Biodiversity And Abundance Of Benthic Macroinvertebrates Commiunity Of Kishanpura Lake, Indore (M.P.) India

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Abstract- Aquatic macro-invertebrates play significant role in responding to a variety of environmental conditions of rivers and streams and therefore may be used as bio-indicators for water quality assessment. In the past, biological communities like plankton, periphyton, microphytobenthos, macrozoobenthos, aquatic macrophytes, fishes etc. have been used for the assessment of water quality of rivers ,lakes and streams, but now the use of benthic macro-invertebrates as bio-indicators is gaining importance as these can be easily caught and seen with naked eyes and the method is less costlier and less time consuming compared to other methods given above. Oligochaeta Seven species like Tubifex tubifex, Chaetogaster sp., Nais simplex, Aeolosoma bengalensis, Dero limosa, Branchiura soverbyi, Stylaria fossularis were indentified during the present study HIRUDINEA Three species, Helobdella sp. Glossiphonia sp. and HemicIepsis marginata of the family Glossiphonidae were identified during the present study period. GASTROPODA Altogether individuals of the three families Planorbidae. Lymnaidae and Viviparidae were recorded among the class Gastropoda during the study period. In the family Planorbidae only one species Planorbis was identified during the study period. Among family Lymnaidae three species were identified. They were Limnaea auricularia , L. acumainata and other Limnaea sp. Limnaea auricularia and L. acumainata family Viviparidae only three species namely Vivipara bengalenis, V. oxytropsis and Bellamya sp. were identified during the investigation period. BIVALVIA (PELECYPODA) Only two species of Lamellidens was identified in the family unionidae during the study period. Insecta Chironomus phumosus, Strictochironomussp, Baetissp., Corixasp.,Berosus sp., Hydaticus sp. Crustacea Apus (tadpole shrimp), Daphnia (water flea) was identified during the study period. The present studies deals with the population density and species diversity of aquatic macro invertebrate fauna have been discussed.

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Key Words: Seasonal diversity, macro invertebrates, bio-assessment' Population density, Littoral region, Kishanpura Lake

Introduction

Benthic macro invertebrates are best indicators for Bio-assessment. The abiotic environment of the water body directly affect in the distribution, population density and diversity of the macro benthic community. Benthic fauna are especially of great significance for fisheries that they themselves act as food of bottom feeder fishes (walker et. al 1991).

The littoral region is an important interface between land and pelagic zone of water body. It is occupied by rooted plants, micro and macro-invertebrates and demersal fish species. The studies on benthic communities of shallow tropical lakes of India are reported by several authors (Shrivastava 1956, 1957; Krishnamurthy 1966, Michael 1968; Mandal and Moitra, 1975, Oomachan & Belsare 1979, 1985; 1986; Pahwa 1979; Sarkar 1989; Kaushal and Tyagi 1989;; Malhotra et al 1990; Jaiswal & Singh 1994; Singhal, 1991). Gupta and Pant (1983) reported energy content of macro-invertebrates and their seasonal changes in Indian sub-tropical lake water body which explains rich biodiversity of the region. The present studies deals with the population density and species diversity of aquatic macro invertebrate fauna have been discussed.

Material and Methods

Kishanpura Lake, Indore (M.P.) is a shallow tropical lake whose shoreline has dense population of macroinvertebrate communities and bottom fish fauna. This lake is 22 km away from Indore. It is located in the West-South direction near Chhota Betma, village on Indore – Dhar road. Littoral zone along the shoreline of the lake is rich in biodiversity

of macroinvertebrates and fishes, that's why population dynamics were made between macroinvertebrates and fish fauna. Due to dense and rich availability of food material and favourable environmental conditions, seasonal fluctuation in animal biomass is related to rich flora & fauna and physico-chemical factors, which fluctuates or denotes population dynamics. Kishanpura lake is situated in a less populated area of Indore Township. The lake receives considerable amount of water. Its basin has shrubs on two sides while on other two sides there is open agricultural land. Total catchment area at lake site is 11.0 Sq. Km.

After preliminary survey of the Kishanpura lake for the benthic biodiversity and nature of bottom. There four sampling station are selected of the study on shore line of lake. Monthly sampling of all these stations were made (April.2005-March2007). A rod net was used in collecting hand sample and sieving them for isolation. The bigger animal species picked up by hand, where as the smaller forms were isolated by sugar floatation method and studied them under low power (x50) microscope. They were preserved by narcotizing them by Methanol and Chloral hydrate and late 70% Alcohol. The benthic organisms were identified with the help of Pennak (1989), Tonapi (1980), APHA (1998) standard books.

Result and Discussion

- ***Hirudinea***

Three species, *Helobdella sp. Glossiphonia sp. and HemicIepsis marginata* of the family *Gglossiphonidae* were identified during the present study period. *Helobdella sp.* was collected irregalaty in depths of O.2m-O.5m and not recorded in deeper depth zone (lm-1.5m). *Glossiphonia sp.* was also irregularly found in shallow depth and not recorded in deeper depth. *Hemiclepsis marginata* was not recorded in shallow zone and was recorded only irregular and less abundant in deeper zone (1.5m).

