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ASSESSMENT OF THE HABITAT AND DIVERSITY OF MALACO-FAUNA OF KOSI RIVER SYSTEM, NORTH BIHAR

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INTRODUCTION

During recent years, there has been a growing recognition for better understanding of freshwater macroinvertebrate communities due to the important role played by them in the ecosystem dynamics, particularly at secondary trophic level. This has led to an increased effort to study their diversity, density and relationship with the physicochemical and biological characteristics of the habitat. Molluscs, which constitutes an important component of macroinvertebrate communities of both lotic and lentic habitats , not only form the food of many commercially important fishes but are also utilised by mankind in several ways.

In Bihar, although several studies have been carried out during recent past on physico-chemical and biological characteristics of some rivers (David and Ray, 1966; Pashwa and Mahrotra 1966; Nasar and Munshi, 1971; Bilgrami & Munshi, 1979 and 1985) and also on some aspects of molluscan ecology/ biology in lake and ponds (Rai *et.al.* 1981, Singh and Roy, 1991 Sinha, 1995), no attempt has been made to study the molluscan fauna with reference to physicochemical and biological properties of rivers of Kosi-Burhi Gandak System which are important rivers of North Bihar and major tributaries of River Ganga (Datta Munshi and Datta Munshi, 1991). Therefore, an attempt has been made during present investigations to study the general physico-chemical and biological characteristics of the water of the two rivers and the qualitative diversity of malacofauna at some selected site.

STUDY AREA :

The Kosi river system in North Bihar comprises of several smaller rivers, rivulets, dhars, flood plain lakes (*chaurs* and *mans*) and swamps. Samples for the study were collected from the following four selected stations of Rivers Burhi Gandak and Kosi as indicated in Fig 1.

Station I. Siluri Ghat (District Begusarai) : it is situated nearly 15 km away from Begusarai town, just below the Manjhaul bridge over river Budhi-Gandak.

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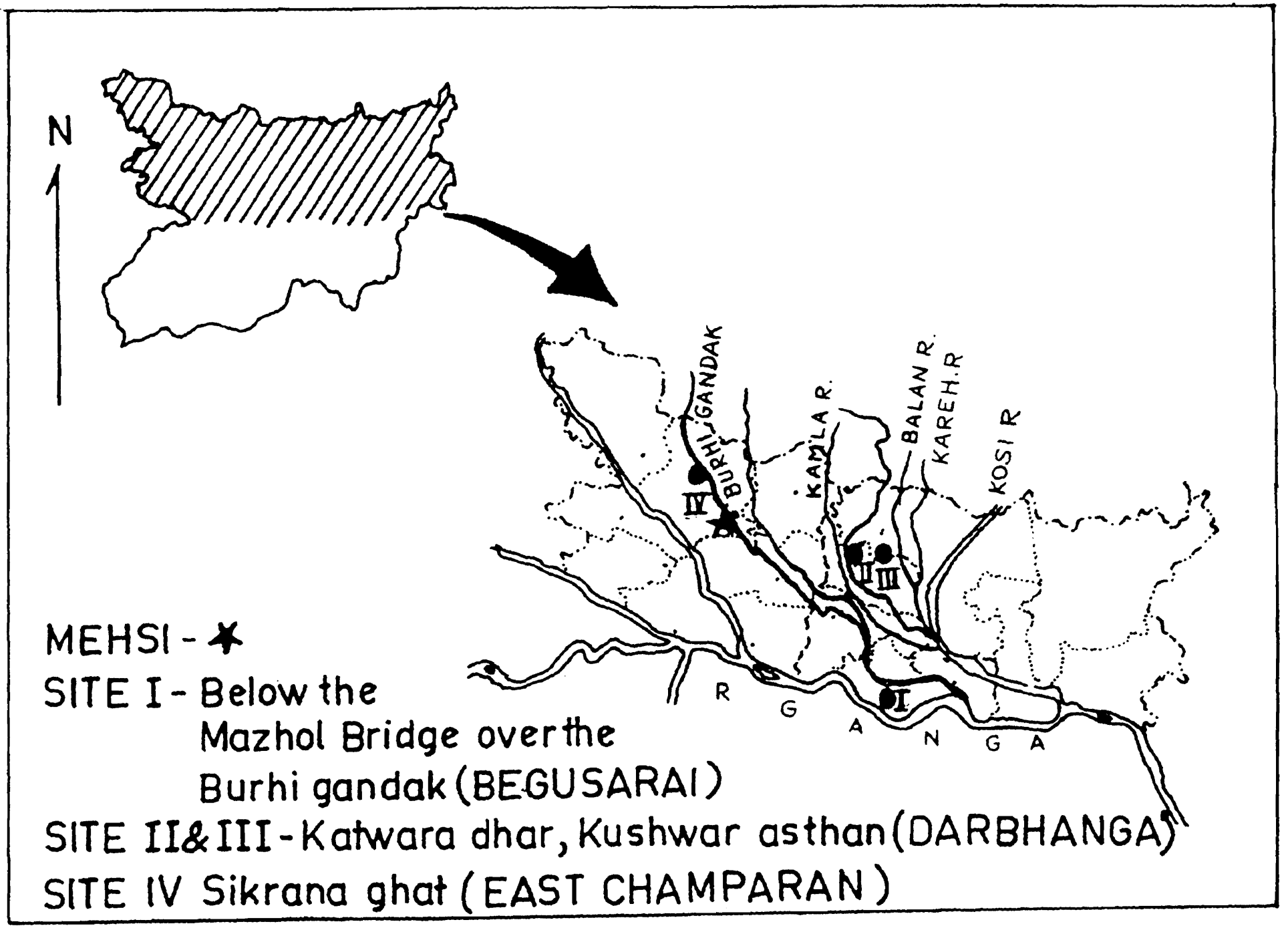

