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RAPID DETERIORATION OF WETLAND IN BANGLADESH: A SCENARIO OF NOIKANDI *BEEL*

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Abstract

Wetland aggregates at least a part of human heritage. It has direct impact on human culture and society. Besides, wetland comprises significant components in the context of local and national biodiversity. *Beel* wetland is a unique environment of floral and faunal association. In Bangladesh, wetland plays a vital role in its economic, industrial, ecological, socioeconomic and cultural attitudes. A study was conducted in the Noikandi *beel* where rapid destruction was observed due to anthropogenic activities. In the present study, seasonality and macro aquatic diversity and of the Noikandi *beel* Bangladesh was examined. Plant materials were collected from the *beel* once in a month for a period of 24 months. In the first 12 months, a total of 52 taxa have been recorded. Among them 40.38% was aquatic, 46.77% amphibians and 13.46% were found to be terrestrial. In addition, a rare taxon *Euryale ferox* Salisb was found. In the consecutive year of the study, 22.03% were aquatic, 52.54% terrestrial, 22.03% amphibians and1.69% was found to be macro algae. The rapid disappearance of aquatic plants is alarming. On the contrary, a good number of plants have been noted that is not associated with wetland environment indicating the transformation of wetland in to terrestrial ecosystem. Along with declining water depth and siltation other anthropogenic activities, agricultural, developmental initiatives have been identified as major threats, towards the Noikandi *beel*. The recommendations of the present study could be implemented by the government with the help of local people, as well as, this information may be useful for other *beels* of Bangladesh.

Key words: Bangladesh, diversity, Noikandi *beel*, policy, rapid deterioration, wetland

Introduction

Bangladesh is a well-known country overlapped by numerous *beels*, *haors*, *baors*, rivers, lakes, tributaries, floodplains and ponds (Islam and Wahab 2005, Alam et al. 2014). As usual, the wetlands are famous for its biodiversity (Nishat et al. 1993, Davis and Froend 1999, Islam and Wahab 2005). Almost 50% of the total land surface are wetland including *beels*, *haors*, *baors*, rivers, estuaries, mangrove swamps, and water storage reservoirs, fish ponds and some other lands that are seasonally flooded to a depth of about 30 cm or more than 30 cm (Islam and Gnauck 2008).

The village people exclusively rely on the natural resources for their food, shelter, fuel, medicine or any other means of daily subsistence in Bangladesh. Almost 50% of the people of Bangladesh are directly reliant on wetlands resources. The majority of the deprived people in the wetlands areas are directly or indirectly depend on the resources for their nutrition (Davis and Froend 1999)

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Wetlands have great impact and have been well established as an active force for floral and faunal conservation as well as rural socioeconomic improvement. The widespread loss and degradation of wetlands is remarkable in the recent decade (Russi et al. 2013). Therefore, degradation or sustainable existence of the resources impacts on livelihood security to a great extent (Baland and Platteau 1996, Scherr 2000). In addition, the wetland comprises very rich components of biodiversity in the context of local, national, and regional implication. They also make available habitat for a diversity of resident and migratory waterfowl, a significant number of endangered species, as well as a large number of commercially important species (Islam 2010, Webb et al. 2010).

More than 350 species have been noted as weeds of the cultured field including wetlands. The number of species in an area be subject to the land usage patterns and its ecological circumstances (Gaston 2000). In *beels*, *haors*, *baors*, ditches where no crop cultivation is experienced, a large number of aquatic plants grow and form thick natural vegetation. Recently, awareness regarding wetland as a resource of living security is a concern to the populace. Diverse human actions are nowadays a key force upsetting the all ecosystems worldwide (Vitousek et al. 1997, Sala et al. 2000).

The present study was aimed to evaluate the seasonality, diversity and status of the plants of the Noikandi *beel*, Natore, Bangladesh. Moreover, the causes of wetland degradation and destruction along with their possible conservation strategy have been focused.