- ***Gastropoda***

Altogether individuals of the three families *Planorbidae. Lymnaidae* and *Viviparidae* were recorded among the class *Gastropoda d*uring the study period. In the family *Planorbidae* only one species *Planorbis* was identified during the study period. This species was regular and abundant and constituted the largest group composer in February, March and April. It was single record in 1.5m depth.

Among family *Lymnaidae* three species were identified. They were *Limnaea auricularia, L. acumainata and other Limnaea sp. Limnaea auricularia and L. acumainata* were not recorded from the depths of 2m but regular and abundant were found at the depths of 0.2m-0.5m and single record at depth of m. Other *Limnaea sp.* was also irregularly present in shallow and deeper depths zone. In the family viviparidae only three species namely *Vivipara bengalenis, V. oxytropsis and Bellamya sp.* were identified during the investigation period.

Vnipara bengalenis and *V. oxytropsis* were regular and abundant at the depths of O.2m to 1m. but these two species were irregular and less abundant at the 1.5m zone. Both the species were more abundant in the shallower depth zone than in the deeper depth zone. *Bellamya sp.* was collected at O.2rn, 1m and 1.5m zones in regular and abundant but in O.5m depth; it was irregular and less abundant. A maximum abundance of this species was found in May and minimum in February.

- ***Bivalvia (Pelecypoda)***

Only two species of *Lamellidens* was identified in the family unionidae during the study period. *Lamellidens marginalis* and *L. consobrinus* were found irregular and less abundant at the depths of 0.2m - 0.5m. But these tow species were not recorded in the deeper depth zone (1.0m to 1.5m).

- ***Insecta***

Insecta formed the second largest group of bottom fauna. *Chironomus* (family-chironormidae) was the most abundant genus and they were found throughout the year in greater number. They were recorded at shallower & deeper zones (O.2m to1.5m). Similarly, *Stictochironomus sp* was regular and abundant throughout the study period in both zones.

Other insects represented in the collection were *Corixa* which were found to clung vegetation. These hemipterans showed wide seasonal fluctuations in the distribution and diversity in this pond. They were found irregular at the depths of 0.2m-0.5m and was regular and abundant at 1.0m depth zone but was completely absent at the depth of 2.0m zone.

Baetis sp. was irregular and less abundant and was not found at 1.5m depth zone. *Berosus sp.* was irregular in both zones (Shallower & deeper). May flies (Ephemeroptera), nymphs of damsel flies and dragon flies (Odonata) contributed a small percentage in total composition.

Hydaticus sp. represented the coleptera, always few in number and irregular & less abundant. These species were not recorded at the depths from 1.0m to 1.5m respectively.

Qualitative Analysis of Benthic Macro- Invertebrates

Table 01: Macro-invertebrates recorded at different depth of Krishnapura Lake Indore.

Group	Macro-invertebrates	0.2m	0.5m	1m	1.5m
1. Phylum Annelida	1. *Tubifex tubifex*	RA	RA	RA	RA
(A) Class-Oligochaeta	2. *Chaetogaster sp.*	I	I	I	SR
	3. *Nais simplex*	I	I	I	I
	4. *Aeolosoma bengalensis*	I	I	I	NR
	5. *Dero limosa*	I	I	RA	RA
	6. *Branchiura sowerbyi*	RA	RA	IRA	RA
	7. *Stylaria fossularis*	RA	RA	RA	RA
(B) Class-Hirudinea (Leeches)	*1. Helobdella sp.*	I	I	NR	NR
	2. Glossiphonia sp.	I	I	NR	NR
	3. Hemiclepsis marginata	NR	NR	NR	ILA
2. Phylum Mollusca	1. *Planorbis sp.*	RA	RA	RA	SR
(A) Class-Gastropoda	2. *Limnaea auricularia*	RA	RA	SR	NR
	3. *L. acumainata*	RA	RA	SR	NR
	4. *Limnaea sp.*	I	I	I	I
	5. *Vivipara bengalenis*	RA	RA	RA	ILA
	6. *V. oxytropsis*	RA	RA	RA	ILA
	7. *B bellamya sp.*	RA	ILA	RA	RA
(B) Class-Pelecypoda (Bivalvia)	*1. Lamellidens marginalis*	ILA	ILA	NR	NR
	2. L.consobrinus	ILA	ILA	NR	NR
3. Phylum Arthropoda	*1. Chironomus phumosus*	RA	RA	RA	RA
(A) Class-Insecta	*2. Strictochironomus sp.*	RA	RA	RA	RA
	3. Baetis sp.	ILA	ILA	ILA	-
	4. Corixa sp.	I	I	RA	-
	5. Berosus sp.	I	I	I	I
	6. May fly nymphs	ILA	ILA	ILA	ILA
	7. Dragon fly nymphs	ILA	ILA	ILA	-
	8. Damsel dly nymphs	ILA	ILA	ILA	ILA
	9. Hydaticus sp.	ILA	ILA	-	-
(B) Class-Crustacea	*1. Apus (tadpole shirimp)*	ILA	ILA	ILA	ILA
1. Branchipoda (Shimps)	*2. Daphnia (water flea)*	ILA	ILA	ILA	ILA

