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DIVERSITY OF MOLLUSCAN FAUNA IN RELATION TO PHYSICO-CHEMICAL CHARACTERS OF MANJRA RIVER, BIDAR DISTRICT, KARNATAKA, INDIA.

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ABSTRACT:

Molluscan Fauna occurs in various habitats, they are marine, freshwater and terrestrial forms. The freshwater molluscs play a very important role in aquatic ecosystems and some of them are edible species like Bellamya bengalensis, Pilavirens and Lamellidens marginalis proven food for many aquatic animals and man. Lamellidens marginalis and Lamellidens corrianus have also been used to produce pearls in some parts of India (Subba Rao & Dey, 1989). Some of them are also intermediate hosts for parasites, like Pila globosa, Lymnae etc.(Subba Rao,1989). Aim of the present study on the molluscan fauna and impact of physico-chemical parameters on their diversity from Manjra River on monthly basis. The investigation reveals that a total number of 21 species of molluscs representing 04 orders, 05 families and 09 genera were recorded from the Manjra River. Gastropods substitute abundant and richest group of macro-invertebrates present throughout the study period. 14 species of gastropoda recorded were representing 02 orders, 03 families, 06 genera and 07species of Bivalvia recorded were representing 02 orders, 02 families, 03 gerera were present as macro-invertebrate benthos. Aquatic macro invertebrates play important role in responding to various environmental conditions and parameters of rivers.The presence of safe and reliable drinking water is also an essential pre-requisite for a stable community. 'Many of the Indian rivers, which are used as drinking water contaminated by various sources (Chaturvedi et.al.,2003,Sujata et,al., 2011). Therefore, molluscan fauna diversity may be used as bio-indicators for water quality assessment.

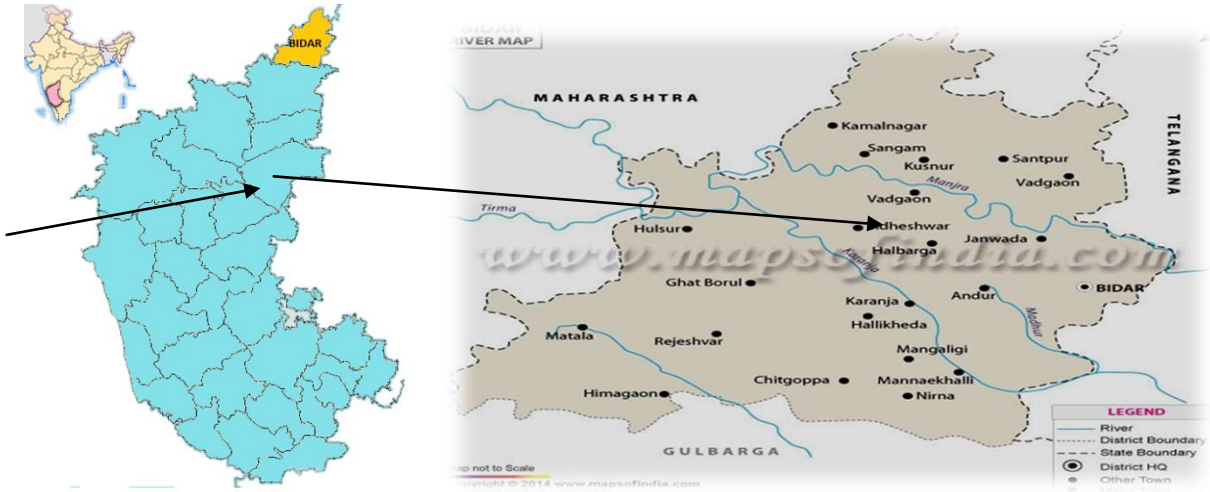
Keywords: ***Manjra river, molluscs, malacofauna, physico-chemical parameters, diversity indices.***

INTRODUCTION:

Freshwater ecosystems covers 0.80% of earth's surface and inhabit 0.009% of its total water. They generate nearly 3% of its net primary production. Among the macro-invertebrates, molluscs are an integral component of aquatic ecosystem Molluscs are highly successful invertebrates in terms of ecology and adaptations and are found in all habitats ranging from deepest ocean trenches to the intertidal zones, and fresh water to land occupying a wide range of habitats. During their evolution, they have adapted to live in nearly all available habitats. Among the eight classes, all are represented in the sea with highest densities, followed by freshwater where only two groups Gastropods and Bivalvia (Pelecypoda) are recorded, and terrestrial habitat where only class Gastropda occurs. Macro-invertebrates are very sensitive to changes in water quality, making them an excellent indicator species, thus assessing the trophic statusof freshwater systems (Choubisa, 1992). In India, till today, 5070 species of molluscs have been recorded of which, 3370 species are from marine habitats (Subba Rao, 1991). There are 1671 species of non marine mollusks living in the wild in India (Ramakrishna and Mitra, 2002).This includes 1488 terrestrial species in 140 genera and 183 freshwater species in 53 genera. (Arvind *et al*., 2005). Thus aim of study is to determine the monthly variation in water quality parameters and its impact on the molluscan density and diversity. Considering the role of molluscs in maintaining the overall environmental conditions, the conservation of this group is of urgent need. It requires multiple approaches including research (systematic, ecology etc.), inventories (distribution, population size), mitigation of human impact and active intervention to promote recovery (Lydeard *et al*., 2004; Seddon, 1998). Hence Manjra river is the precious aquatic ecosystem playing significant role in supplying potable water to Bidar city as well as sustain a rich aquatic fauna.