Materials and Methods

The study was carried out from April 2014 to April 2016 to collect all the plant materials from the Noikandi *beel* located at Natore Sadar upazilla (88° 56' 24.41" N, 88.93°E) beside the Natore Paurosava, Natore, Bangladesh. It is approximately 2 kilometers long and 1 kilometer width. The *beel* is connected with the river Barnoi, which is the outlet river of the Atrai. Major parts of the *beel* are plain land but the middle position of the *beel* is deep, where the water retains round the year. The inundation depth during the flood period differs from 1-5 meters. Total 500m areas have been thoroughly searched (Fig. 1 A, B). Specimens were sampled by hand from the *beel* from 5 to 20 cm depth of water. An anchor tied with rope was used to assemble the specimen from greater depth. Plants were agitated underwater to remove the bulk of loose detritus and stored for transportation in the plastic vial containing the *beel* water.

In the laboratory, specimens were washed with double distilled water, preserved in Transeau's solution (Transeau 1916) and also preserved as dry herbarium specimens. The herbarium sheets have been conserved at the Phycology and Limnology Laboratory, Department of Botany, University of Rajshahi, Bangladesh. Fresh specimens were cautiously teased out and arranged in distilled water on a white tray.

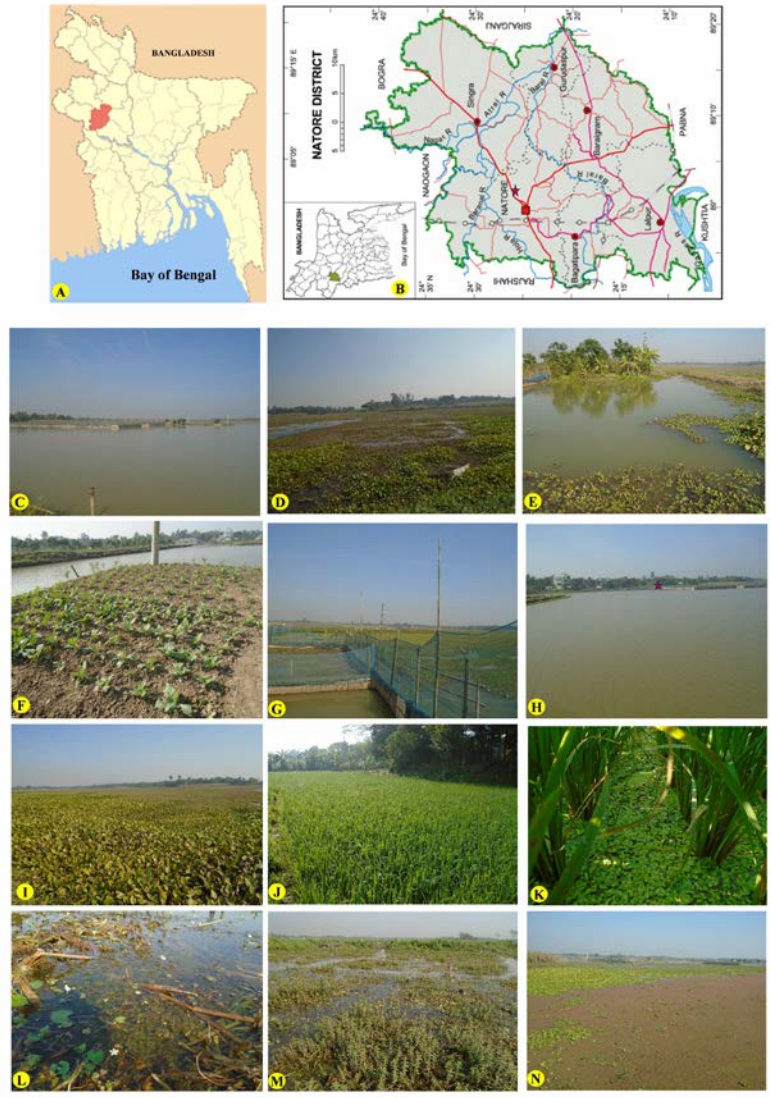

Fig. 1. (A) Map of Bangladesh indicating Natore district, (B) Map presents Natore city in the Natore district, Bangladesh, (C) Parts of Noikandi *beel* wetland with the artificial water supply, (D) Hydrophytes with other vegetation, (E) Parts of the beel where a current jal (fine net) is drying for the fishing, (F) Encroachment and Tomato cultivation inside the *Beel*, (G) Artificial barrier for fish culture adjacent with the *beel* water, (H) The red point indicate an animal farm a biscuit factory near the *beel*, (I) Massive *Echinochloa* spp. are disturbing the regular flora, (J) Rice cultivation alongside the beel, (K) Algae and other amphibians in the rice field inside the *beel*, (L) Charophyceae and Nymphaeaeceae were observed during the rainy season, (M) *Enhydra* sp. with other vegetations, (N) Parts of the *beel* with algal bloom and hydrophytes indicating eutrophication.

