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Research Article

Diversity of Aquatic Macrophytes in Four Blocks of Purba Medinipur District, West Bengal, India

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ABSTRACT

The Current research was conducted to find the diversity of aquatic macrophytes in four selected block areas of Purba Medinipur district in the Indian State West Bengal. This overall study was conducted for a duration of 18 months, from February 2021 to August, 2022. A total of 67 aquatic macrophytes under 54 genera belonging to 32 families were identified from the study areas. Among them, about 18% represents the floating macrophytes, 40% emergent, 8% submerged and 34% marginal. Poaceae, Araceae, Asteraceae, Ulvaceae, Convolvulaceae, and Acanthaceae are the families that contain most of the identified species.

Keywords: *Aquatic macrophytes, Diversity, Habitat, Purba Medinipur district.*

INTRODUCTION

Different freshwater bodies such as ponds, canals, rivers, lakes, wetlands, and others occupy less than 2% of the earth's total land surface area. The worldwide estimated number of discovered freshwater species is between 9,000 to 25,000 (Cosgrove & Rijsberman, 2000). Aquatic ecosystems also provide a home to many aquatic species, including phytoplankton, zooplankton, aquatic plants, insects, fish, mammals, birds, and others. "Aquatic macrophytes" refers to aquatic photosynthetic organisms' group, which are large enough to see with the naked eye. Mainly seven plant divisions represent the aquatic macrophytes are Cyanobacteria, Rhodophyta, Chlorophyta, Xanthophyta, Bryophyta, Pteridophyta, Spermatophyta (Chambers et al., 2008). Aquatic plants are more widely distributed worldwide than terrestrial plants because aquatic plants require uniform factors and conditions, where terrestrial plants need to adapt to different ecosystems (Aloo et al., 2013). Aquatic weeds are generally divided into submerged, floating, emergent, submerged and marginal types.

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Aquatic macrophytes are important aquatic components because they provide shelter and food to fish, aquatic invertebrates and other wild life (Kumar, 2011), they reduce turbidity, oxygenate in water and provide spawning beds (Dutta, 2014). The macrophytes can improve water quality by absorbing nutrients with their effective root system (Paul, 2022). Some of the aquatic macrophytes are involved in removing pollutants like heavy metals, which are used for wastewater purification systems (Sanyal, 2017). Floating and submerged weeds are infested waterbodies, which results in reducing the water storage capacity and reduce the sunlight penetration. Therefore, it is essential to control the aquatic weeds, so that the waterbodies can be utilized to their best efficiency (Arif et al., 2018). The diversity of aquatic weeds varies in different areas of India because of different nutrient load in different region (Sitre et al., 2014). Many aquatic macrophytes are cultivated in public places such as parks, gardens and private places like personal apartment, home garden etc. for decorative purposes (Ame et al., 2022).

Documentation and survey of species is the most important aspect in ecological and biodiversity studies, which helps estimate species abundance and identify ecological and economical importance (Chiarucci et al., 2011 & Ferreira et al., 2011). In spite of several research work on aquatic macrophytes by several researches such as Sugunan (1989), Venkatraman et al. (2000), Yadav & Sardesai (2002), Pejawar (2005), Kumar (2011), Sitre (2013), Sitre et al. (2014), Datta (2014), Parveen et al. (2014), Parikh et al. (2015), Pradeep & Dwivedi (2016), Murkute & Chavan (2016), Kaisar et al. (2016), Islam et al. (2017), Sanyal (2017), Prasad & Das (2018), Pimpalshende et al. (2021), Yadav (2021), Patil (2022), Rathod (2022), Paul (2022), there are no reported research work on aquatic macrophytes diversity in Purba Medinipur district of West Bengal, India. Therefore, the work was carried out to study the aquatic macrophytes diversity in four blocks of Purba Medinipur district.

