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Aquatic Plant Diversity Measurement and Ecological Importance of Saheb Bandh in Purulia District, West Bengal

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Abstract: *Awareness of pond conservation is growing all over the world. Ponds are an important ecosystems supporting large number of species. This study investigated the macrophyte community to measure the biodiversity of the macrophytes and to define the botanical conservation value of Saheb bandh. In the study period (July 2016) a total of 50 Macrophyte taxa were collected in the studied pond. Macrophyte biodiversity is measured by Shannon and Simpson indices. The result highlighted different macrophyte assemblages (including some of conservation interest at regional scale), exclusively found in the pond. This suggested that Sabeb bandh could give an irreplaceable aquatic plant diversity of fresh water ecosystem.*

Keyword: *Macrophyte, Biodiversity, Shannon index, Simpson index, Species richness, Species evenness.*

I. Introduction

Saheb bandh is a large lake in Purulia district, West Bengal, India. This manmade lake is known to have been constructed in the middle of 19th century. This water body was dug by freedom fighters held captive in jail to meet the drinking water needs of Britishiers . Even 69 years after independence, the 88 acre water body is the only source of drinking water in Purulia Sadar town. This artificial lake is a haven for different aquatic macrophytes. Improving water quality through the use of floating macrophytes is recently a popular phytotechnological application. According to Ubom et al.(2012)the macrophyte community of a water body is very important to conservation and sustainability.

The aim of the study was to listing the macrophytes present in the water and its edges and determine the species richness and biodiversity indices in different areas of the waterbody to conclude the ecological significance of the pond.

Study Area

Sahib bandh is located in the district of Purulia, West Bengal, India (23° 20'1"N 86° 21'3"E). It is a large 88 acre man made pond and is popularly called an artificial lake.

Fig:- Google map of Saheb bandh

II. Material & Method

Biological diversity of a community can be quantified in many different ways. Two main factors taken into account when measuring diversity are richness and evenness(Bai 2004). Richness is a measure of the number of different kinds of organisms present in a particular area and Evenness compares the similarity of the population size of each of the species present. For sampling data 5 quadrates(Q1-Q5) (1mx1m) were taken in each sampling station. A total of 4 sampling stations i.e.North,East,South & West were marked out for quadrat sampling. The observed data are listed in table 1.1 to 1.4 for each sampling station respectively. To calculate plant species diversity of each collection station area two types of indices are studied. The equations for the two indices are:

$$H = -\sum_{i=1}^{s} p_i \ln p_i$$

$$D = \frac{1}{\sum_{i=1}^{s} p_i^2}$$

The Shannon index[H] is an information statistic index which means it assumes all species are present in a sample and that are randomly sampled. In the Shannon index, P is the proportion of individuals (n/N) of one particular species found (n) divided by total number of individuals found (N) and S is the number of species. The Simpson index [D] is a dominant index as it gives more weight to common or dominant species. In Simpson index, P is the proportion (n/N) of individuals of one particular species found (n) divided by the total number of individuals found(N). Both indices are calculated by PAST(Paleontological Statistics Software Package for Education) software version 3.1 for each sampling station .PAST generated data is tabulated in Table 2 with Diversity profile graph.

Table 1.1-sampling station NORTH

SL. NO	NAME OF SPECIES	Q1	Q2	Q3	Q4	Q5	TOTAL
1	Nympoides hydrophylla	2	0	0	2	0	4
2	Eclipta postrata	2	0	0	1	1	4
3	Oldenlandia corymbosa	1	0	0	1	1	3
4	Ludwigia perennis	2	1	1	2	0	6
5	Croton bonplandianum	1	0	1	0	1	3
6	Cyperus difformis	2	1	0	0	1	4
7	Boerhavia diffusa	2	1	1	2	0	6
8	Leersia hexandra	2	0	1	0	0	3
9	Panicum paludosa	2	2	1	0	0	5
10	Phyla nodiflora	0	1	0	1	0	2
11	Hygrophila difformis	1	0	0	0	1	2
12	Pistia stratiotes	0	2	2	0	1	5
13	Alternanthera sessilis	3	0	1	0	0	4
14	Salvinia natans	0	3	0	2	0	5
15	Parthenium hysterophorus	0	1	1	0	1	3
16	Becopa monnieri	1	1	0	1	0	3
17	Spirodela intermidia	0	22	26	17	15	80
18	Jussiaea repens	1	4	2	3	1	11
19	Heliotropium indicum	1	0	0	0	0	1
20	Alysicarpus monilifer	0	0	1	0	2	3
21	Lindernia crustacea	0	0	0	1	0	1
22	Spilanthes acmella	2	0	0	1	0	3
23	Limnophila heterophylla	0	0	0	1	1	2
24	Centella asiatica	0	0	1	0	0	1
25	Evolvulus nummularius	1	1	0	2	2	6
26	Ammania baccifera	0	1	0	2	1	4
27	Martynia diandra	0	1	0	0	0	1
28	Commelina benghalensis	0	1	0	0	0	1