Results and Discussion

During the first year of the present investigation (April 2014 - March 2015) a total of 52 taxa were noted (Table 1); among these 40.38% were aquatic, 46.15% amphibian and 13.46% were found to be terrestrial. It appears that terrestrial plants are occupying wetland habitat that represents the threatened status of the wetland (Table 1). Seasonality of the collected plants was noted. Some of them were present throughout the year and others occurred only in particular season (Table 1). Throughout the period of study, the regular depth of water of the *Beel* was not more than 150 cm.

In case of diversity, the members of cyperaceae dominated over the rest followed by characeae and euphorbiaceae (Table 1). Twelve families had only sole representative out of 21 families. During the study period *Euryale ferox* Salisb. was only found in 2014. *E. ferox* is credited to absorb the toxic heavy metals. As a consequence, it could be a reason for the less richness and for the short seasonality of this plants (Rai et al. 2002). *Nelumbo* spp. only originated during rainy and autumn season. This plant exhibited sporadic abundance indicating its declining population in this wetland. Eutrophication, as well as acidification of water bodies, may eventually consequence in the total disappearance of all aquatic macrophytes with the exception of the floating-leaved Nymphaeids *Nymphaea* spp. (Arts et al. 1990). Likewise, we observed the rich abundance of *Nymphaea* sp. among the members of Nymphaeaceae throughout the study period.

In the first year of study, charophytes were not found during summer, autumn, late autumn, winter and spring. During these seasons, almost the whole *beel* area goes under agricultural practices. In the rainy season, the deepest zone of the wetland is kept free from agricultural practices. Only in the post monsoon i.e. during mid September to late October charophytes were found with other aquatic vegetation (Table 1) in the deepest zone of the wetland concerned. In general, charophytes are found in Bangladesh all the year round (Naz et al. 2009, Naz et al. 2011, Diba et al. 2013) but during the present study, charophytes were recorded during rainy season indicating their threatened existence in this wetland due to agricultural practices. On the contrary, a charophyte was recorded for the first time from Bangladesh (*Nitella axillaris* Braun) during this study. In a similar study performed to assess the biodiversity status of a wetland ecosystem, Mohangonj Upazila in Netrakona district of Bangladesh concluded with the findings that the wetland diversity is at a life-threatening risk due to major environmental threats (Alam 2014). As evident, the water depth of this wetland is drastically getting lesser during longer dry seasons and in post monsoon too; causing the nearly threatened existence of deep rooted hydrophytes in this wetland.

In the second year of the study, the 52.54% were terrestrial, 22.03% were amphibious, 1.69% was macro algae and the rest were other macrophytes of different groups (Table 2). Most of the wetland plants have not been noted with the higher abundance that was found in the first year of study. On the other hand, some new plants have been recorded, indicating the present status of the *beel* (Table 2). Numbers of taxa belonging to poaceae family have been increased. This indicate that the beel is being transforming to terrestrial environment (Rosa et al. 2009).

According to Gallagher et al. (2003) dominance of Asteraceae realm the terrestrial environment. During present study 8 taxa of Asteraceae were observed indicating the transformation wetland towards terrestrial ecosystem; In addition, during the second-year study, we found only one species of charophyceae whereas in the first year we recorded 8 taxa. This information indicates that the biodiversity of this beel is rapidly declining due to enhanced eutrophication; because it is commonly known that charophyte can flourish well in clean water (Naz et al. 2011).

Table 1. Checklist and seasonal distribution of vegetation of the Noikandi *beel* (2014-2015).