MATERIALS AND METHODS:

Study Area:



Bidar district falls under both the basins of Krishna and Godavari. About 2% of the area in the northern district of Bidar is drained by the Godavari river system. Major part of the district is covered by Godavari basin, drained by its two major tributaries the Manjra and Karanja rivers. The Godavari basin extends to over 4,411km^2 of which Manjra covers up to 1,989 km^2 and Karanja up to 2,422 km^2. The Manjara River is perennial and flows over a distance of 155 km in the central parts of the district and flows towards eastern direction with a meandering course. The present study is performed in Manjra river which co- ordinates latitude N18^o 06', E 77^o 19' and N 17^o 56', E77^o 39'longitude at an elevation of 548-575 MSL Bidar district, Karnataka. The average rainfall is 830mm to 998mm and average temperature ranges between 35^{o}C - 42^{o}C. The relative humidity is high during the southwest monsoon, being between 75% to 80%. Summer is the driest part, when the relative humidity is between 30% to 40%. Manjra river (a tributary of Godavari River) was initially implemented and commissioned in the year 1974. The scheme was designed for supply 4.55 MLD water to 50,000 population of the city. The subsequent augmentation of this scheme has been recently undertaken and completed in the year 2002. This was the prime source of water distribution in the city. The source is manjra river, with intake works located near village Janawada. But the river stretch at this point is not perennial. Flow of water is not good. As a result the homeostatic mechanism of water itself becomes poor along with the course of stretch. Industrial effluents are also added some extent to make it deterioration of quality. Presently STPs (Sewage water treatment Plant) has been in operation in city to make environmentally good to river course. Agricultural lands and villages surround the river. The availability of food throughout the year made the prime river a favourite nesting place for resident and nonresident and some migratory birds. Aquatic vegetation of river increases breeding area for fish population and the river extensively used for fishing.

METHODOLOGY:

Water sampling: Present research studies were conducted for the period of one year January 2013 to December 2013. The sampling collections will be made on specific dates of every month. Surface water samples will be collected using a clean and sterile plastic container for the study of various physico-chemical and biological parameters. Temperature and pH were determined immediately at the sampling station. Water samples collected will be subjected to analysis by using standard methods. The physic-chemical parameters were estimated according to the methods for examination of pure water and waste water Trivedy and Goel (1986).

Collection of Molluscan fauna: Molluscans, both benthic and peripheral formsare collected from theriver sampling sites in three replicates with the help of dip net or dredges and live ones and shells are collected by hand. The live ones are cleaned and preserved carefully in 4% formalin and the collected shells will be thoroughly

washed with ethyl alcohol and water before they are subjected to identification. The molluscans are separated and enumerated group wise on the basis of standard identification keys for molluscan specimen like Preston(1915),Mellanby(1963), Subba Rao N.V and Mitra, S.C[1979], Tonapi(1980), Adoni *et al*.,(1985), Subba Rao (1989 and 1993), Pennak(2004), Ramakrishna and AnirudhaDey (2007) and Aravind N.A *et al.*, (2008) every molluscan specimen was characterized, identified with its class, subclass, family, genus and species.

Statistical Analysis:

Statistical analysis was carried out using Statistical Package for SocialSciences (SPSS 10.0) is summerised in table-2.

Shannon Weinner index: H=s/I=1SUM(pi)(log2pi)

Where,

H Shannon-Weiner diversity

SUM represents a capital epsilon

S number of speies

Pi proportion of individuals of the total sample belonging to the i^{th} species calculated as ni/N for each ith species with ni being the number in species i and N the number of individuals in the sample.

SPECIES DIVERSITY OR SHANNON-WEINER INDEX				
GENERA	SPECIES	pi=ni/N	ln pi	H(pi*lnpi)
Bellamya	6	0.28571429	-1.25276	-0.3579323
Bithynia	2	0.0952381	-2.35138	-0.2239405
Gabbia	1	0.04761905	-3.04452	-0.1449773
Thiara	1	0.04761905	-3.04452	-0.1449773
Melanoides	2	0.0952381	-2.35138	-0.2239405
Tarebia	2	0.0952381	-2.35138	-0.2239405
Lamellidens	3	0.14285714	-1.94591	-0.2779872
Perreysia	3	0.14285714	-1.94591	-0.2779872
Corbicula	1	0.04761905	-3.04452	-0.1449773
	21			∑ =-2.020
	Shannon Weiner diversity index = 2.0206599			

RESULTS AND DISCUSSION:

A total of 21 species of molluscs representing 04 orders, 05 families and 09 genera were recorded from the Manjra river. The recorded species are represented in Table 1.