Key:
RA = Regular and abundant.
I = Irregular
- = Absent
ILA = Irregular and less abundant
NR = Not Recorded
RLA = Regular & less abundant
TSO = Two Specimens in one month.
SR = Single Record Specimens

Average percentage composition of macro invertebrates (2005-06 and 2006-07) as listed in table 03 & 04 with Figs. 25 & 26.

May

In 2005, the dominance of Oligochactes (69.3%) was maintained in this month also. A noticebie decreac in the population density of Gastropods (16.4%). A marginal fall in Pelecypods (2.1%) was observed and a slight increase in insect population was registered. While shrimps are totally absent in this month. Leeches maintained their previous month's status. In 2006, the trend of increase in Oligochaetcs density (68.3%) and decrease in Gastropods (12.4%) was maintained in this month during 2007. Other groups i.e. insects Leeches (2.5%), Pelccypoda (2.0%) were present and Shrimps remained absent.

June

In 2005, Oligochaetes (74.5%) registered its maximum occurrence in population density in this

month. In sects and gastropods showed their decreasing trends. Pelecypoda registered their presence (3.5%).

An sudden enhanced population of leeches was found (5.5%). Shrimps registered their presence (3.5%) after an interval of two consecutive months.

In 2006, Oligochaetes (70.0%) occupied about 3/4 part of the total benthic density while insects shared only 10.8%. A decrease in the percentage composition was observed in the case of Gastropods (6.0%). But the benthic density of remaining groups were not significant i.e. Pelycepoda (3.9%), Leeches (3.8%.) Shrimps also registered after a gap of two consecutive months and shared 3.5% like that of the previous year.

July

In 2005, the Oligochactes repeated their previous month trend (72.5) while the graphs of Gastropods and insects were 9.2% and 6.3% respectively. Pelecypods were up (4. 1%) and leeches (3.4%) and shrimps (1 .8%) were down. In 2006, the collection of Oliochaetes shared the maximum population and constituted about 72.2% while insects. Gastropods, bivalves were only 9 %, 6.5% and 3.9% respectively. Shrimps showed downward tendency and Leeches was present only 3.5%.

August

In 2005, a trend of decrease in Oligochaetes (64.5%) and a trend of increase in insect population (11.8%) were the important phenomena of this months. Gastropods (10.2%) and shrimps (2.2%) showed their increasing trends while Bivalvia (2.5%) were the looser. Leeches (4. 1%) improved their position. In 2006, An abrupt decrease of Oligochaetes (61.4 %) population were recorded. insects, Gastropods and Pelecypods(17.7, 8.5, 5.9) were observed with increasing trends. while Leeches were down (2.3%) only.

September

In 2005, a trend of gradual decrease in Oligochaetes (51.8%) and a sudden increase in insect population densities (35.4%) were the twin salient features of (his month. distinct fall in Gasropods (7.5%), and Leeches (1.2%) were observed. Pelecypods were maintained their position.

In 2006, the same trend of decrease in the occurrence of benthic fauna of Oligochcatcs (58.5%) while insect population (32.7%) showed a sudden increase tendency. Gastropods, Petecypods, Leeches were recorded with decreasing pattern (4.6%,2.5%, l.2%and 1.2%).But shrimps were not found in this month.

October

In 2005, a gradual decreasing trend were observed in the case of Oligocheates population (49.0%) while a slight increase was noticed in the density of insects (36.2%). An increasing trend was also found in Gastropods (8.4%) shrimps were not be traced. Leeches were up (2.0%).

In 2006, A major set back was in the population density of Oligocheates which could contribute 48.8% only while insect population density (36.0%) which showed with increasing trend. Gastropods (8.5%), Pelecypods (2.8%), Ostracods (4.0%) were recorded. Leeches and shrimps were completely absent from the collection of the bottom fauna.

November

In 2005, a slight decrease in Oligocheates population density (49.0%). Insects population was 35.3%. Gas pods. were noticed with sight increasing trend (8.5%). Leeches and Pelecypods, were 1.8% and 1.4% respectively in constituents of bottom fauna. Shrimps were found to be absent as in previous months.

In 2006, there was a fall in oligachactes population with 47.5%. Insects population shared about 35.5%. The population of Gestropods (9.2%), Leeches (1.5%) and Pelccypods (1.5) were present. Shrimps were not found.