Family	Taxon	Habit	Habitat	Seasonal distribution					
				Summer 2014	Rainy 2014	Autumn 2014	Late-autumn L.Autun 2014	Winter 2015	Spring 2015
	Oryza sativa L.	Monocot	Aquatic	+	+	+	+	+	+
	Cynodon dactylon L.	Monocot	Terrestrial	+	_	+	+	+	+
Poaceae	*Echinochloa colonum* L.	Monocot	Amphibian	+	_	+	+	+	+
Cyperaceae	*Schoenoplectus grossus* L.	Monocot	Amphibian	+	+	+	+	+	+
	Cyperus difformis L.	Monocot	Amphibian	+	+	+	+	+	+
	Cyperus michelianus L.	Monocot	Amphibian	+	+	+	+	+	+
	Cyperus tuberosus Rottb.	Monocot	Amphibian	+	+	+	+	+	+
	Cyperus rotundus L.	Monocot	Amphibian	+	+	+	_	_	_
	Eleocharis acutangula Roxb.	Monocot	Amphibian	_	+	+	_	_	_
	Fimbristylis schoenoides Retz.	Monocot	Amphibian	_	+	+	_	_	_
	Fuirena ciliaris (L.) Roxb.	Monocot	Amphibian	_	+	+	_	_	_
	Kyllinga brevifolia Roxb.	Monocot	Amphibian	_	+	+	_	_	_
	Schoenoplectus articulates (L.) Palla	Monocot	Amphibian	_	+	+	_	_	_
	Schoenoplectus juncoides (Roxb.) Palla	Monocot	Amphibian	_	+	+	_	_	_
Eriocaulaceae	*Eriocaulon setaceum* L.	Monocot	Amphibian	_	+	+	_	_	_
Hydrocharitaceae	*Hydrilla verticillata* (L.F.) Royle	Monocot	Aquatic	_	+	+	_	_	_
	Ottelia alismoides (L.) Pers.	Monocot	Amphibian	_	+	+	_	_	_
	Vallisneria spiralis L.	Monocot	Amphibian	_	+	+	_	_	_
Lemnaceae	*Lemna* L.	Monocot	Aquatic	_	+	+	_	_	_
	Spirodela polyrhiza L.	Monocot	Aquatic	_	+	+	_	_	_
Najadaceae	*Najas graminea* Del.	Monocot	Aquatic	_	+	+	_	_	_
	Potamogeton mucronatus Presl.	Monocot	Aquatic	_	+	+	_	_	_
Pontederiaceae	*Eichhornia crassipes* Mart.	Monocot	Amphibian	_	+	+	_	_	_
	Monochoria hastata L.	Monocot	Amphibian	_	+	_	_	_	_
Alismataceae	*Sagittaria guayanensis* Kunth	Monocot	Amphibian	_	+	_	_	_	_
Salviniaceae	*Salvinia natans* (Linn.) All.	Pteridophyta	Amphibian	_	+	_	_	_	_

Table 1 Contd.

Azollaceae	*Azolla pinnata* R.Br.	Pteridophyta	Amphibian	+	+	+	+	+	+
Marsileaceaceae	*Marsilea minuta* L.	Pteridophyta	Amphibian	_	+	_	_	_	_
Parkeriaceae	*Ceratopteris pteridoides* (Hook.) Hiern.	Pteridophyta	Amphibian	_	+	_	_	_	_
Ceratophyllaceae	*Ceratophyllum demersum* L.	Dicot	Terrestrial	+	+	+	+	+	+
Asteraceae	*Enhydra fluctuans* Lour.	Dicot	Amphibian	+	+	+	+	+	+
Convolvulaceae	*Ipomoea aquatica* Forsk.	Dicot	Aquatic	_	+	_	_	_	_
Lentibulariaceae	*Utricularia inflexa* Forsk.	Dicot	Aquatic	_	+	_	_	_	_
Menyanthaceae	*Nymphoides aurantiacum* Dalz.	Dicot	Aquatic	_	+	_	_	_	_
Nymphaeaceae	*Nymphaea nouchali* Burm.f.	Dicot	Aquatic	_	+	_	_	_	_
	Nelumbo nucifera Gaertn.	Dicot	Aquatic	_	+	+	_	_	_
	Euryale ferox Salisb.	Dicot	Aquatic	_	+	+	_	_	_
Onagraceae	*Ludwigia adscendens* (L.) Hara.	Dicot	Amphibian	+	_	_	+	+	+
Euphorbiaceae	*Euphorbia hirta* L.	Dicot	Terrestrial	+	_	_	+	+	+
	Chenopodium album L.	Dicot	Terrestrial	+	_	_	+	+	+
	Amaranthus spinosus L.	Dicot	Terrestrial	+	_	_	+	+	+
	Amaranthus viridis L.	Dicot	Terrestrial	+	_	_	+	+	+
	Vicia sativa L.	Dicot	Terrestrial	+	_	_	+	+	+
	Heliotropium indicum	Dicot	Terrestrial	_	+	_	_	_	_
Charophyceae	*Chara corallina* Klein ex Willd.	Algae	Aquatic	_	+	_	_	_	_
	C. setosa Klein ex Willd.	Algae	Aquatic	_	+	_	_	_	_
	C. zeylanica var. *sejuncta* (A,Br.) R.D.W.	Algae	Aquatic	_	+	_	_	_	_
	Nitella hyalina (DC.) Agardh	Algae	Aquatic	_	+	_	_	_	_
	Nitella axillaris Braun	Algae	Aquatic	_	+	_	_	_	_
	Lychnothamnus barbatus (Meyen) Leonhardi	Algae	Aquatic	_	+	_	_	_	_
	N. furcata var. *mucronata*	Algae	Aquatic	_	+		_	_	_
	Chara fibrosa Ag. ex Bruuz	Algae	Aquatic	_	+	_	_	_	_