MATERIALS AND METHODS

1.1. Study area and period

Four different community-development blocks of Purba Medinipur district in West Bengal were selected for this study. The four selected community-development blocks are Ramnagar-I, Ramnagar-II, Egra-I, Egra-II (Figure 1). The four selected CD blocks form an administrative division situated in Purba Medinipur district of West Bengal, India. Ramnagar-I block is located between 21.6786° N and 87.5632° E and has an area of 139.4 Km^2. Ramnagar-II is located between 21.689533° N and 87.592193° E and has an area of 163.27 km^2. Egra-I is located between 21.900526° N and 87.538078° E and has an area of 211 km^2. Egra-II is located between 21.8709° N and 87.5798° E and has an area of 184.71 km^2. The study was conducted for a period of 18 months from February 2021 to August, 2022.

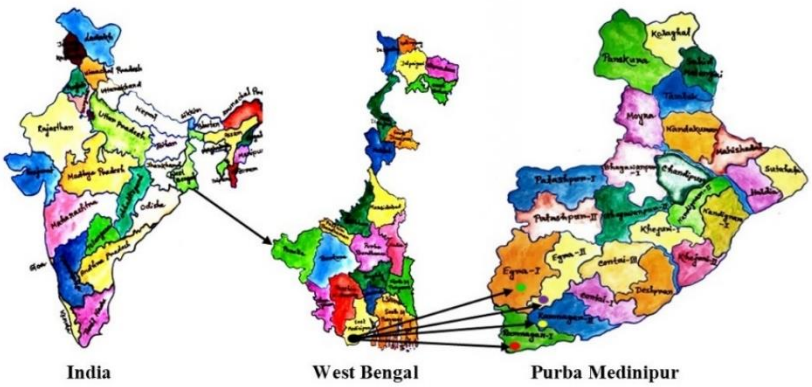


Figure1. Map showing the four study blocks in Purba Medinipur district of the Indian state West Bengal

1.2. Sample collection

The macrophytes were collected in monthly basis from the water bodies of the four community development blocks through hand pickling methods or using collection hooks. After collection, macrophytes were rinsed thoroughly with clean water, soaked with blotting paper, and put into plastic zip bags.

1.3. Sample identification

The macrophyte samples were brought to the department of Industrial Fish and Fisheries general laboratory at Ramnagar College in Purba Medinipur district of the Indian state of West Bengal. Samples were identified using standard literature Cook (1996), Naskar (1990), Lucas & Southgate (2012), Gupta (2001), Fassett (2006), APHA (2017).

RESULTS

1.4. Distribution of aquatic macrophytes in the four blocks

Different types of aquatic macrophytes were found and recorded during the study period from the four blocks of Purba Medinipur. Based on different characteristics, they are mainly classified into free-floating, emergent, submerged and marginal. The available macrophytes recorded from the selected four blocks are given below (Table 1.)

Table1. Available species of aquatic macrophytes in four blocks of Purba Medinipur district