Fig. 1 : Map showing location of study sites, North Bihar drainage system.

Station II. Katwara Dhar (District Darbhanga) : It is about 50 km away from Darbhanga town on way to Kusheshwarsthan on river Jiwach, a comparatively smaller tributary of the Kosi system. This station was characterized by the occurrence of a diverse malacofauna.

Station III. Kusheshwarsthan (District Darbhanga) : This was an important site, situated nearly 60 km from Darbhanga town. This huge chaur (Ox-bow Lake) covers an area of about 500 acres. This is a perennial *chaur* receiving large quantities of water from several smaller tributaries of the river Kosi like Kamla, Balan, Kareh and Bagmati, beside Kosi.

Station IV. Sikrahana Ghat (District. East Champaran) This is situated about 145 km north-west of Kusheshwarsthan in the Mehsi block on Burhi Gandak river. This is an important site for the commercial shell fish collection as there are several Mother of Pearl button industries located here.

MATERIAL AND METHODS

The studies were conducted on seasonal basis during 1995-96. There are three defined seasons in this part of the country viz. summer (March-June), Monsoon (July – October) and winter (November-February). Samples were collected during different season from all the three sites. Samplings were done from the slow flowing zones of rivers having less current and from pools/ oxbow lakes/ beels and chaurs. Data for the respective seasons of the two annual cycles are pooled together in order to have mean values.

Water samples for physicochemical analysis were collected from the surface (1ft depth) manually with the help of a fisherman by filling the water slowly in a 250-ml glass bottle from the desired depth and lifting slowly after tightly fitting the stopper. Generally all samplings for both physico-chemical and biological parameters were done at sites of approximately 5ft depth. Sampling at all stations were done in the morning around 9.00 A.M. Temperature was measured by a glass thermometer, light intensity by a Lux meter and pH by a battery operated pH meter. Other parameters were determined following Standard method (APHA, 1991).

Quantitative samples of phytoplankton, collected by filtering 1 lit of water on a Whatman filter paper, were preserved in Lugol's solution. Counting was done major group wise by taking one-ml sample in the Sedgwick Rafter counting chamber and observing under a microscope.

Zooplankton was collected by plankton net made of No. 21 bolting cloth. Random tows were made several times and all samples collected were preserved in 4% formalin. Counting was done major group wise with the help of Sedgwick rafter counter under a stereo binocular.

Molluscan fauna was collected qualitatively both from littoral as well as benthic zones with the help of a drag net made of a rectangular iron frame of 0.5 x 0.5 m attached with a loose bag made of mosquito net cloth. The drag net was operated at the littoral zone and also in the bethic zones of the river in areas where depth did not exceed 5 ft, for a distance of about 5 meters and

all material collected were taken out. This procedure was repeated several times at different places. Samples from the deeper areas of the rivers were collected with the help of a fisherman who brought bottom soil in a cloth bag by diving. Live molluscan specimens were picked up from the macrophytes as well as soil All samples from one site were mixed and preserved in 5% formalin. Dead shells were not taken into consideration. Samples were brought to the laboratory and sorted group-wise. Species identification was done following Subba Rao (1989).

Seasons were divided as summer (March-June) Monsoon (July-October) and winter (November-February).