Table 2. Checklist and seasonal distribution of vegetation of the Noikandi *beel* (2015-2016).

Family	Taxon	Habit	Habitat	Seasonal distribution					
				Summer 2015	Rainy 2015	Autumn 2015	Late-Autumn 2015	Winter 2016	Spring 2016
Poaceae	*Oryza sativa* L.	Monocot	Aquatic	+	+	+	+	_	_
	Cynodon dactylon L.	Monocot	Terrestrial	+	+	+	+	+	+
	Echinochloa colonum L.	Monocot	Terrestrial	+	+	+	+	+	+
	Pennisetum purpureum Schum.	Monocot	Terrestrial	+	+	+	+	+	+
	Saccharum officinarum L.	Monocot	Terrestrial	+	+	+	+	+	+
	Saccharum spontaneum L.	Monocot	Terrestrial	_	+	+	+	_	_
	Dactyloctenium aegyptium (L.) P. Beauv.	Monocot	Terrestrial	+	+	+	+	+	+
	Hygroryza aristata (Retz.) Nees	Monocot	Terrestrial	_	+	+	+	+	_
Pontederiaceae	*Eichhornia crassipes* (Mart.) Solms	Monocot	Aquatic	_	+	+	+	+	_
	Monochoria hastata (L.) Solms	Monocot	Aquatic	_	+	+	+	+	_
Potamogetonaceae	*Potamogeton natans* L.	Monocot	Aquatic	_	+	+	+	+	_
Cyperaceae	*Cyperus difformis* L.	Monocot	Amphibian	+	_	_	_	+	+
	Cyperus michelianus L.	Monocot	Amphibian	+	_	_	_	+	+
	Cyperus tuberosus Rottb.	Monocot	Amphibian	+	_	_	_	+	+
	Cyperus rotundus L.	Monocot	Amphibian	+	_	_	_	+	+
	Eleocharis acutangula Roxb.	Monocot	Amphibian	_	+	+	_	_	_
	Fimbristylis schoenoides Retz.	Monocot	Amphibian	+	_	_	+	+	+
	Schoenoplectus articulates (L.) Palla	Monocot	Amphibian	_	+	+	+	+	_
	Schoenoplectus juncoides (Roxb.) Palla	Monocot	Amphibian	_	+	+	+	+	_
Hydrocharitaceae	*Ottelia alismoides* (L.) Pers.	Monocot	Aquatic	_	+	+	+	+	_
	Vallisneria spiralis L.	Monocot	Aquatic	_	_	_	_	_	_
Lemnaceae	*Lemna perpusilla* Torrey	Monocot	Aquatic	_	+	+	_	_	_
	Spirodela polyrhiza L.	Monocot	Aquatic	_	+	+	_	_	_
Salviniaceae	*Salvinia natans* (Linn.) All.	Pteridophyta	Aquatic	_	+	+	+	+	_
Azollaceae	*Azolla pinnata* R.Br.	Pteridophyta	Aquatic	_	+	+	+	+	_
Boraginaceae	*Heliotropium indicum*	Dicot	Terrestrial	+	_	_	_	+	+
Marsileaceae	*Marsilea minuta* L.	Pteridophyta	Amphibian	+	+	+	+	+	+
Ceratophyllaceae	*Ceratophyllum demersum* L.	Pteridophyta	Amphibian	+	+	+	+	+	+
Asteraceae	*Enhydra fluctuans* Lour.	Dicot	Amphibian	+	+	+	+	+	+
	Ageratum conyzoides L.	Dicot	Terrestrial	+	_	_	_	+	+
	Cirsium arvense (L.) Scop	Dicot	Terrestrial	+	_	_	_	+	+
	Eclipta alba (L.) Hassk	Dicot	Terrestrial	+	_	_	_	+	+
	Mikania cordata (Burm.f.) Robinson	Dicot	Terrestrial	+	_	_	_	+	+
	Tridax procumbens L.	Dicot	Terrestrial	+	_	_	_	+	+
	Vernonia petula (Dryand.) Merr.	Dicot	Terrestrial	+	_	_	_	+	+
	Xanthium indicum Koen. ex Roxb.	Dicot	Terrestrial	+	_	_	_	+	+