SL No.	Scientific Name	Family	Local/Common Name	Habitat	Availability Status			
					R-I	R-II	E-I	E-II
1	*Ceratophyllum demersum* L.	Ceratophyllaceae	Coontail/ Hornwort	Submerged	_	+	_	_
2	*Colocasia esculenta* (L.) Schott	Araceae	Kochu/ Elephant-ear/ Taro	Emergent	++	++	++	++
3	*Colocasia gigantea* (Blume ex Hassk.) Hook.f.	Araceae	Bon kochu/ Giant elephant-ear	Emergent	_	_	_	_
4	*Pontederia crassipes* Mart.	Pontidariaceae	Kochuripana/ Water hyacinth	Floating	++	++	++	++
5	*Ipomoea aquatica* Forssk.	Convolvulaceae	Kolmi/Morning glory/Water Spinach	Emergent	+	+	+	+
6	*Ipomoea carnea* Jacq.	Convolvulaceae	Bush Morning glory/ Dhol kolmi	Emergent	_	+	+	_
7	*Ipomoea indica* (Burm.f.) Merr.	Convolvulaceae	Forest morning glory/ Buno kolmi	Emergent	×	×	_	_
8	*Ipomoea pes-caprae* (L.) R.Br.	Convolvulaceae	Chagol pa/ Bayhops, Beach morning glory	Marginal	+	+	_	_
9	*Lemna minor* L.	Araceae	Khudepana/Duckweed/Common duckweed	Floating	+	+	+	+
10	*Marsilea quadrifolia* L.	Marsileaceae	Susni Shak/ Water clover	Emergent/ Semi-submerged	+	+	+	+
11	*Nymphoides indica* (L.) Kuntze	Menyanthaceae	Chandmala/ banana plant/ water snowflake	Emergent	+	+	+	+
12	*Nymphoides aquatica* (J.F.Gmel.) Kuntze	Menyanthaceae	Banana lily/big floating heart	Emergent	+	+	_	_
13	*Nymphoides hydrophylla* (Lour.) Kuntze	Menyanthaceae	Chandmala/ White snowflake	Emergent	_	_	+	+
14	*Pistia stratiotes* L.	Araceae	Topa pana/ Water lettuce	Floating	++	++	++	++
15	*Spirodela polyrrhiza* (L.) Schleid.	Araceae	Giant duckweed/ Water velvet	Floating	×	×	_	_
16	*Trapa bispinosa* Roxb.	Lythraceae	Panifol/ Water chestnut/ water nut	Emergent	×	_	_	_
17	*Azolla* pinnata R. Br.	Salviniaceae	Mosquito fern, Duckweed fern, Water fern	Floating	+	+	+	+
18	*Najas indica* (Willd.) Cham.	Hydrocharitaceae	Naiads/ Water-nymphs	Submerged	×	×	_	+
19	*Centella asiatica* (L.) Urban	Apiaceae	Thankuni/ Indian pennywort	Marginal	++	++	+	+
20	*Hydrilla verticillata* (L.f.) Royle	Hydrocharitaceae	Water thyme/ Hydrilla	Submerged	_	×	+	_
21	*Nymphaea pubescens* Willd.	Nymphaeaceae	Sada saluk/ Common water lily	Emergent	+	+	+	+
22	*Nymphaea rubra* Roxb. ex Andrews	Nymphaeaceae	Lal saluk/ Red water lily	Emergent	×	×	_	_
23	*Nymphaea nouchali* Burm. f.	Nymphaeaceae	Nil saluk/ Blue water lily	Emergent	×	_	×	×
24	*Bacopa monnieri* (L.) Pennell	Scrophulariaceae	Brahmi/ Water hyssop/ Thyme-leaved gratiola	Marginal	×	_	_	_
25	*Neptunia oleracea* Lour.	Fabaceae	Lajjabati/Water mimosa/ sensitive neptunia	Marginal	++	+	+	+
26	*Phragmites karka* Adans.	Poaceae	Kash ful/ Perennial reed grass	Emergent	_	+	++	++
27	*Alternanthera philoxeroides* (Mart.) Griseb.	Amaranthaceae	Jal sechi/ Alligator weed/ Pig weed	Emergent	+	+	+	+
28	*Glinus oppositifolius* L.	Molluginaceae	Gima Shak/ Indian chick weed	Marginal	++	++	++	++
29	*Nelumbo nucifera* Gaertn.	Nelumbonaceae	Padma/ Lotus	Emergent	_	_	_	_
30	*Wolffia arrhiza* (L.) Horkel ex Wimm.	Araceae	Rootless duckweed/ Spotless watermeal	Floating	+	+	+	+
31	*Oxalis corniculata* L.	Oxalidaceae	Amrul Sak/ Creeping woodsorrel	Marginal	++	+	+	+
32	*Ludwigia adscendens* (L.) H. Hara	Onagraceae	water primrose	Emergent	_	_	+	+
33	*Cyperus* spp.	Cyperaceae	Nut grass	Marginal	+	+	+	+
34	*Panicum repens* L.	Graminae	Torpedo grass/ Dog-tooth grass	Marginal	++	++	++	++
35	*Pontederia* sp.	Pontederiaceae	Kotopana/ Pond weed	Emergent	_	_	_	+
36	*Enhydra fluctuans* Lour.	Asteraceae	Hincha/ Helonchi/ Buffalo spinach	Emergent	+	++	_	×
37	*Commelina communis* L.	Commelinaceae	Kanshira/ Asiatic dayflower	Marginal	+	++	×	×
38	*Mikania cordata* Kunth	Asteraceae	Rabon lota/ Bitter vine/ Climbing hemp vine	Marginal	++	++	++	++
39	*Leersia hexandra* Sw.	Poaceae	Arail	Emergent	_	_	_	_
40	*Juniperus* sp.	Cupressaceae	Abhal, Juniper	Marginal	_	_	×	×
41	*Acanthus ebracteatus* Vahl	Acanthaceae	Holly mangrove	Emergent	_	_	×	×
42	*Avicennia officinalis* L.	Acanthaceae	Indian mangrove	Emergent	_	×	×	×
43	*Avicennia marina* (Forssk.) Vierh.	Acanthaceae	Grey mangrove	Emergent	_	×	×	×
44	*Andropogon gerardii* Vitman	Poaceae	Indian Warrior (Big Bluestem)	Emergent	+	+	+	+
45	*Sesuvium portulacastrum* (L.) L.	Aizoaceae	Sea Purslane	Marginal	+	×	×	×
46	*Chromolaena odorata* (L.) R.M.King & H.Rob.	Asteraceae	Camphor grass/ flowering shrub	Marginal	+	+	+	+
47	*Oplismenus burmannii* (Retz.) P. Beauv.	Poaceae	Busket grass	Marginal	+	+	+	+
48	*Guilandina bonduc* L.	Fabaceae	Nicker nut/ Fever nut	Marginal	+	_	×	×
49	*Parthenium hysterophorus* L.	Asteraceae	Gajar ghas/ Congress grass	Marginal	+	+	+	+