RESULTS

1. Physicochemical characteristics of water quality

The mean seasonal values of different physicochemical parameters are given in Table 1. At Station 1 (River Burhi Gandak), the mean atmospheric temperature varied between 33.0 °C and 26.0 °C, lowest in winter and highest in summer. There was not much difference with surface water temperature excepting during winter season. Light intensity in surface zone ranged between 780 Lux (summer) and 230 Lux (monsoon) and varied between 480 and 260 at deeper zone. Light measurements during winter could not be carried out. pH of both, surface as well deeper zone were always acidic and ranged from 5.5 (summer) to 6.5 (winter) in surface water. Not many differences were noticed in the values of pH between surface and depth water. Conductivity ranged between 270 and 439 micromhos. Dissolved oxygen concentration ranged from 4.56 to 5.2 mg/l. Free carbon dioxide were also recorded in significant quantities and values ranged from 24.0 to 34.0 mg/l. While Carbonate alkalinity was recorded only from surface waters during winter season. Bicarbonates were recorded almost throughout the year. Exorbitantly high values (296 mg/l) were recorded during winter and only 16.0 mg/l was observed during monsoon. The values of chloride were comparatively low and fluctuated between 8.0 and 27.0 mg/l The values were lowest during monsoon. The hardness of surface water during winter was about 169.6 mg/l, which decreased during following monsoon season (135 mg/l). The concentration of the nutrients, phosphate (PO4 -P) and Nitrate (NO3-N) were moderate throughout the year. Highest values of phosphates were recorded during monsoon month (0.145 mg/l) and lowest during summer (0.03 mg/l). Contrary to these nitrates was high during summer (1.42 mg/l) and lowest during monsoon (0.05 mg/l). Calcium and magnesium ions were present in moderate quantities.

The physicochemical characteristics at Stations II, III and IV , barring few parameters, did not vary much (Tables 1). The value of silicates varied widely at different stations during different season. Exceptionally high values were recorded from Station I during monsoon (100 mg/l), which was accompanied by very high values of PO4-P (0.145 mg/l). pH values were comparatively high at Station IV during summer (7.3), otherwise it ranged between 5.5 and 6.8 at different stations during different seasons.

Table 1. Physicochemical characteristics of the Surface water quality at different Stations of River Kosi/Burhi Gandak.

Parameters	Station I : Slurighat			Station II : Katwara Dhar			Station III : Kusheshwarsthan			Station IV : Sikhrana Ghat		
	Summer	Monsoon	Winter	Summer	Monsoon	Winter	Summer	Monsoon	Winter	Summer	Monsoon	Winter
Air Temperature °C	33	33	26	33	28	26.5	34	31	20.5	31	–	23.2
Water Temperature °C	32	32	22	32	31	22.5	29	30	22.5	29	–	21.5
Conductivity (umhos)	–	270	439	–	190	350	–	240	–	–	–	460
Ligh intensity (Lux)	780	230	–	660	260	–	1025	240	320	–	–	–
pH	5.5	5.5	6.5	6.8	6	5.2	6.1	6.5	6.5	7.3	–	5.5
Dissolved oxygen (mg/l)	4.8	4.56	5.2	6	3.6	5.2	2.2	4.48	9.2	5.6	–	6.9
Free CO_2 (mg/l)	24	34.1	–	–	9.2	4.4	10.8	12.6	–	7.2	–	2
Carbonate (mg/l)	–	–	16.6	15	–	–	–	–	3	–	–	–
Bicarbonate (mg/l)	1.16	16	296	164	82	194	138	84	184	108	–	278
Chloride (mg/l)	27	8	11.6	14	9	11.2	12	6	7	29.48	–	7.6
Silicate (mg/l)	35.71	100	4.1	3.8	12.5	12	11.36	27.7	5.5	16.6	–	8
Phosphate, PO4-P (mg/l)	0.03	0.145	0.06	–	0.14	0.18	–	0.01	0.2	0.02	–	0.28
Nitratate, NO3-N (mg/l)	1.42	0.05	1.35	1.12	0.04	1.85	2.18	0.06	0.35	1.73	–	1.33
Total Hardness (mg/l)	–	135	169.6	–	85	103.6	–	125	170.8	–	–	120
CaH mg/l	–	105	120	–	55.5	72	–	100	115.2	–	–	–

2. Macrophytes

Table 2 shows the occurrence and relative abundance of various macrophytic species at different stations based on approximate eye estimation. The macrophytes were found to grow profusely, particularly in the slow flowing littoral region of the rivers, side pools and chaurs. Eight important taxa of submerged/floating macrophytes were recorded which were present at all the stations. Although water hyacinth (*Eichhornia sp*) was present at all stations during all seasons, it was found in great abundance in Kusheswarasthan chaur (Station III). The other important flora was *Vallisneria sp, Hydrilla sp., Potamogeton sp., Najas SP, Ceratophyllum sp., Ipomea sp.*

Table 2. Occurrence and relative abundance of different macrophyte taxa at different stations of Kosi river system.