December

In 2005, according to the data collected in this month the Oligochates was decreased to 37.3% whereas insects population was recorded as 46.7%. Gastropods, Pelecypods and Leeches were observed as 10.3%, 1.5%, 1.4% and 1.3% respectively. Strimps appeared after two months gap and was only 0.5%.

In 2006, in this month the population of the oligochaetes was also decreased to 3 6.5%. Insects alone constituted near about half portion (47.5%) of total benthic density with an increasing trend. This trend was followed by gastropods (10.8%), Leeches (2.1%), pelecycepods (2.0%) respectively. Shrimps registered their presence (1.0%) after an interval of three consecutive months.

January

In January 2006, Oligochaets were 34.9%, Leeches, Gastropodas (Pelecypoda) and shrimps were 1.8%, 15.8%, 205% and 2.6% respectively. Insects larvae were constitute about 42.3% which showed a major share.

In January 2007, Oligochaetes were 35% followed by insects (36.5%) and Gastropds (17.8%). The remaining groups were not significant i.e. Pelecypoda (3.5%), Shrimps (3.0%) and Leeches (3.5%) respectively.

February

In February 2006, a marked decrease in the population density of oligochaetes (32.5%) and a sudden fall in insect density (32.9%). There was an abrupt and large increase in population of gastropods (24.8%). A marked increase in pelecypods population (4.8%) but slight decrease in population of Shrimps (2.4%) and Leeches (1.5%) were found.

In February 2007, Oligochaetes population were decreased (29.5) and graph of insects were down to 33.7% But gastropods were up (22.8%, significantly. Pelecypods were shared about 8.7% which showed an increasing trend. Shrimps and Leeches were about l.8°/ and 1.0% respectively.

March

In 2006, there was a further decline in oligochaetes population (31.3%) and also fall incidence in insect population (30.5%). The gastropods (28.6%), Pelecypoda (5.8%) groups were in increasing order in comparison to previous month. Shrimps (1.2%), Leeches (0.7%) showed slightly decreasing trend.

In 2007, A sudden rise in oligochaetes population (35.0%) was observed in this month making it largest constituent of total benthic community. A slightly decrease of insects population (31.2%) was observed. Gastropods (28.1%), Pelecypoda (4.0%), and Shrimps (I .2%) were recorded respectively Leeches were found to be absent.

April

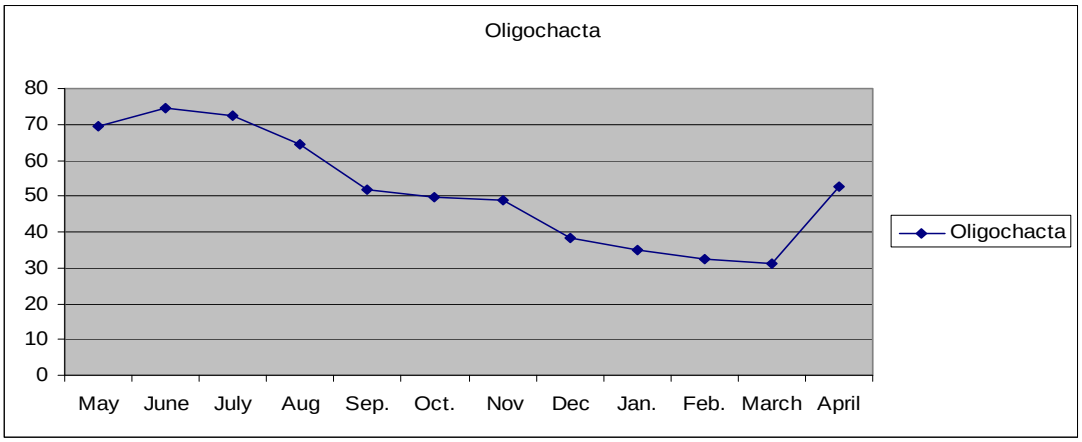
In 2005, Oligochaetes (52.7%) were the largest contributor the total collected benthic community and constituted more than half portion of total benthic fauna. The next group was the gastropods (30.4%). Insects registered their presence only 9.2% slumps were completely absent in the collection. Leeches were only 1.5%.

In 2006, the trend of gradual increase in oligochaetes density (48.5%). The 2nd position of the Gastropods (35.4%) was constituted, insects shared only 9.5% which showed an abrupt decline. Shrimps could not be traced like that of previous year. Leeches appeared after one month of gap and was about 1.8%.