Table 1: Molluscan fauna recorded in Manjra River, during January 2013 to December 2013.

S.no	Class	Order	Family	Genus	Species
1	Gastropda	Mesogastropoda	Viviparidae	*Bellamya*	*bengalensis f.typica* (Lamarck, 1822)
2					*bengalensis f.colairensis* (Annandale, 1921)
3					*bengalensis f.gigantea* (Reeve,1862)
4					*bengalensis f.mandiensis* (Kobelt, 1909)
5					*crassa* (Benson, 1836)
6					*dissimilis* (Mueller,1774)
7		Caenogastropoda	Bithyniidae	*Bithynia*	*troscheli* (Paasch, 1842)
8					*pulchella* (Benson, 1836)
9				*Gabbia*	*orcula* (Frauenfeld, 1862)
10			Thiaridae	*Thiara*	*crebra* (Mueller,1774)
11				*Melanoides*	*crebra* (Lea, 1850)
12					*tuberculata* (Mueller,1774)
13				*Tarebia*	*granifera* (Lamarck,1822)
14					*lineata*(Gray, 1828)
15	Bivalvia	Trigonoida	Uninoidae	*Lamellidens*	*consobrinus* (Lea, 1859)
16					*corrianus* (Lea,1834)

17					*marginalis* (Lamarck, 1819)
18				*Parreysia*	*corbis* (Benson,1856)
19					*corrugata*(Mueller, 1774)
20					*cylindrica* (Annandale & Prashad, 1919)
21		Veneroida	Corbiculidae	*Corbicula*	*striatella* (Deshayes, 1854)

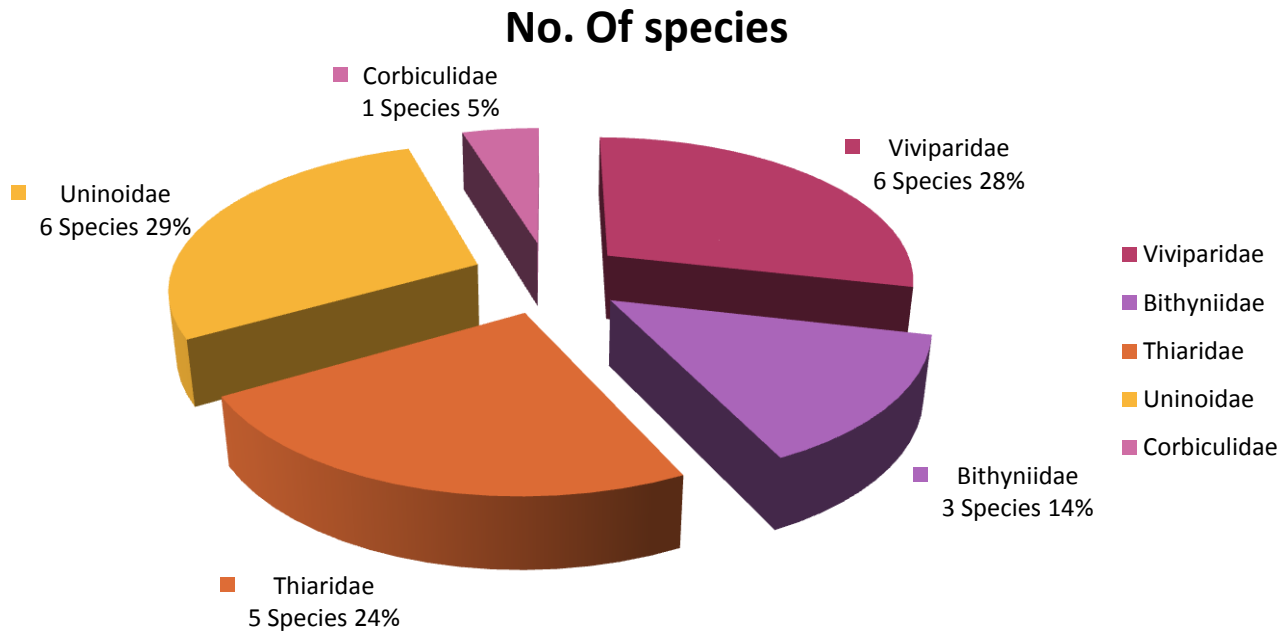


Figure 1. Graphical presentation of Molluscan species found in the Manjra river Bidar District, Karnataka.