	Station -I Siurighat			Station-II Katwara Dhar			Station-III Kusheshwarsthan			Station-IV Sikhrana Ghat		
Taxa	S	M	W	S	M	W	S	M	W	S	M	W
Eichhornia crassipes	++	–	+	+++	+	++	+++	++++	+++	+++	+++	+
Vallisneria sp.	++	+	–	+++	+	+++	++	++	++	–	–	+
Hydrilla sp	++	–	++++	++	++	+++	++	++	+++	+	++	+++
Potamogeton sp.	+	+	++	+	+	++	+	–	++	++	+	++
Najas sp.	++	–	++	+	–	++	–	++	++	–	–	–
Ceratophyllum sp.	+	+	++	–	–	++	++	–	++	–	–	++
Jussia sp.	–	–	+	+	+	+	+	+	+	+	+	++
Scripus sp.	+	+	–	+	–	++	++	+	–	+	+	+
Ipomea sp.	+	+	+	++	++	+	++	+	++	+	+	+

++++ Abundant; +++ – fairly common ; ++ Common, recorded in moderate numbers; + occasional; – absent.

3. Phytoplankton

The phytoplankton community of the river system was comprised of Chlorophycaeae (green algae), Myxophyceae (blue green algae) and Bacillariophyceae (diatoms). Table 3 gives a combined list of various taxa recorded form different stations. A total of 32 taxa were recorded during the entire course of the study. There were not many differences in the qualitative diversity of phytoplankton either at different stations or during different seasons. The green algae were

Table 3. List of Phytoplankton taxa recorded from different study stations of rivers Kosi river system.

Chlorophyceae	Myxophyceae	Bacillariophyceae
Chlorococcus sp.	*Microcystis aeroginosa*	*Cymbrlla cymbiformis*
Volvox sp.	*Oscillatoria sp.*	*Nitzschia sp*
Chlorella valgaris	*Spirulina sp.*	*Gomphonema sp.*
Scenedesmus quadricula	*Anabaena sp.*	*Melosira ambiguans*
Eudorina sp.	*Aphanizomenon sp.*	*Pinnularia sp.*
Panorina sp.	*Phormidium sp.*	*Synedra sp.*
Cosmarium sp.	*Nostoc sp.*	*Diatomella sp.*
Closterium monoliferum	*Gleotrichia sp.*	*Naviculla sp.*
Zygnema sp.		*Tabellaria sp.*
Mougeotia sp.		*Asterionella sp.*
Hydrodictyon sp.		*Fragilaria sp.*
Oedogonium sp.		
Spirogyra sp.		

represented by 13 taxa, followed by diatoms -11 taxa-and lowest number belonged to blue green algae (8 taxa).

The phytoplankton density (number /l) ranged from 84/l to 2082/l at station I, 113/l –2061/l at Station II and 105/l-2471/l at Station III. Plankton sampling from Station IV, Sikhrana Ghat was done only during winter and mean density for the season was recorded as 1473/l (Table 4). Highest density was recorded during summer seasons and lowest during monsoon at all stations from where samplings were done for all seasons. While green algae dominated at Station-I in all seasons, blue green algae were the dominant component during summer at Stations II and III. During monsoon season diatoms were in abundance at both Station I and II. Highest concentration of blue green algae was recorded from the slow flowing chaur of Kusheswarsthan (Station-III).

4. Zooplankton

The zooplankton community of the rivers were composed of four important groups viz. Protozoa, Rotifera, Cladocera (Crustacea) and Copepoda (Crustacea). Altogether 27 taxa were recorded during the course of the study from all stations (Table 5). The Rotifers, represented by the largest number of species (13), were dominated by the species belonging to brachionid genera *Brachionus* and *Keratella.* Protozoan was represented by 6 species belonging to genera *Arcella, Difflugia* and *Centropyxis.* Only few taxa-5 and 3 represented the Cladocera and Copepoda respectively.

Table 4. Seasonal variations in mean density (no/l) and relative composition (%) of major groups of phytoplankton at different stations of Kosi river system (***S- Summer, M- Monsoon, W- Winter) - indicates no sampling.***

	Station -I Siurighat			Station-II Katwara Dhar			Station-III Kusheshwarsthan			Station-IV Sikhrana Ghat		
	S	M	W	S	M	W	S	M	W	S	M	W
Numerical Density (no/l)												
Myxophyceae	260	11	60	836	11	60	1691	26	510	–	–	640
Chlorophyceae	1041	45	452	557	34	452	130	17	432	–	–	385
Bacillariophyceae	781	28	113	668	68	113	650	62	240	–	–	448
TOTAL	**2082**	**84**	**625**	**2061**	**113**	**625**	**2471**	**105**	**1182**	–	–	**1473**
Relative composition(%)												
Myxophyceae	12.5	13.1	9.6	40.6	9.0	9.6	5.3	24.8	43.2	–	–	43.4
Chlorophyceae	50.0	53.6	72.3	27.0	30.1	72.3	26.3	16.2	36.5	–	–	26.1
Bacillariophyceae	37.5	33.3	18.1	32.4	60.2	18.1	26.3	59.0	20.3	–	–	30.4

The zooplankton density ranged between 33/l -470/l at Station-I, 50/l -2454/l at Station II and 27/l -1953/l at Station III, highest during summer and lowest in monsoon at all the three stations. The mean density at Station-IV during winter was 403/l. The highest density was at Station-II during all seasons. Except during monsoon season at Station-II, Rotifers dominated the zooplankton composition at all stations during all seasons and their percentage composition was above 32%. Rotifers were followed by Cladoceran, which contributed, between 26-46% to the total zooplankton. The contribution of Copepods was also moderate Table 7.