The role of aquatic oligochaetes in the retrieval of organic matter and as fish food were studies by Shobana and Nair (1983). Their population size in littoral region is controlled by physico-chemical parameters. Rajaram et.al. (1985),

Table –02: Average quantitative percentage composition of bottom fauna of Kishanpura Lake during 2005-2006 Four Station (Per Cm^2- of sediment)

Macro Invertebrates (Bottom Fauna)	May	June	July	Aug	Sep.	Oct.	Nov	Dec	Jan.	Feb.	Mar	April	Total	Remakes
Oligochacta	69.3	74.5	72.5	64.5	51.8	49.5	49.0	38.3	34.9	32.5	31.3	52.7	614.3	IST
Hirudinea (Leeches)	1.5	5.5	3.4	4.3	1.2	2.0	1.8	1.4	1.8	1.5	0.7	1.5	26.4	VI
Gastropoda	16.4	4.8	10.2	9.6	7.5	8.4	8.6	10.3	15.8	24.8	28.6	30.4	156.3	III
Pelecypoda (Bivalve)	2.1	3.5	4.1	2.5	2.5	1.5	1.4	1.8	2.5	4.8	5.8	3.8	35.9	IV
Insecta	10.2	7.7	6.3	11.8	35.4	36.2	36.2	46.7	42.3	32.2	30.5	9.2	291.8	II
Shrimps	Nil	3.5	1.8	2.2	0.8	Nil	Nil	0.5	2.6	2.4	1.2	Nil	15.0	VII
Miscellaneous	0.5	0.5	1.7	2.1	0.8	3.4	3.9	1.0	0.2	1.6	1.9	2.4	18.8	


Oligochacta
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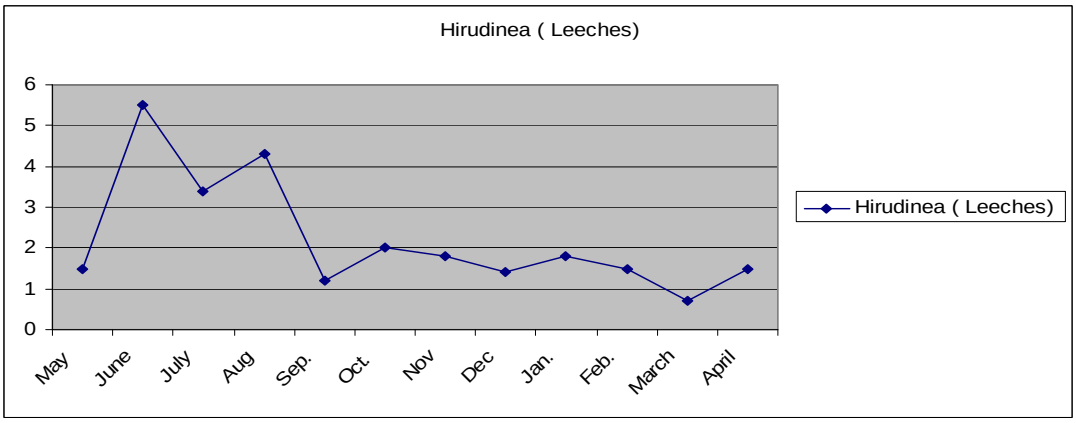
May June July Aug Sep. Oct. Nov Dec Jan. Feb. March April
Oligochacta


Hirudinea (Leeches)
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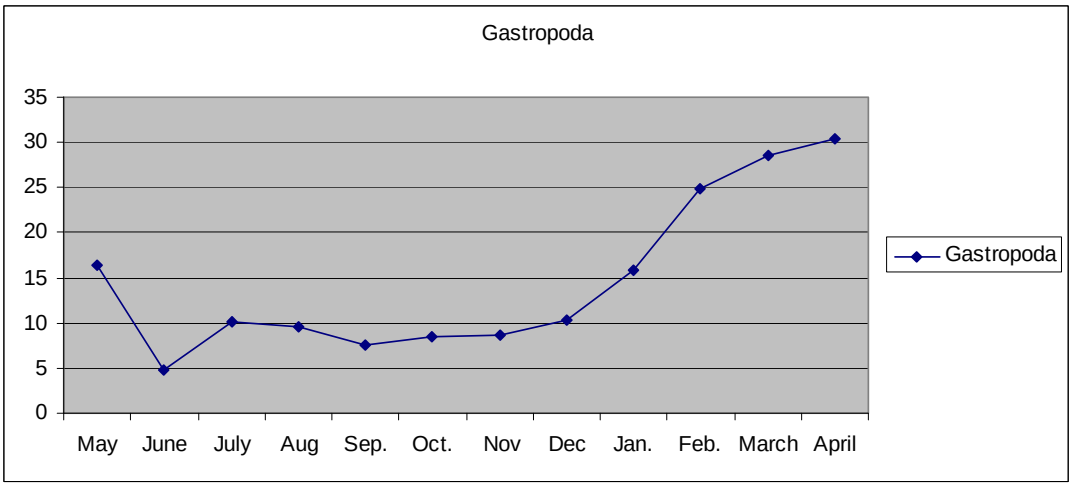
Hirudinea (Leeches)