50	*Trianthema portulacastrum* L.	Aizoaceae	Horse Purslane	Marginal	_	_	_	_
51	*Dactyloctenium aegyptium* (L.) Willd.	Poaceae	Crowfoot grass	Marginal	+	+	+	+
52	*Hygrophila auriculata* Schumach.	Acanthaceae	Kulekhara/ Kokilaksha	Emergent	+	+	+	+
53	*Salvinia* sp.	Salviniaceae	Floating fern	Floating	_	_	_	_
54	*Ulva compressa* Linnaeus	Ulvaceae	Shaola/ Green algae	Floating	+	+	×	×
55	*Ulva flexuosa* Wolfen	Ulvaceae	Shaola	Floating	_	_	×	×
56	*Ulva intestinalis* L.	Ulvaceae	Green bait weed	Floating	+	+	+	+
57	*Ulva linza* Linnaeus	Ulvaceae	Shaola/ Sea lettuce	Floating	+	_	×	×
58	*Ulva prolifera* O.F.Müller	Ulvaceae	Shaola	Floating	_	+	×	×
59	*Ageratum conyzoides* L.	Asteraceae	Gendhua Bon/ Goat Weed	Marginal	+	+	+	+
60	*Glyceria grandis* S.Wats.	Poaceae	American manna grass	Emergent	_	_	_	_
61	*Typha latifolia* L.	Typhaceae	Hogla/ Southern Cattail	Emergent	_	_	+	+
62	*Vallisneria spiralis* L.	Hydrocharitaceae	Tape grass/ eelgrass	Submerged	_	_	_	_
63	*Cynodon dactylon* (L.) Pers.	Poaceae	Durba ghas/ Bermuda grass	Marginal	++	++	++	++
64	*Chara zeylanica* L.	Charophyceae	Common stonewort	Submerged	×	×	_	_
65	*Commelina benghalensis* L.	Commelinaceae	Kanshira	Marginal	+	+	+	+
66	*Christella normalis* (C.Chr.) Holttum	Thelypteridaceae	Southern shield fern	Marginal	+	+	+	+
67	*Polystichum acrostichoides* (Michx.) Schott	Dryopteridaceae	Christmas fern	Marginal	_	_	_	_