5. Malacofauna

A total of 32 species of Mollusca comprising 16 species each of Gastropoda and Bivalvia were recorded form all the stations during the entire course of study. Table 8 enlists various species recorded from different stations during different seasons. Gastropods were represented by the families Viviparidae 3 species), Pilidae (1 species), Bithynidae (3 species), Thiaridae (4 species), Lynnaeidae (2 species) and Planorbidae (3 species). Bivalves were represented by the families Unioidae ((3 species), Amblemidae (11 species/subspecies), Corbiculidae (1 species) and Pisidiidae (1 species). The number of species at various stations during different seasons varied between 14 and 29. Highest number was recorded from Station II and lowest from Station III. Overall highest

Table 5. List of Zooplankton taxa recorded from different study stations of Kosi river System.

Protozoa	Rotifera	Cladocera	Copepoda
Arcella megastoma Penard	*Brachionus angularis* Gosse	*Diaphanosoma sp.*	*Diaptomus sp.*
Arcella discoides Ehrenberg	*Brachionus caudatus* Fadeev	*Daphnia carinata* King	*Cyclops sp.*
Difflugia lebes Penard	*Brachionus diversicornis* (Daddy)	*Bosminopsis sp.*	*Mesocyclops edex*
Difflugia lobostoma Leidy	*Brachionus forficula* Wierzejski	*Chydorus sphaericus* (O.F.Muller)	
Centropyxix ecornis (Ehrenberg) Leidy	*Brachionus plicatus* Muller	*Alona sp.*	
Centropyxis arcelloides Penard	*Keratella cochlearis* (Gosse)		
	Keratella quadrata (Muller)		
	Keratella tropica (Apstein)		
	Lecane (L) luna (Muller)		
	Filinia longiseta (Ehrenberg)		
	Hexarthra sp.		
	Polyarthra sp.		

species richness was observed during winter months at all stations and lowest during monsoon. There were not much significant differences in the species richness of different stations during any particular season. Both, Gastropods and Bivalves appeared to contribute almost equally in term of number of species at all stations (Fig. 2).

The approximate qualitative estimation of the abundance (eye estimation) of various species revealed the dominance of *Bellamya bengalensis, Pila globosa, Thiara (M.) tuberculata*, *Bortia costula* and *Gyraulus convexiusculus* among Gastropods and *Lamellidens corrianus, L. jenkensianus, L. marginalis, Parreysia (P.) favidens and P. (P.) corrugata* among Bivalves at almost all the stations throughout the year.