Table 2 Contd.

Acanthaceae	*Acanthus auriculata* Schumach	Dicot	Terrestrial	+	+	+	+	+	+
Convolvulaceae	*Ipomoea aquatica* Forsk.	Dicot	Amphibian	+	+	+	+	+	+
Menyanthaceae	*Nymphoides aurantiacum* Dalz.	Dicot	Aquatic	_	+	+	+	+	_
Moraceae	*Ficus hispida* L.f.	Dicot	Terrestrial	+	+	+	+	+	+
Musaceae	*Musa sapientum* L.	Dicot	Terrestrial	+	+	+	+	+	+
Nymphaeaceae	*Nymphaea nouchali* Burm.	Dicot	Aquatic	_	+	+	+	+	_
Onagraceae	*Ludwigia adscendens* (L.) Hara.	Dicot	Amphibian	_	+	+	+	+	_
Euphorbiaceae	*Euphorbia hirta* L.	Dicot	Terrestrial	+	_	_	_	+	+
Fabaceae	*Vicia sativa* L.	Dicot	Terrestrial	+	_	_	_	+	+
	Lablab purpureus (L.) Sweet	Dicot	Terrestrial	+	_	_	_	+	+
Chenopodiaceae	*Chenopodium alba* L.	Dicot	Terrestrial	+	_	_	_	+	+
Amaranthaceae	*Amaranthus viridis* L.	Dicot	Terrestrial	+	_	_	_	+	+
	Amaranthus spinosus L.	Dicot	Terrestrial	+	_	_	_	+	+
Anacardiaceae	*Mangifera indica* L.	Dicot	Terrestrial	+	+	+	+	+	+
Rutaceae	*Citrus aurantifolia* (Christm. and Panzer) Swingle	Dicot	Terrestrial	+	+	+	+	+	+
Scrophulariaceae	*Limnophila heterophylla* (Roxb.) Benth., Scroph	Dicot	Amphibian	_	+	+	+	_	_
	Limnophila indica (L.) Druce	Dicot	Terrestrial	_	+	+	+	_	_
Verbenaceae	*Lippia alba* (Mill.) Briton et Wilson	Dicot	Terrestrial	+	+	+	+	+	+
	Phyla nodiflora (L.) Greene	Dicot	Terrestrial	+	_	_	_	+	+
Solanaceae	*Physalis minima* L.	Dicot	Terrestrial	+	_	_	_	+	+
	Physalis angulata L.	Dicot	Terrestrial	+	_	_	_	+	+
	Capsicum frutescens L.	Dicot	Terrestrial	+	_	_	_	+	+
Charophyceae	*Nitella furcata* var. *mucronata*	Algae	Aquatic	_	+	+	+	+	_

The information gap and threats

Inhabitants of large vertebrates may not be precise indicators of the status of all of freshwater species, but there are grounds for grave concern if their rank were reflected in even 5% of the total species complement. To date, however, there has been no comprehensive global analysis of freshwater biodiversity equivalent to those recently accomplished for terrestrial systems. Existing data on the population status or destruction rates of freshwater biota are prejudiced in terms of geography, territory types and taxonomy; most populations and habitats in some regions have not been supervised at all. Even a elementary global mapping of inland waters, classified by broad geomorphic categories, is deficient and therefore, there are no global estimates of changes in the extent of lakes, rivers or wetlands (Myers et al. 2000, Balmford et al. 2002, Dudgeon et al. 2006).