R-I = Ramnagar-I, R-II = Ramnagar-II, E-I = Egra-I, E-II = Egra-II

'++' Abundant, '+' Common, '_' Rarely available, '×' Not found

Plate 1.1. *Ceratophyllum demersum* L. **2.** *Colocasia esculenta* (L.) Schott **3.** *Colocasia gigantea* (Blume ex Hassk.) Hook.f. **4.** *Pontederia crassipes* Mart. **5.** *Ipomoea aquatica* Forssk. **6.** *Ipomoea indica* (Burm.f.) Merr. **7.** Ipomoea pes-caprae (L.) R.Br. **8.** *Lemna minor* L. **9.** *Marsilea quadrifolia* L. **10.** *Nymphoides indica* (L.) Kuntze **11.** *Pistia stratiotes* L. **12.** *Spirodela polyrrhiza* (L.) Schleid. **13.** *Trapa bispinosa* Roxb. **14.** *Azolla* pinnata R. Br. **15.** *Najas indica* (Willd.) Cham. **16.** *Centella asiatica* (L.) Urban **17.** *Hydrilla verticillata* (L.f.) Royle **18.** *Nymphaea pubescens* Willd. **19.** *Nymphaea rubra* Roxb. ex Andrews **20.** *Bacopa monnieri* (L.) Pennell **21.** *Phragmites karka* Adans. **22.** *Glinus oppositifolius* L. **23.** *Nelumbo nucifera* Gaertn. **24.** *Wolffia arrhiza* (L.) Horkel ex Wimm. **25.** *Oxalis corniculata* L. **26.** *Ludwigia adscendens* (L.) H. Hara **27.** *Cyperus* sp. **28.** *Panicum repens* L. **29.** *Enhydra fluctuans* Lour. **30.** *Commelina communis* L. **31.** *Mikania cordata* Kunth **32.** *Juniperus* sp. **33.** *Acanthus ebracteatus* Vahl **34.** *Avicennia officinalis* L. **35.** *Avicennia marina* (Forssk.) Vierh. **36.** *Andropogon gerardii* Vitman **37.** *Sesuvium portulacastrum* (L.) L. **38.** *Chromolaena odorata* (L.) R.M.King & H.Rob. **39.** *Oplismenus burmannii* (Retz.) P. Beauv. **40.** *Guilandina bonduc* L. **41.** *Parthenium hysterophorus* L. **42.** *Hygrophila auriculata* Schumach. **43.** *Salvinia* sp. **44.** *Ulva* sp. **45.** *Ageratum conyzoides* L. **46.** *Typha latifolia* L. **47.** *Christella normalis* (C.Chr.) Holttum **48.** *Polystichum acrostichoides* (Michx.) Schott **49.** *Cynodon dactylon* (L.) Pers. **50.** *Neptunia oleracea* Lour.

1.5. Distribution of macrophytes

A total number of 67 aquatic macrophytes species under 32 families were recorded during this study. Habitat wise four different macrophytes are recorded from the study sites. Family and habitat wise recorded species with their percentage of availability are enlisted below.

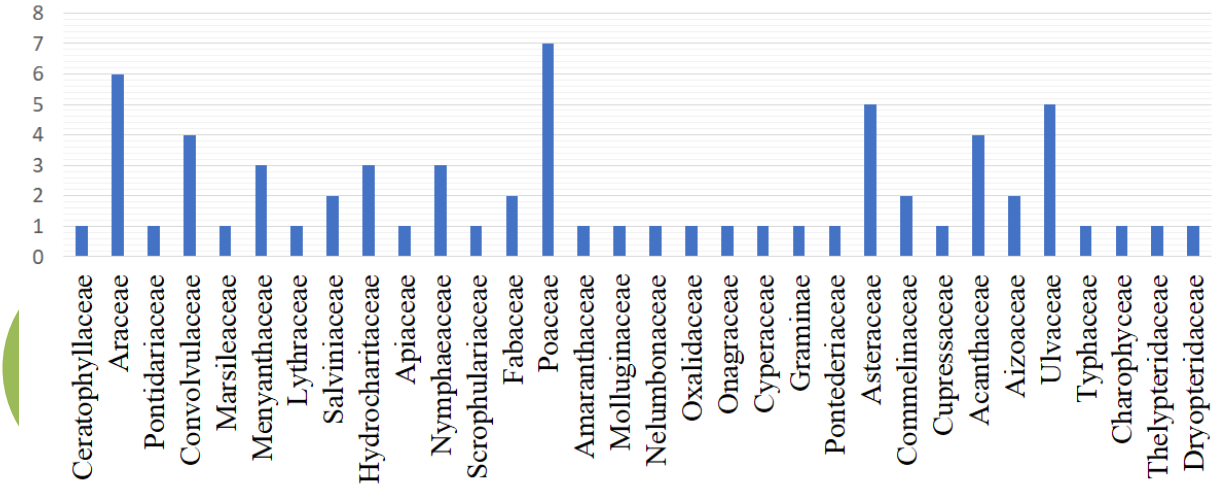


Figure 2. Percentage of macrophytes distribution in four blocks of Purba Medinipur district

