	Poaceae	H	A
50	*Ottelia alismoides* (L.) Pers.	Hydrocharitaceae	H	P
51	*Oxalis corniculata* L.	Oxalidaceae	H	A
52	*Pistia stratiotes* L.	Araceae	H	A
53	*Polygonum barbatum* L.	Polygonaceae	H	A
54	*P. glabrum* Willd.	Polygonaceae	H	A
55	*P. hydropiper* L.	Polygonaceae	H	A
56	*Potamogeton crispus* L.	Potamogetonaceae	H	P
57	*Ranunculus aquatalis* L.var. *tricophylls*	Ranunculaceae	H	P
58	*Rumex nepalensis* Spreng.	Polygonaceae	H	P
59	*Sagittaria sagitifolia* L.	Alismataceae	H	A
60	*Salvinia molesta* D.S.	Salviniacea	H	A
61	*Schoenoplectus articulatus* L.	Cyperaceae	H	A
62	*S. grossus* (L. f.) Palla	Cyperaceae	H	A
63	*Spirodella polyrrhiza* (L.) Schleid	Lemnaceae	H	P
64	*Trapa natans* L.	Trapaceae	H	A
65	*Utricularia aurea* Lour.	Lentibulariaceae	H	A
66	*Vallisneria spiralis* L.	Hydrocharitaceae	H	A
67	*Vetiveria zizanioides* (L.) Nash	Poaceae	H	A
68	*Xanthium strumarium* L.	Asteraceae	H	A

The attributes of seasonal variation in diversity indices of the aquatic macrophytes of the wetland of the study site is depicted in Table 2. Species diversity affords stability to ecosystem. The Shannon-Weaver diversity index was maximum (3.14) during the summer season and minimum (2.45) in the winter season of the study period. Simpson diversity index value was highest (0.56) during the summer season whereas minimum value (0.34) was found during the winter season. Maximum value (1.07) for Menhinick diversity index was found during the summer season of the study period while minimum value of 0.82 was found during the winter season. The concentration of dominance was maximum (0.67) during the summer season while it was minimum (0.42) in the winter season of the study period (Table: 2).

Table 2: Seasonal variation in diversity indices of aquatic macrophytes of the wetland of the study site:

Diversity indices	Index values (Summer)	Index values (Winter)
Shannon- Weaver diversity index	3.14	2.45
Simpson diversity index	0.56	0.34
Menhinick diversity index	1.07	0.82
Concentration of dominance	0.67	0.42

The results of this investigation reveal that species diversity is a useful parameter for the comparison of communities under the influence of anthropogenic disturbances or to know the state of succession and stability in the community. Maximum values of the diversity index were found during the summer season of the study period. It may 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. Maximum concentration of dominance during the summer season reflects the dominance of few species only. During the winter season diversity of macrophytes were found to decreased 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.

CONCLUSION

Based on the above results it can be concluded that the wetland of the study site showed high diversity of macrophytes during summer season. The obtained Shannon-Weaver diversity index value (H' = 3.14) indicates that the structure of habitat is stable and balanced. However during the present study it has been found that due to natural as well as anthropogenic activities and poor maintenance by the "Mahalder", and also the negligence of concerned Govt. authorities, the process of gradual degradation of the wetland has been started. Therefore proper conservation measures should be taken for sustainable livelihood and existence of this important wetland.

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REFERENCES

[1] M. Z. Islam and A. R. Rahmani, *Potential and existing 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), **2008**.
[2] T. V. Ramachandra, N. Ahalya and M. Payne, *Status of Varthur lake Opportunities for restoration and sustainable management*. Technical report 102. Centre for Ecological Sciences, Indian Institute of Science, Bangalore. **2003**.
[3] P. Sharma, Geo Ecological Study of Beels and Swamps in Nagaon and Morigaon Districts , Assam. Unpublished Ph.D Thesis, GauhatiUniversity (Guwahati, Assam, **1993**).
[4] A. K. Pandit, *J. Environ. Manage.*, **1984**,18 : 73-78.
[5] R.G. Wetzel, *Limnology*, third edition. Academic Press Elsevier, San Diego. **2001**.
[6] N. S. Gayevskaya, *The Role of Freshwater Plants in Animal Nutrition Nymphoides*, Nauka, Moscow, **1966**, 327.
[7] V. M. Dembitsky, O. A. Rozentsvet and U. S. Zhuicova, Phytochemistry, **1992**, 31:851-853.
[8] R. M. Devlin, *Plant Physiology*. Reinhold, New York, **1967**, 564.
[9] I. H. Chung and S. S. Jeng, *Bulletin of the Institute of Zoology, Academy of Science*, **1974**, 13: 69-73.
[10] T. Boyer and S. Polasky, Valuing Urban Wetlands: A Review of Non- Market Valuation Studies, Wetlands, **2004**, 24 (4): 744-755.
[11] C. N. Solak, S Acs E. Barinova and H. Dayioglu, *Turkish Journal of Botany*, **2012**, 36: 191-203.
[12] E. P. Odum, *Fundamentals of ecology* (third edition), Natraj publishers, Dehradun, India, **1996**, 574.
[13] M. V. Mirishi, *J. Indian bot. Soc.* **1954**, 33: 298-308
[14] D. N. Sen and U. N. Chetterjee, *A Survey. Agra Uni. Res. (Sci)*, **1959**, 8: 17-27.
[15] K. Subramanyam, *Aquatic Angiosperms*, New Delhi. **1962**.
[16] L. N. Vyas, *J. Indian bot. Soc.*, **1964**, 43: 17-30.
[17] K. C. Mishra, Manual of plant ecology, oxford and IBH publishing co. New Delhi, **1974**, 491.
[18] K. S. Unni, *Hydrabol.*, **1971**, 37:139-155.
[19] K. K. Singh and R. P. S. Tomar, *J.Bombay Nat. Hist. Soc.*, **1982**, 79: 271-274.
[20] R.C. Srivastava and A. Kumar, *Journal of Ecology Tau. Bor*, **1987**, 9: 433-458.
[21] D. K. Billore and I. N. Vyas, *J. Ecol. Env-sci*., **1981**, **7**: 45-54.
[22] K. Biswas and L. C. Calder, *Handbook of common water and marsh plants of India and Burma*, **1984**, 216.
[23] D. Kar and M. H. Barbhaiya, *Proc. Indian Sci. Cong.* New Delhi., **2007**, 76.
[24] R. J. Chandra, B. A. K. Prusty and P. A. Azeez, Biomass and productivity of plant community in a rain fed monsoonal wetland ecosystem with specific emphasis on its temporal variability. In: *International wetland Ecology, Conservation and restoration.* **2008**, 5: 1-21.
[25] C. Raunkaier, *The life-form of plants and statistical plant geography.* Oxford. Claredon Press. **1934**.
[26] S. K. Jain and R. R. Rau, *A Hand Book of Field and Herbarium Methods*, Today and Tomorrow Printers and Publishers, New Delhi, **1976**.
[27] C. E. Shannon and W. Weaver, "The Mathematical Theory of communication" The Uni. of Illinois press, Urbana, IL. **1964**.
[28] E. H. Simpson, *Nature*, **1949**, 163-188.
[29] E. F. Menhinick, *Ecology*, **1964**: 45: 858-862.