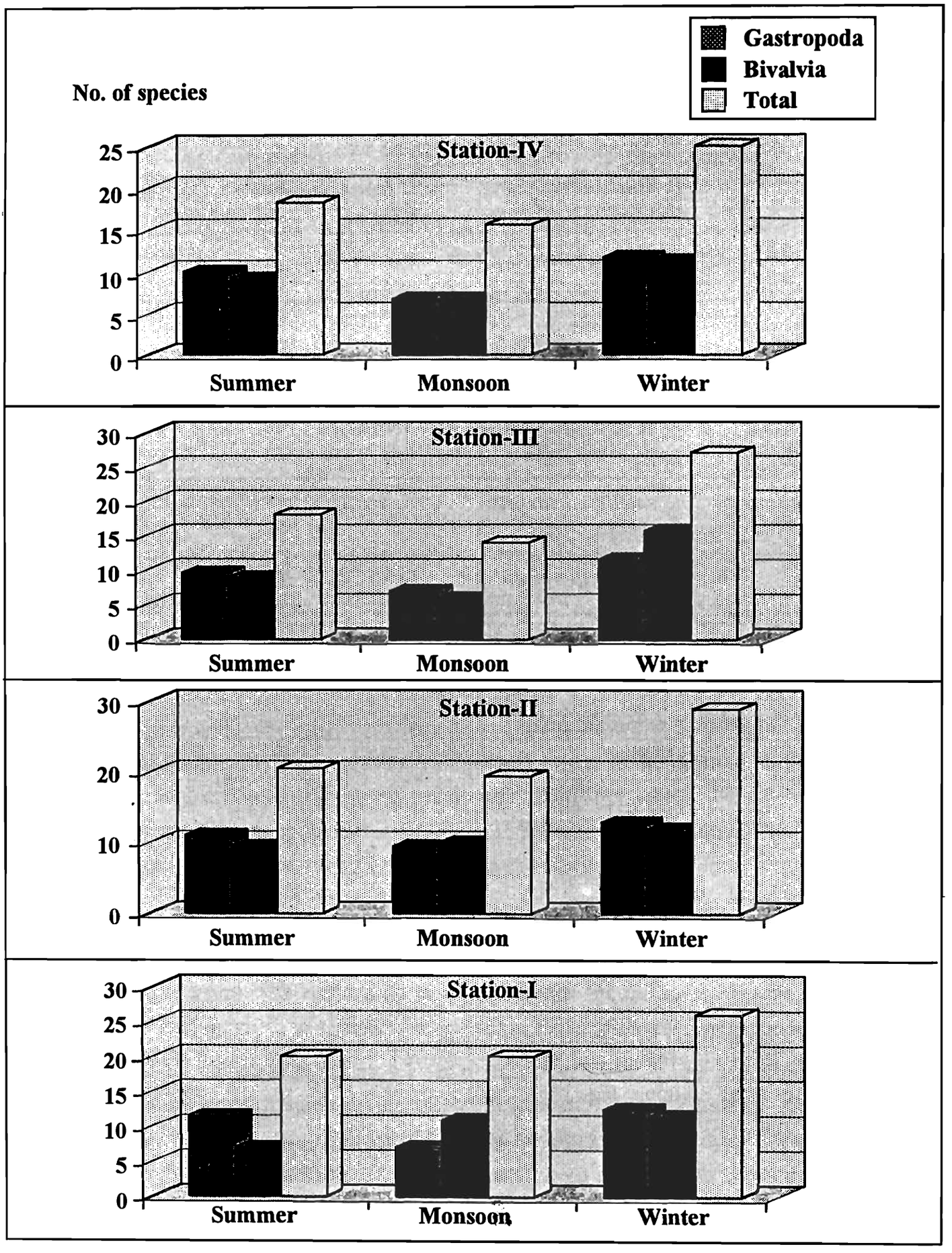

Fig. 2. Seasonal variations in the molluscan species richness at different Stations of Kosi river system.

Table 6. Seasonal variations in mean density (no/l) and relative composition (%) of major groups of phytoplankton at different stations (*S–Summer, M–Monsoon, W–Winter)—indicates no sampling.*

	Station -I Siurighat			Station-II Katwara Dhar			Station-III Kusheshwarsthan			Station-IV Sikhrana Ghat		
	S	M	W	S	M	W	S	M	W	S	M	W
Numerical Density (no/l)												
Myxophyceae	260	11	60	836	11	60	1691	26	510	–	–	640
Chlorophyceae	1041	45	452	557	34	452	130	17	432	–	–	385
Bacillariophyceae	781	28	113	668	68	113	650	62	240	–	–	448
TOTAL	**2082**	**84**	**625**	**2061**	**113**	**625**	**2471**	**105**	**1182**	–	–	**1473**
Relative composition(%)												
Myxophyceae	12.5	13.1	9.6	40.6	9.0	9.6	68.4	24.8	43.2	–	–	43.4
Chlorophyceae	50.0	53.6	72.3	27.0	30.1	72.3	5.3	16.2	36.5	–	–	26.1
Bacillariophyceae	37.5	33.3	18.1	32.4	60.2	18.1	26.3	59.0	20.3	–	–	30.4

Table 7. Seasonal variations in mean density (no/l) and relative composition (%) of major groups of zooplankton at different stations of Kosi river system. *S–Summer, M–Monsoon, W–Winter —indicates no sampling.*

	Station -I Siurighat			Station-II Katwara Dhar			Station-III Kusheshwarsthan			Station-IV Sikhrana Ghat		
	S	M	W	S	M	W	S	M	W	S	M	W
Numerical Density (no/l)												
Protozoa	40	–	–	260	5	–	390	4	43	–	–	35
Rotifera	260	16	45	991	11	45	781	11	60	–	–	280
Cladocera	130	11	23	591	23	23	521	6	48	–	–	58
Copepoda	40	6	11	612	11	11	261	6	32	–	–	30
TOTAL	470	33	79	2454	50	79	1953	27	183	–	–	403
Relative composition(%)												
Protozoa	8.5	–	–	10.6	10.0	–	20.0	14.8	23.5	–	–	8.6
Rotifera	55.3	48.5	57.0	40.4	22.0	57.0	40.0	40.7	32.8	–	–	69.5
Cladocera	27.7	33.3	29.1	24.1	46.0	29.1	26.7	22.2	26.2	–	–	14.5
Copepoda	8.5	18.2	13.9	24.9	22.0	13.9	13.3	22.2	17.5	–	–	7.4

DISCUSSION

Rivers, lakes, floodplain wetlands (beels , chaurs, Mans) and ponds etc with suitable water quality and luxuriant growth of macrophytes possess diverse assemblage of macroinvertebrate fauna, particularly insects and molluscs. In fact, the health of an aquatic ecosystem can be judged by the variety of macrophyte associated and benthic macroinvertebrate communities. Molluscs, which are an integral component of both types of habitats viz., macrophyte associated as well as littoral benthic, play an important role in the trophic dynamics of the ecosystem by forming a sizable component of food for a variety of fishes.