Gastropoda
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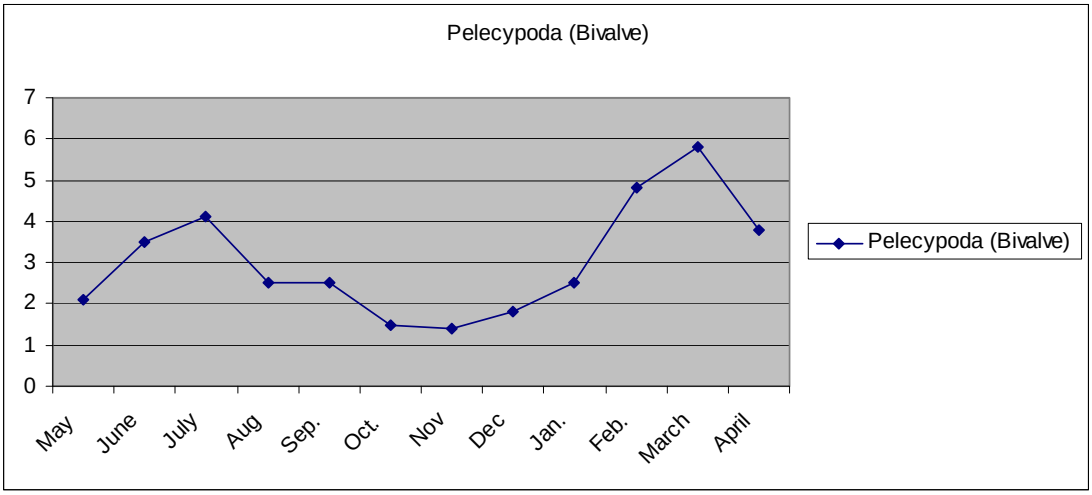
Gastropoda


Pelecypoda (Bivalve)
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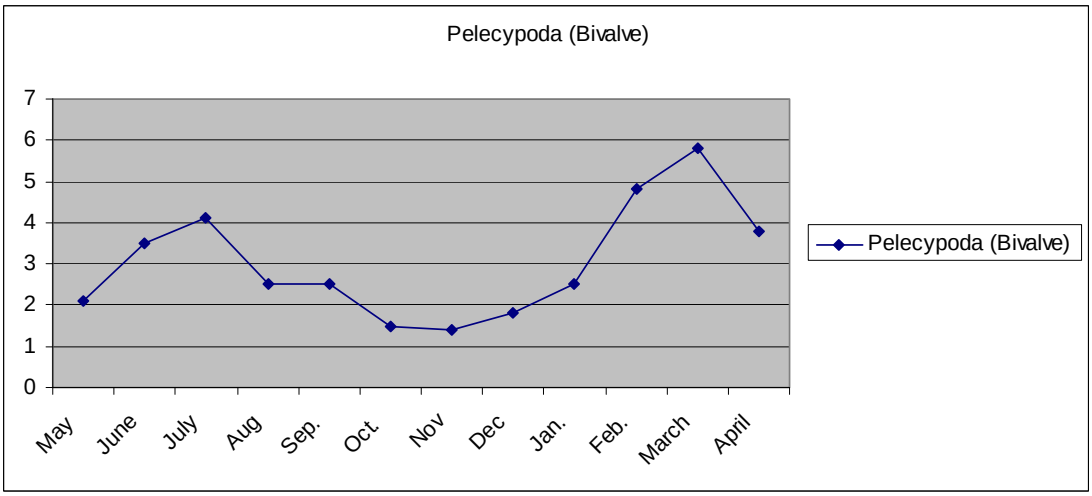
Pelecypoda (Bivalve)


Pelecypoda (Bivalve)
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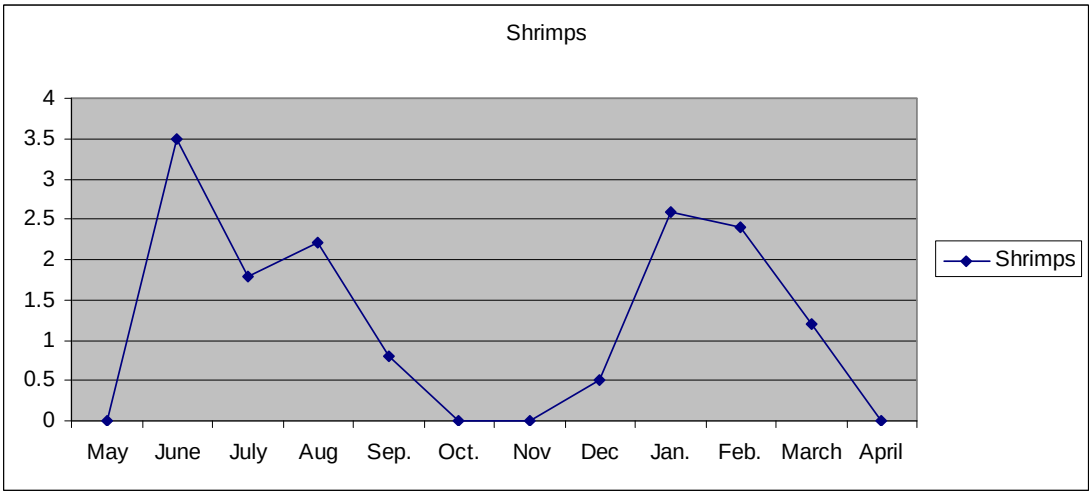
Pelecypoda (Bivalve)