Management efforts for freshwater biodiversity are controlled by the fact that majority of the species in diverse communities are sporadic and thus their natural histories tend to be elusive. This indicates that overall species numbers are predictable; predicting the identities of the affected taxa is not possible.

In this study, the major threat was noted by the author's field visit and personal observation for the recent past few years from the study area. According to opinion and remarks of the local people, relevant literature,

and the present investigation, aquatic diversity was being drastically reduced due because of the massive agricultural practices (Fig. 1). As a normal procedure of agricultural practice, the farmers are using herbicides and pesticides to protect their crops.

Regular fertilization and irrigation is a common phenomenon for the agricultural practice. Both of the aforesaid practice in the wetland is also hampering the lifecycle of the aquatic plant diversity. Of note, the wetland area goes under drought for few months that directly affect the biodiversity of the wetland. Since there is less water in the wetland, the local people do the over fishing, in particular, during late autumn and early winter as well as thriving in the mud for collecting the fishes. In the *beel* area, there has been residential/commercial development that influence directly or indirectly to this *beel*.

Alien invasive species is another concern for the regular flora and fauna. In this *beel* presence of terrestrial alien invasive species *Cyperus rotundus* L. and *Ageratum conyzoides* L. were recorded during last year of investigation. Furthermore, indiscriminate utilization, encroachments for fishing or agricultural cultivation (Fig. 1) and urbanization have created negative impacts on the *beel*. The household effluent regularly discharged to the *beel*. For the artificial fish culture in the *beel*, people use rotten rice, different types of dung, rotten oilcake that may not be good for the other species which does also increases the accelerate the rate of eutrophication. Apart this, a biscuit factory and an animal farm have recently been established near the *beel* which produces organic wastes which are released in the beel water resulting change in the trophic status of the waterbody and shrinking the floral as well as faunal diversity of the concerned.

Recommendations for management of the Noikandi *beel*

Suitable use of wetlands can resolve the ecosystems problems in the wetland areas. The country needs an adequate scientific guideline, appropriate interdisciplinary policy and political commitment to implement it, for sustainable management and protection of wetlands e.g. *beels* and ecologically sensitive wetland ecosystems in Bangladesh. Thus, a consistent data bank is important what is provided in this study to improve the conservation measures initiated by the Government.

In the Fig. 1G, it was evident that artificial fish cultivation was going on inside the *beel* that has created a continuous negative impact on this *beel*. This artificial barrier should be removed as soon as possible. For the fish cultivation, farmers use deep tube well throughout the year that disturbs the natural growth and occurrence of the flora. Therefore, if there is a need for water to supply that should be by a scientific way.

Increasing awareness, understanding about the *beel* ecosystem, to the fishermen as well as to local people are the fundamental steps that may be employed through educational and cultural institution in the locality. The use of current jal (fine mesh net) should completely be prohibited. There are some scientific ways to manage the hydrophytes that can be applied manually. Around the *beel* area, there is a huge of agricultural cultivation. In case of fertilization, indiscriminate use of fertilizers should be stopped and the use of inorganic fertilizer should gradually be replaced by organic manure. After observing the siltation stage, there can be dug after particular time interval to prevent siltation. Agricultural practices must be practiced in a controlled way that does not harm the existence of the wetland. Use of pesticides and herbicides should be controlled and minimized as wetlands are one of the intricate, delicate and fragile ecosystems of Bangladesh its values yet to be explored by all. Any sort of drastic initiatives in or nearby wetlands should be safeguarded. Integrating the indigenous knowledge with the scientific knowledge could be helpful for the sustainable management of the wetland concerned.

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