Table 1.2-sampling station WEST

SL. NO	NAME OF SPECIES	Q1	Q2	Q3	Q4	Q5	TOTAL
1	Nymphaea pubescens	1	2	0	1	0	4
2	Eclipta postrata	2	0	0	2	0	4
3	Oldenlandia corymbosa	3	2	0	0	1	6
4	Ludwigia perennis	2	0	0	2	1	5
5	Croton bonplandianum	0	1	0	0	1	2
6	Cyperus difformis	2	1	1	0	1	5
7	Boerhavia diffusa	1	1	0	0	2	4
8	Leersia hexandra	0	1	2	1	0	4
9	Panicum paludosa	1	1	2	1	1	6
10	Phyla nodiflora	0	0	1	0	0	1
11	Hygrophila difformis	0	0	1	0	0	1
12	Pistia stratiotes	2	3	1	1	0	7
13	Alternanthera sessilis	1	1	1	0	2	5
14	Salvinia natans	0	3	0	1	2	6
15	Parthenium hysterophorus	0	1	1	0	0	2
16	Becopa monnieri	0	1	0	1	0	2
17	Spirodela intermidia	18	24	21	16	22	101
18	Commelina benghalensis	2	0	2	0	0	4
19	Commelina paludosa	0	2	1	0	0	3
20	Jussiaea repens	1	2	0	0	0	3
21	Heliotropium indicum	0	0	1	0	0	1

22	Alysicarpus monilifer	1	0	0	1	0	2
23	Lindernia crustacea	1	0	0	0	0	1
24	Spilanthes acmella	2	1	2	0	1	6
25	Limnophila heterophylla	1	2	0	0	2	5
26	Centella asiatica	0	1	0	2	0	3
27	Evolvulus nummularius	3	1	0	0	2	6
28	Ammania baccifera	2	1	0	0	1	4
29	Hydrilla verticillata	3	4	5	4	5	21
30	Verbascum chinense	1	1	0	0	0	2
31	Ceratophyllum demersum	5	4	3	3	5	20
32	Potamogeton crispus	0	2	1	2	0	5
33	Sagittaria sagittifolia	2	1	2	0	0	5
34	Eichhornia crassipes	1	1	0	1	0	3
35	Nelumbu nucifera	0	1	0	0	0	1
36	Marsilea minuta	1	2	1	0	0	4
37	Leucas aspera	1	0	2	0	0	3

Table 1.3-sampling station SOUTH

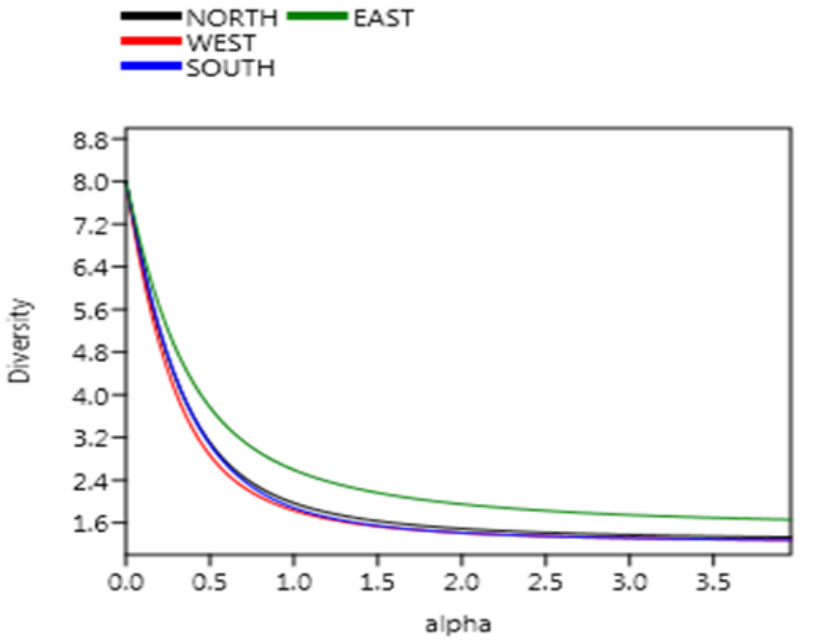
SL. NO	NAME OF SPECIES	Q1	Q2	Q3	Q4	Q5	TOTAL
1	Eichhornia crassipes	2	1	1	0	1	5
2	Spirodela intermidia	18	12	9	5	5	49
3	Nelumbu nucifera	1	1	0	0	2	4
4	Desmodium gangeticum	0	1	1	0	0	2
5	Centella asiatica	0	0	0	0	1	1
6	Nymphaea pubescens	1	1	0	0	0	2
7	Croton bonplandianum	0	1	2	0	0	3
8	Crotolaria incana	1	1	0	0	0	2
9	Alternanthera sessilis	2	1	1	0	1	5
10	Gomphrena seratta	0	1	3	2	0	6
11	Lobelia alsinoides	1	0	0	0	1	2
12	Hydrilla verticillata	3	4	0	4	3	14
13	Mikania micrantha	1	0	0	0	0	1
14	Ceratophyllum demersum	4	5	3	3	6	21
15	Vallisneria spiralis	1	0	1	0	0	2
16	Utricularia aurea	0	1	1	0	2	4
17	Oldenlandia corymbosa	0	0	1	0	2	3
18	Cyperus difformis	2	2	1	3	1	9
19	Panicum paludosa	3	3	2	4	4	16
20	Sida cordifolia	1	0	0	2	0	3