From the analysis of general physico-chemical parameters of water quality at different study stations of Kosi River system, it was fairly evident that the quality was reasonably good at most of the stations throughout the year. This was quite expected as there were no apparent sources of any pollution / degradation excepting the profuse growth of water hyacinth at certain points which might have prevented the oxygen assimilation. However, the impact was not visible. Similarly all stations were characterised by the abundant growth of diverse macrophytes. The running water of the river system had sufficient vegetation, even during monsoon months when most of the macrophytes are uprooted, though in reduced density. This has resulted in diverse assemblage of molluscan fauna throughout the year at all stations. High species richness of malacofauna in clean or unpolluted freshwaters of this region has also been reported by several earlier workers (Rai *et al.*, 1981; Baruah, 1995; Sinha, 1995). Singh and Roy (1991) reported the abundance of molluscs in Kawar Lake, Bihar, which was related to abundant growth of macrophytes. Thick strands of *Ceratophyllum, Eichhornia, Hydrilla, Potamogeton* and *Phragmites* are known to harbour a variety of Gastropod fauna because of their bushy roots. The bushy roots and submerged leaves provide shelter and suitable space for Gastropods to remain attached. These also act as spawning places for many species of Gastropods.

Besides macrophytes, the distribution and abundance of molluscan fauna in freshwater habitat has been related to several other physico-chemical and biological factors, like temperature, rainfall, flooding, dissolved oxygen, nature of bottom sediment and availability of food (Macon, 1950; Peter, 1968; Roy *et al.*, 1988; Subba Rao, 1989). The moderate temperature, pH, alkalinity, carbonates, hardness, nitrate, phosphate and availability of Ca++ in sufficient quantity together with abundant phyto and zooplankton were definitely responsible for the flourishing populations and communities of molluscs at all stations.

There were significant differences in the habitat preferences of Gastropods and Bivalves at all stations, both lotic as well as lentic (Station-III, Kusheshwarsthan-a Chaur). While most of the Gastropods adults as well juveniles, except large sized *Bellamya* and *Pila,* preferred macrophytes strands, most of Bivalves preferred the sandy soil of the littoral zones.

It was observed that most of the species of both Gastropods and Bivalves occurred in littoral regions and their availability at the bottom of open water was markedly poor. This phenomenon

could be observed in the deep *chaur* of Kusheshwarsthan. The dredge samples from open and comparatively deeper waters had very few Bivalves. This indicated the suitability of littoral zones of both running as well as confined freshwaters for the growth of the natural molluscan population. Further, in *dhars* and rivers too Bivalves were caught with dredges in considerable numbers at the banks. However, the bottom of the macrophytes choked littoral zones at certain places in relatively confined waters, were not found to be a very suitable habitat as these harboured very few species. Other workers have also observed such phenomenon. Peter (1968) observed that in the eutrophic waters of weed choked shallow basin, the benthic fauna usually leave the bottom due to hypoxic or anoxic conditions prevailing therein. In such zones faunal assemblage increases considerably at macrophyte strands (Kumar, 1985). Thus it can be concluded that diversity and density of molluscs depend upon not only macrophyte biomass but also the extent and quality of littoral zones. Another reason why littoral macrophytic zones harboured greater variety and density of malacofauna was the abundant availability of phyto and zooplankton, which formed the basic food of most of the species.

As reported by some workers (Macon, 1950), it was also observed during present investigations that atmospheric temperature exerted a great influence on the seasonal variations in the diversity and density of molluscan community which in turn controlled their metabolic and reproductive activities. The seasonal variation in the distribution and abundance of malacofauna of this river system was well defined because of clearly demarcated temperature regimes during different seasons. Maximum number of species and relatively higher numerical density and biomass were observed during winter season at all stations. Significant lowering of atmospheric temperature, which in turn created optimum environmental conditions, facilitated this. The macrophytes also flourished during this season, which had direct impact on molluscan diversity and density.

