NUTRIENT STATUS OF LOTIC WATER BODIES AND DIVERSITY OF AQUATIC MACROPHYTES

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ABSTRACT

Lotic water bodies receive nutrients from allochthonous and autochthonous sources and they promote the succession of aquatic macrophytes. The present study comprises nutrient condition of sediment and water and its influence on the growth and diversity of aquatic plants. During the study period (1985-1986), water and sediment sample were collected and analyzed for Calcium(Ca^{2+}),magnesium(mg^{2+}),Sodium(Na^{+}),Potassium ($^{K+}$),nitrates($No3^{2+}$) and Phosphate ($Po4^{3-}$).Similarly aquatic macrophytes were collected and identified to know the distribution and diversity of macrophytes. The present study concluded that increase in the nitrate and phosphate concentration both in sediment and water, influence the distribution and diversity of macrophytic vegetation and luxuriant growth with great succession of dominant species was encountered.

INTRODUCTION

Aquatic plants play a key role in biogeochemical cycles and food webs of living things in the lotic water bodies. On the other hand aquatic plants are primary products of food in aquatic ecosystem and further the absence of aquatic flora may also lead to the absence of fauna. Distribution of macrophytic plants and abundance also indicate the water quality. Biological productivity includes qualitative and quantitative features and its actual and potential aspects. In natural ecosystems macrophytes remove both toxic and non toxic elements in the sediments and water. Bilgrami & Dutta Munshi (1997), Narayan and Somashekar (1997).The trophic status is mainly influenced by the variety of communities and indicator species occurring at the source. More ever, metabolic activities of macrophytic communities accelerate to physico-chemical conditions of the streams. Submerged aquatic macrophytes are one of the most important components of the littoral zones of rivers. Field studies conducted by Carpenter and Lodge (1986),Chitranshi V.R. and Bilgrammi R.S. 1986, Sondergaard et al (1996), evidenced that submerged macrophytes have an important role in restoration of shallow eutrophic rivers. Therefore, from an engineering point of view, evaluation of life cycles of macrophytes is a key issue before using them in restoration lakes. Carpenter and Adams (1997), rivers Pahwa D.V. and Mehrotra S.N. (1966),Chitranshi V.R.and Bilgrami R.S. (1986), and Asaeda and Bon (1997).

However, no separate work on aquatic plants of Allahabad District has been published. Hence, necessary for present day aquatic plants and status to lotic ecosystem. Macrophytes also take up a large amount of nutrients from the sediment and water. But after death and decay the nutrient load is again increased in the sediment. In succeeding

decomposition process, accumulated organic matter and nutrients are released which has a significant influence on the river ecosystem. The release of ammonia and phosphorous raises the nutrients concentration in the over lying waters and the oxygen consumption in the chemical and biological decomposition process may decrease the dissolved oxygen level in the over lying waters as well as sediments, Jewell (1971), Pereira et al (1994).

An attempt has been made to bring the nomenclature up to date as for as possible.

STUDY AREA AND METHODOLOGY

Allahabad, Prayag of the yore, has been known for ages as the holiest of the holy pilgrimages of India because of its location at the 'Sangam',the confluence of the sacred Ganga and Yamuna, as well as the invisible Sarswati, the three, on meeting farming the legendry 'Triveni'. The city attracts millions of pilgrims from all over the country all the year round but specially during the Hindu month of 'Maagh' for the annual fair and a holy bath and specially every 14^{th} year during the 'Kumbh' when crores of devout pilgrims converge here.

Besides the Ganga and Yamuna, the aquatic ecosystem of the Allahabad region also includes the river 'Tons' in the south. It meets the Ganga near 'Sirsa', about 40 km. from Allahabad city down stream Sangam. After an intensive survey of Allahabad region and keeping in view the points of discharge of sewage and effluents of the following stations were chosen for study. Sediments on bank and water samples (midstream) were collected from four sites namely Kara, Rasoolabad in river Ganga and Sujawan,Kilaghat (Allahabad Fort) in Yamuna river.

(a) On the river Ganga, upstream Sangam
1-Kara Ghat
2-RAsoolabad Ghat
(b)On the river Yamuna upstream Sangam
1-Sujawan
2- Allahabad Fort (Kilaghat)

The different physico-chemical parameters such as $No3^{2-}$, $Po4^{3-}$, Ca^{2+}, Mg^{2+}, Na^{+} were analyzed using standard methods,(Adoni1985).Similarly aquatic plants were also collected and preserved for identification. The standard books and manuals were used for identification (Cook1974, Fasset1975, K.K.Singh and R.P.S. Tomar1982, Adony1985).

RESULTS AND DISCUSSIONS

Table 1

Average values of Nutrient concentration in water & sediments samples.

Parameters	P1		P2		P3		P4	
	S	W	S	W	S	W	S	W
No_3	5.8	6.1	0.2	0.3	0.75	11.3	0.80	11.1
Po_4	2.0	2.6	0.7	2.6	0.4	0.7	0.66	7.0
Ca^{2+}	48.21	27.02	10.29	35.25	32.40	23.84	48.07	30.60
Mg^{2+}	14.48	35.08	14.60	44.62	34.11	25.70	44.00	38.10
Na^{+}	0.42	3.82	0.32	2.44	5.06	32.20	5.66	40.18

Index:

1-On the river Ganga up stream Sangam

P1= Kara 40 km. W=Water samples values in mg/l. in water

S=Sediment samples values in mg/kg in water

P2= Rasoolabad 8 km.