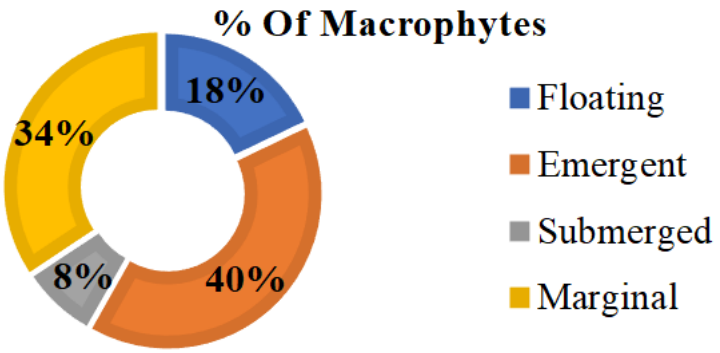
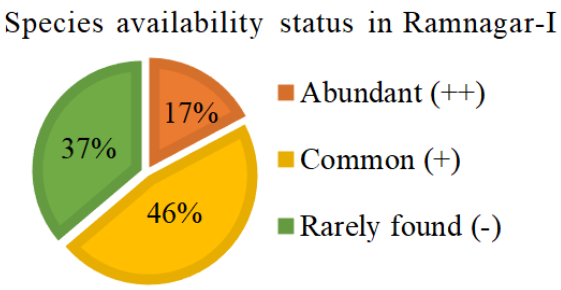


Figure3. Family wise species diversity in the four-study area

1.6. Species availability status

The recorded species are abundant, common or rarely found in the study areas. An account of species availability status is stated below.



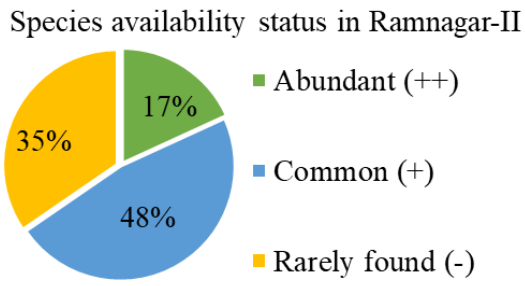


Figure 4 & 5. Percentage of species availability in Ramnagar-I & Ramnagar -II block