SUMMARY

The Assessment of physicochemical and biological properties of some important riverine stretches and floodplain lakes (Chaurs) of Kosi River system in North Bihar, India in relation to the distribution and abundance of molluscan fauna was carried out during 1995-96. Four sites, *viz.* Siuri Ghat, and Sikrana Ghat on river Burhi Gandak, Katwara Dhar on river Jiwach (a small tributary of Kosi) and a floodplain wetland, Kusheshwarsthan *Chaur* located between tributaries Jiwach and Balan were selected for the study. Samplings were done on seasonal basis. The physico-chemical quality of water was reasonably good at most of the stations throughout the year as there was no apparent source of any pollution/degradation. The macrophytes were found to grow profusely, particularly in the slow flowing littoral region of the rivers, side pools and chaurs. Eight taxa of submerged/floating macrophytes were recorded which were present at all study stations. The phytoplankton of the river system was comprised of 32 taxa belonging to Chlorophyceae , Myxophyceae and Bacillariophyceae. The density (number /l) ranged from 84/l to 2471/l. The zooplankton community was composed 27 taxa belonging to of Protozoa,

Rotifera, Cladocera and Copepoda. The Rotifers, represented by the largest number of species (13), were dominated by the species of brachionid genera *Brachionus* and *Keratella.* The Cladoceran and Copepods were represented by only few taxa. The zooplankton density ranged between 33/l–2454/l, highest during summer and lowest during monsoon. A total of 32 species of Mollusca comprising 16 species each of Gastropoda and Bivalvia were recorded during the entire course of study The number of species at various stations during different seasons varied between 14 and 29. Highest at Station II and lowest at Station III. Overall highest species richness was observed during winter months at all stations and lowest during monsoon. The approximate qualitative estimation of the relative abundance of various species revealed the dominance of *Bellamya bengalensis, Pila globosa Thiara (M.) tuberculata*, *Bortia costula* and *Gyraulus convexiusculus* among Gastropods and *Lamellidens corrianus, L. jenkensianus, L. marginalis, Parreysia (P.) favidens and P.(P.) corrugata* among Bivalves at almost all the stations throughout the year. The considerably good water quality and abundance of varied macrophytes were responsible for the diverse assemblage of malacofauna in sufficient numbers at all stations.

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REFERENCES

A. P. H. A. 1991. *Standard Method for the Examination of Water and Wastewaters.* 15th Edition American Public Health Association, Washigton D. C.

Baruah, A. 1995. Assessment of primary and secondary productivity of Kawar Lake (Begusarai), Bihar. *Ph.D. thesis, Bhagalpur university, Bhagalpur.*

Bilgrami, K. S. and J. S. Datta Munshi, 1979. Limnological survey and impact of human activities on the river Ganges Barauni to Farakka. *Tech. Report, MAB. Project. No. 5.*

Bilgrami, K. S. and J. S. Datta Munshi 1985. Ecology of river Ganges. Impact of human activities and conservation of aquatic biota (Patna to Farakka). *Final technical Report MAB Project No 5.* The Allied Press, Bhagalpur.

Datta Munshi, J. S. and J. Datta Munshi 1991. Physiography of the Kosi river basin and formation of wetlands in North Bihar. An unique freshwater system. *J. Frewshwaster Biol.*, **5** : 105-122.

David, A. and Ray, P. 1966. Study of the Pollution of River Daha (N. Bihar) by sugar and distillery Wastes. *Env. Hlth.*, **8** : 6-35.

Kumar, K. 1985. Hydrobiological studies of a freshwater beel with special reference to its production potentialities. *Ph.D. thesis,* Bhagalpur University, Bhagalpur.

Macan, T. T 1950. Ecology of freshwater mollusca in English lake district. *J. Anim. Ecol.* **19** : 124-146.

Nasar, S. A. and J. S. Datta Munshi 1971. Study on the macrophytic biomass production and fish population on a pond of Bhagalpur, Bihar. *J. Bh. U.*, **4** : 8-16.

Pashwa, D. V. and S. N. Mahrotra 1966. Observation on fluctuation in the abundance of plankton in relation to certain hydrobiological conditions of river Ganga. *Proc. Nat. Acad. Sci. India*, **36**(B) : 157-189.

Peter, Y 1968. Population changes in aquatic invertebrates living on two plants in a tropical man -made lake. *Hydrobiologia*, **32** : 449-485.

Rai, D. N., S. P. Roy and U. P. Sharma 1981. Freshwater gastropod (Mollusca) community structure in relation to macrophytes of littoral zone of a fish pond at Bhagalpur, Bihar. *Indian J. Ecol.* **8** : 88-95.

Roy, S. P. , V. Kumar and H. S. Pathak 1988. Faunistic composition of aquatic insects of Eastern Bihar with notes on their some aspects of ecology. *Rec. zool. Surv., India.* **85** : 49-57.

Singh, J. P, and S. P. Roy 1991. Interaction between macrophytic biomass and macroinvertebrate abundance in Kawar lake, Begusarai (Bihar*). J. Freshwater Biol.* **3** : 229-234.

Sinha, A. K. 1995. Benthic ecology of Kawar lake (Begusarai), Bihar. *Ph.D. thesis,* Bhagalpur Uuniversity, Bhagalpur

Subba Rao, N. V. 1989. *Handbook of Freshwater Molluscs of India* Zool. Surv. India, Calcutta : 1-289.

Sunder, S. and Vaas, K. K. 1988. Seasonal dynamics of benthos in some Kashmir lakes. *Proc.*