Shrimps
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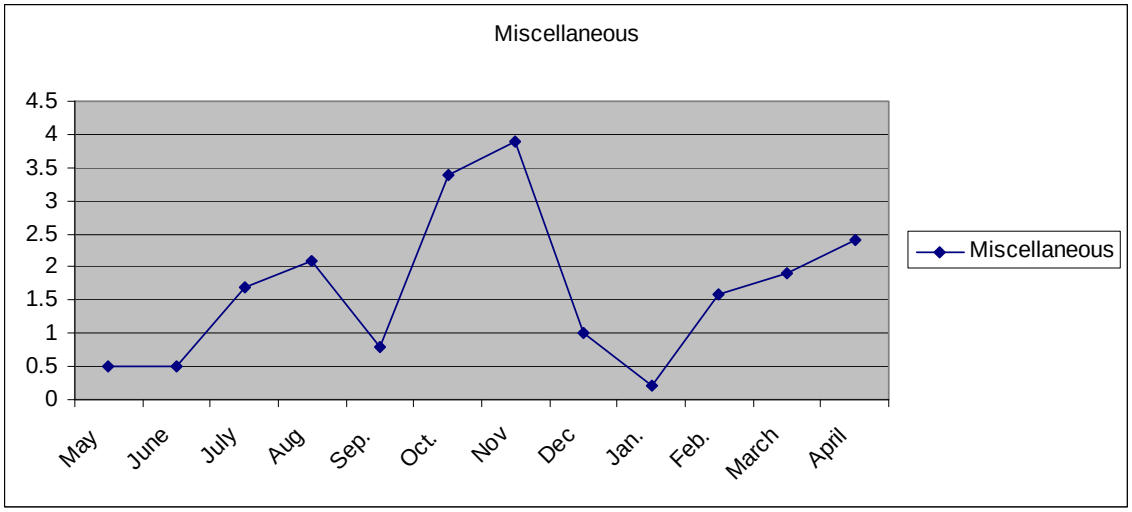

Fig 01: Showing Groups of Organisms of Macro vertebrates in Kishanpura Lake, Indore in year 2005-2006(Per cm^2 of sediments)

Table-03: Average quantitative percentage composition of bottom fauna of Kishanapura Lake during 2006-2007 Four Station (per Cm^2 of sediment)

Macro Invertebrates (Bottom Fauna)	**May**	**June**	**July**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar.**	**April**	**Total**	**Remakes**
Oligochacta	68.3	70.0	72.5	61.4	58.5	48.8	47.5	36.5	35.5	29.5	35.0	48.5	597.9	IST
Hirudinea) Leeches)	2.5	3.8	3.5	2.3	1.2	Nil	1.5	2.1	3.5	1.0	Nil	1.8	23.2	VI
Gastropoda	12.4	6.0	6.5	8.5	4.6	8.5	9.2	10.8	17.8	22.8	28.1	35.4	164.1	III
Pelecypoda (Bivalve)	2.0	3.9	3.9	5.9	2.5	2.8	1.5	2.0	3.5	8.7	4.0	4.3	45.0	IV
Insecta	12.2	10.8	9.0	17.7	32.7	36.0	35.5	47.5	36.5	33.7	31.2	9.5	296.3	II
Shrimps	Nil	3.5	2.8	2.5	Nil	Nil	Nil	1.0	3.0	1.8	1.2	Nil	15.8	VII
Miscellaneous	2.6	2.0	1.8	1.7	0.5	3.9	4.8	0.1	0.7	2.5	0.5	0.5	21.6	