Table 1.4-sampling station EAST

SL. NO	NAME OF SPECIES	Q1	Q2	Q3	Q4	Q5	TOTAL
1	Eichhornia crassipes	1	1	0	1	1	4
2	Hydrilla verticillata	2	3	4	3	3	15
3	Vallisneria spiralis	1	0	1	0	0	2
4	Ceratophyllum demersum	5	6	7	4	5	27
5	Nelumbu nucifera	1	1	0	1	1	4
6	Centella asiatica	0	0	0	1	1	2
7	Chara fibrosa	0	0	0	0	2	2
8	Utricularia aurea	0	0	0	1	1	2
9	Heliotropium indicum	1	0	0	0	0	1
10	Salvinia natans	0	0	0	0	2	2
11	Spilanthes acmella	0	2	1	0	1	4
12	Ludwigia perennis	0	0	0	0	2	2
13	Polygonum hydropiper	0	0	0	0	2	2
14	Eclipta postrata	1	0	1	2	0	4
15	Becopa monnieri	0	1	0	0	0	1
16	Jussiaea repens	0	0	0	0	1	1
17	Oldenlandia corymbosa	0	1	0	2	0	3
18	Parthenium hysterophorus	1	0	1	0	0	2
19	Leersia hexandra	0	0	0	2	0	2
20	Desmodium gangeticum	0	0	1	0	0	1
21	Cyperus difformis	2	2	0	0	0	4
22	Nymphoides heterophylla	0	0	0	0	1	1
23	Marsilea minuta	0	0	0	2	0	2
24	Lipia nodiflora	0	1	2	0	0	3
25	Crotolaria incana	0	1	0	0	0	1
26	Sesamum indicum	1	0	0	0	0	1
27	Martynia diandra	1	0	0	0	0	1
28	Leucas aspera	0	1	0	1	0	2
29	Gomphrena seratta	2	1	2	0	0	5

Table 2- PAST generated data

NORTH		WEST		SOUTH		EAST	
Taxa_S	28	Taxa_S	37	Taxa_S	20	Taxa_S	29
Individuals	176	Individuals	267	Individuals	154	Individuals	103
Dominance_D	0.2216	Dominance_D	0.1628	Dominance_D	0.1494	Dominance_D	0.1064
Simpson_1-D	0.7784	Simpson_1-D	0.8372	Simpson_1-D	0.8506	Simpson_1-D	0.8936
Shannon_H	2.396	Shannon_H	2.711	Shannon_H	2.372	Shannon_H	2.817
Evenness_e^H/S	0.3922	Evenness_e^H/S	0.4068	Evenness_e^H/S	0.5357	Evenness_e^H/S	0.5768
Equitability_J	0.7191	Equitability_J	0.7509	Equitability_J	0.7916	Equitability_J	0.8366
Fisher_alpha	9.386	Fisher_alpha	11.66	Fisher_alpha	6.13	Fisher_alpha	13.43



Diversity profile of the four sampling stations

III. Result & Discussion

In the study it is found that area East have more species diversity than other parts . North and South exhibit more or less similar distribution and Western part is less diverse. The species richness is highest in area West but the evenness is maximum in Eastern side of the pond. I postulate and predict that further importance will be provided to the biodiversity of the pond as it performing self purification of water and many vital ecological processes leading to upgrading water quality. By doing so, the multifunctional participation of biodiversity supports the sustainable use of water as one of key resources for mankind.

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