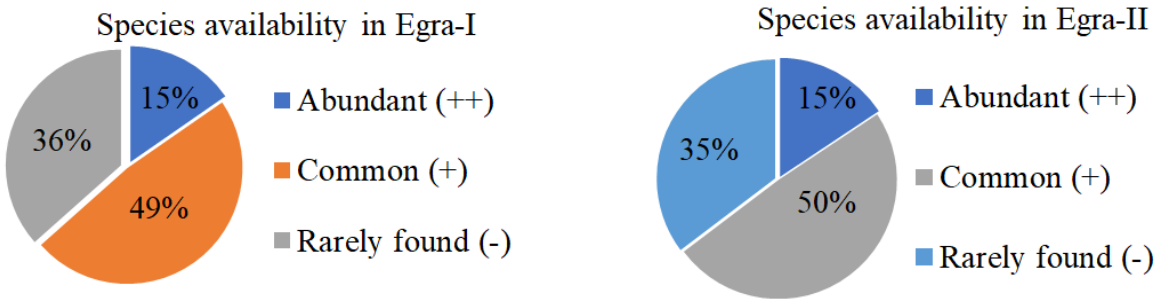


Figure 6 & 7. Percentage of species availability in Egra-I & Egra- II block

DISCUSSION

Altogether a total number of 67 species under 54 genera belonging to 32 families were identified from the present study (Table 1 and Plate 1). Among the species some were abundant where some were rarely found in the study areas. The recorded macrophytes were classified into various habitats, out of all the 67 species 12 species (18%) were floating, 27 species (40%) emergent, 5 species (8%) submerged and rest 23 species (34%) were marginal (Figure 2). Out of the 32 families, family Poaceae represented by 7 species, followed by family Araceae (6 species), Asteraceae and Ulvaceae (5 species each), Convolvulaceae and Acanthaceae (4 species each), while family Menyanthaceae, Hydrocharitaceae, Nymphaeaceae represented by each of 3 species, on the other side family Salviniaceae, Fabaceae, Commelinaceae, Aizoaceae represented by each of 2 species, and rest families are represented by each of only 1 species (Figure 3).

Adhikary et al. (2018) recorded 43 aquatic weed species from 3 different habitat locations of Fatki River in Magura district of Bangladesh. Paul (2022) identified 41 macrophytes belonging to 24 families from twenty ponds of Thrissur district of Kerala. In this present study, 59 species (about 88%) out of total 67 enlisted species were recorded from Ramnagar-I block. Of which 10 species (17%) were abundant in this block area such as *Colocasia esculenta* (L.) Schott, *Pontederia crassipes* Mart., *Pistia stratiotes* L., *Centella asiatica* (L.) Urban etc. 27 species (46%) were common in the block areas, viz. *Ipomoea* spp., *Marsilea quadrifolia*, *Nymphoides* spp., *Commelina communis*. There also 22 species (37%) were rarely found in the areas (Figure 4). Out of the total number of listed species 58 (about 86%) were recorded from Ramnagar-II block. 10 species (17%) were found most abundant in the block areas viz. *Pistia stratiotes* L., Centella *asiatica* (L.) Urban, *Glinus oppositifolius* L., *Panicum repens* L., 28 species (48%) such as *Ipomoea* spp., *Nymphoides* spp., *Phragmites karka* Adans., *Oxalis corniculata* L. were common in the areas. *Juniperus* sp., *Acanthus ebracteatus* Vahl, *Avicennia* sp., *Guilandina bonduc* like these 20 species (35%) were rarely found in the block areas (Figure 5). Most of the species in this block are common with the species found in Ramnagar-I block. This present study enumerated 55 macrophytes species (about 82%) from Egra-I block areas out of which 8 species (15%) like *Panicum repens* L., *Centella asiatica* (L.) Urban, *Mikania cordata* etc. were abundant. 27 species (49%) were common viz. *Cyperus* spp., *Andropogon gerardii*, *Chromolaena odorata* etc. While 20 species (36%) were rarely found in the areas of Egra-I block (Figure 6). Yadav and Majumder (2020) stated the diversity and distribution of 5 taxa of seaweed belonging to the class Chlorophyceae. Some species such as *Acanthus ebracteatus* Vahl, *Avicennia* spp., *Sesuvium* sp., *Guilandina* sp., *Ulva* spp. were not found from the Egra-I block areas during this present study. From the fourth block Egra-II 54 species (about 80%) were recorded. 8 species (15%) were found abundant in the areas of Egra-II block. Other side 27 species (50%) viz. *Oxalis corniculate* L., *Neptunia oleracea* Lour., *Cyperus* spp., *Oplismenus*

burmannii (Retz.) P. Beauv. were commonly found and 19 species (35%) such as *Chara* sp., *Polystichum acrostichoides* (Michx.) Schott, *Vallisneria spiralis* L., *Trianthema portulacastrum* L. were found rarely in this block areas.

CONCLUSION

The aquatic macrophytes significant component for the aquatic ecosystem. Abundance of aquatic macrophytes was observed in all areas of the four blocks. Some aquatic weeds have adverse impacts on the animals living in the waters because they are in eutrophic condition. On another side some aquatic bodies of the study areas are highly productive and in mesotrophic condition. So, they should be managed properly to minimize potential negative impacts. By the way, collecting and preserving of the macrophytes is not a big deal but the decorative diversity record of the aquatic macrophytes in a proper area is an important documentation for future studies on macrophyte vegetation.

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Author Contribution:

All authors contributed equally to establishing the research and design experiment topic.

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