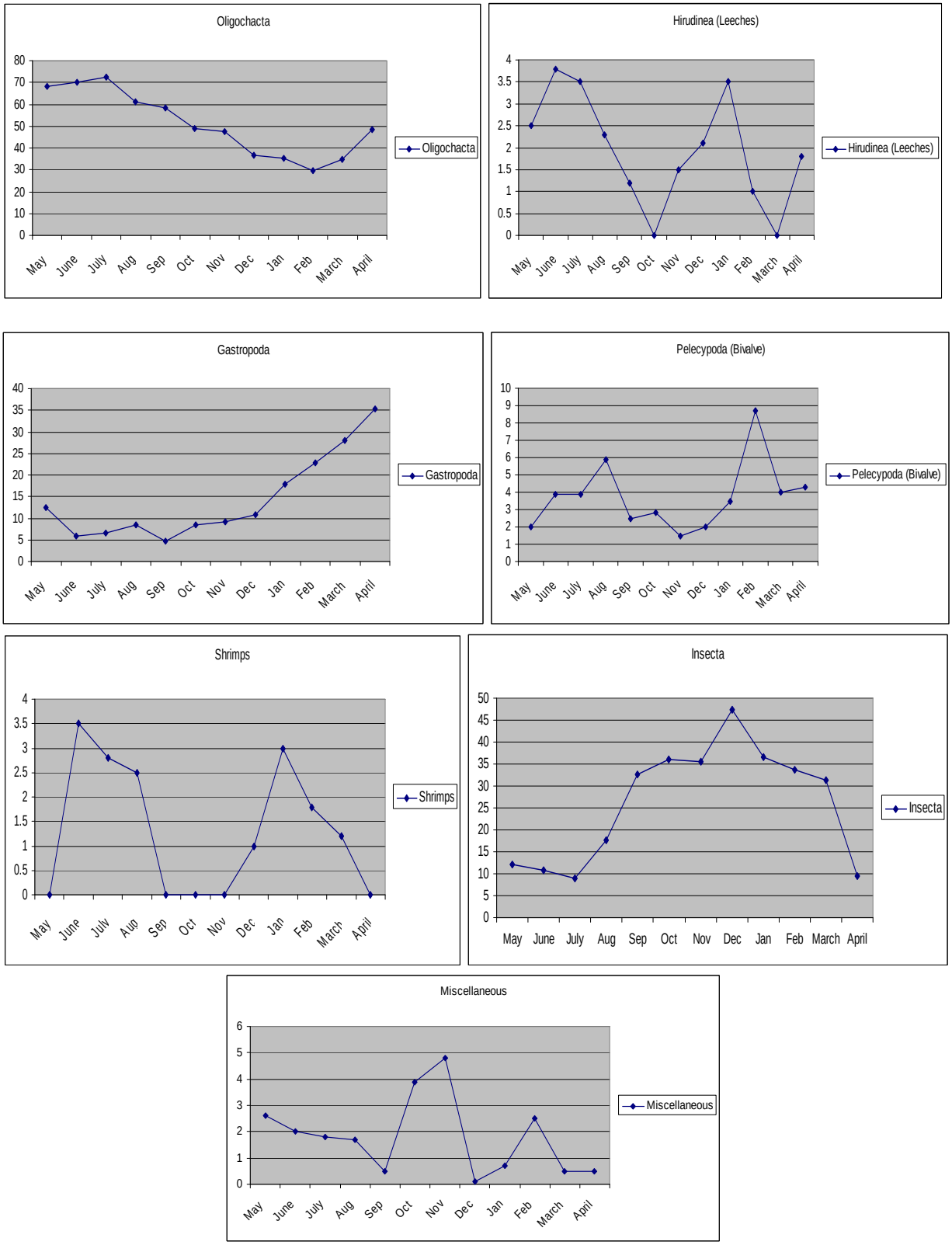

Fig 02 : Showing Groups of Organisms of Macro vertebrates in Kishanpura Lake, Indore in year 2006-2007 (Per cm^2 of sediments).

Similar results from the confined water bodies of India were also noted by earlier workers (Kulshreshtha et al., 1991); Singh & Sinha, 1993; Mandal & Moitra, 1975; Ahmad & Singh, 1987; Sharam & Singh, 1993 and Singh et al., 2002). Williams (1980) stated that the substrate detritus interaction influences the occurrence of Zoo-benthic organisms in an ecosystem. Oligochaetes have been widely used as bioindicators of population (Aston, 1973). On the basis of their abundance Carr and Hilrunan (1965) have classified water bodies into following polluted, moderately polluted and heavily polluted categories.

On this basis of the study ponds exhibit seasonal variation with regards to pollution level. In Rabindra sarovar the number of Oligochaetes i.e. 238 to 18527 indv./m^2 reveals that this pond's water always exists form mildly polluted to heavily polluted condition and with the rise of temperature the pollution level goes up but water of the Kendui tank becomes mildly polluted only during summer season. During this study it was observed that an increase in the decaying matter during summer enhances the growth of Oligochaeta as also observed by Singh et al. (2002). The presence of *Limnodrillus hoffmeisteri* is regarded as the bioindicator of pollution (Brinkhurst, 1963). Mohammad (1979) and Singh et al. (2002) also collected *Limnodrillus* sp. and Tubifex sp. from mildly and highly polluted waters. The present study also supports the findings of the these workers. In the present study it was also observed that some species of macro invertebrates were found to decrease in number or disappeared from the polluted pond. This could be attributed to the intolerant nature of the concerned benthic fauna was recorded in summer and winter. This might be due to input of large quantity of leaf litter from surrounding areas into the pond by wind action. The available food might have possibly accelerated the growth of macro-invertebrates during these periods.

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