2- On the river Yamuna upstream Sangam.

P3= Sujawan 30 km.

P4= Kilaghat 1 km.

The results indicate that the calcium ions show higher concentration in water samples from P1 i.e. Kara as compared to other sampling stations. Similarly Mg^{2+}, values show higher concentration in sediment at P4 (Kilaghat) and P3 (Sujawan) . Similarly other parameters such as Na^{+}, $PO4^{3-}$, $NO3^{2-}$ show lesser concentration in sediment than midstream water.

Distribution of aquatic plants in each riverine station was determined to understand the species diversity, abundance and occurrence of rare species. The presence and absence of species was noted and is presented in Table -2. In the present study 16 different species of aquatic plants are identified from all the river sites. But species distribution from each site of the river is greatly varied which may be due to the physico- chemical characteristics of water (midstream) and bank water (sediment). The disturbance from human and domestic activity leads to the loss of macrophytic vegetation.

Table 2

Distribution and species diversity of aquatic plants recorded from different stations of Ganga and Yamuna in the form of % frequency and % abundance.

Plant species	**P1**	**P2**	**P3**	**P4**
Marginal	Kara	Rasoolabad	Sujawan	Kilaghat
Polygonum glabrum	-	-	-	-
Marsilea quadrifolia	-	5/8	-	-
Potamogeton nodosum	-	-	-	-
Ipomoea aquatica	4/10	-	-	-
Cyperus tegetum	2/10	-	40/62	5/15
Floating				
Eichhornia crassipes	-	5/8	10/3	-
Trapa bispinosa	-	2/3	-	-
Pistia stratiotes	5/4	5/15	10/6	-
Sprirodella polyrhiza	-	5/6	-	-
Submerged				
Hydrilla verticillata	10/24	16/42	20/42	20/22
Naja minor	-	20/36	10/8	-
Ceratophyllum demersum	5/8			10/10
Vallisnaria spiralis	4/10	2/3	10/16	20/29
Chara	4/10	-	-	-
Rooted emergent				
Nelumbium speciosum	20/40	5/10	10/31	10/12
Nymphoides indicum	-	-	-	10/6
Aponogetro monostachyon	-	2/5	-	-

Numerator Percentage frequency
Denominator Percentage abundance
- Absent

It is confirmed that P1 is rich in few aquatic plants such as ***Ipomoea aquatica, Cyperus tegetum ,Pistia stratiotes , Hydrilla verticillata ,Ceratophyllum demersum, Vallisnaria spiralis, Chara, Nelumbium speciosum.*** The site Kara receives water from surrounding crop fields and sewage from Kara town. Due to this P1 site becomes highly eutrophic. On the other hand sediment load has increased due to the runoff from crop fields and this depth is slowly reduced and it supports rich semi aquatic plants such as ***Cyperus tegetum*** and other grass species.
Distribution and species diversity of macrophytic vegetation of P2 (Rasoolabad) Ganga river supports rich aquatic and semi aquatic plants. The river is surrounded by crop fields the runoff has led to the increase in nutrient load. In addition to this farmers have encroached the catchments area of the river and river is totally field with semi aquatic plant ***Marsilea quadrifolia,Eichhornia, Aponogeton***. Similarly floating and submerged plants namely ***Hydrilla verticillata, Naja minor, Ceratophyllum, Nelumbium speciosum***, ***Trapa bispinosa, pteridophytic plant Marsilea*** are abundant.

The third sampling station called as Sujawan (Yamuna) is considered as a clean water because it is linked with Karelabagh pumping station. Interestingly this also supports a number of different species of aquatic and semi aquatic plants. Marginal plant like ***Cyperus tegetum, Floating hydrophyte Eichhornia crassipes,Pistia stratioites***, submerged ***Hydrilla verticillata, Naja minor, Ceratophyllum demersum, Vallishnaria spiralis,Chara*** plants supports rich bio diversity.

Finaly P4 i.e. Kilaghat (Allahabad Fort) Yamuna river site has less sediment load as compared to P3 & P4 sites due to nature of bottom soil and cumulative effect of human activities and increase in nutrient due to discharge of sewage in Rasoolabad site and occurrence of macrophytic vegetation viz. Cyperus tegetum, Eichhornia crassipes, Pistia stratiotes, Hydrilla verticillata, Naja minor,Vallisnaria spiralis, Nelumbium speciosum,etc.

A number of investigators studies the lotic ecosystem and concluded that the physico chemical characters influence the growth, species distribution, indicator groups and pollution tolerant species. (Singh D.K.1988, Srivastav U.S.1988). The increasing concentrations of Phosphorous and Nitrogen have important effects on the primary production. Waglenskaetal 1987 observed a close relationship between Phytoplankton abundance and diversity of submerged macrophytes. The dense stands of macrophytes release large amounts of inorganic nutrients (Dawidowiezetal 1987).

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