Gastropods substituted a dominant group of Malacofauna present throughout the study period. 14 species of gastropods are *Bellamya bengalensis f.typica* (Lamarck,1822), *Bellamya bengalensis f.colairensis* (Annandale, 1921), *Bellamya bengalensis f.gigantea* (Reeve, 1862) *Bellamya bengalensis f.mandiensis*(Kobelt,1909), *Bellamya crassa* (Benson, 1836), *Bellamya dissimilis* (Mueller, 1774), *Bithynia troscheli* (Paasch,1842), *Bithynia pulchella* (Benson, 1836), *Gabbia orcula* (Frauenfeld,1862), *Thiara crebra* (Mueller,1774), *Melanoides crebra* (Lea,1850), *Melanoides tuberculata*(Mueller,1774), *Tarebia granifera* (Lamarck ,1822),*Tarebia lineata* (Gray, 1828). And 06 genera *Bellamya, Bithynia, Gabbia, Thiara, Melanoides and Tarebia,* were recorded during present study. Among the gastropods *Bellamya* species were recorded abundantly during study period. The density of order Gastropoda range between 35 to 45 organisms/m^2 with maximum density in summer and minimum in winter season. Bivalvia were represented by 07 species *Lamellidens consobrinus* (Lea, 1859), *Lamellidens corrianus* (Lea,1834),

Lamellidens marginalis (Lamarck, 1819), *Parreysia corbis* (Benson,1856), *Parreysia corrugate* (Mueller, 1774), *Parreysia cylindrica* (Annandale & Prashad, 1919) and *corbicula striatella* (Deshayes, 1854) are belonging to 02 orders Trigonoida, Veneroida ,02 families Unionidae and Corbiculidae 03 genus *Lamellidens, Parreysia and Corbicula*. Among Bivalvia *Lamellidens consobrinus* and *Lamellidens marginalis* were recorded as a most dominant species. Density of Pelecypoda group was recorded and represented by 08 to 15 organisms/m^2 with maximum density in summer and minimum in winter season. Molluscan abundance during summer may be due to increased temperature which may enhance the rate of decomposition of organic matter in the river (Malhotra *et al*., 1996). The Shannon-weiner index was shown 2.02. And various physico-chemical parameters of three seasons Summer, Monsoon and Winter from January 2013 to December 2013 are summerised in the table -2.

Table 2: Physico-chemical parameters recorded in Manjra River, during January 2013 to December 2013.

S.No		Unit	Range of Varition					
			Season	Min	Max	Mean	Standardd eviation	Variance
1		^{0}C	Summer	32.4	43.5	37.95	5.55	30.8025
			Monsoon	27.0	35.4	31.2	4.2	17.64
			Winter	18.4	31.6	25	6.6	43.56
2	Water temp.	^{0}C	Summer	24.6	32.9	28.75	4.15	17.2225
			Monsoon	19.6	22.2	20.9	1.3	1.69
			Winter	14.3	24.0	19.15	4.85	23.5225
3	pH	--	Summer	7.3	8.2	7.75	0.45	0.2025
			Monsoon	6.8	7.5	7.15	0.35	0.1225
			Winter	7.2	7.8	7.5	0.3	0.09
4	Dissolved Oxygen	Mg/l	Summer	7.1	8.6	7.85	0.75	0.5625
			Monsoon	8.2	9.8	9	0.8	0.64
			Winter	6.1	6.9	6.5	0.4	0.16
5	CO_2	Mg/l	Summer	61.4	88	74.7	13.3	176.89
			Monsoon	34.3	52	43.15	8.85	78.3225
			Winter	25	28.9	26.95	1.95	3.8025
6	Alkalinity	Mg/l	Summer	157	200	178.5	21.5	462.25
			Monsoon	136	160	148	12	144
			Winter	87	95	91	4	16
7	Hardness	Mg/l	Summer	130	214	172	42	1764
			Monsoon	85	130	107.5	22.5	506.25
			Winter	148	185	166.5	18.5	342.25
8	Chloride	Mg/l	Summer	170.4	234.3	202.35	31.95	1020.803
			Monsoon	51.12	63.7	57.41	6.29	39.5641

			Winter	42.4	56.8	49.6	7.2	51.84
9	TDS	Mg/l	Summer	104	165	134.5	30.5	930.25
			Monsoon	195	218	206.5	11.5	132.25
			Winter	133	185	159	26	676
10	BOD	Mg/l	Summer	7.5	9.8	8.65	1.15	1.3225
			Monsoon	8.3	14	11.15	2.85	8.1225
			Winter	6.5	8	7.25	0.75	0.5625

Atmospheric & Water temperature: Atmospheric temperature was lowest 18.4^{0}C in winter and highest 43.5^{0}C in summer. Water temperature lowest in winter 14.3^{0}C and highest 32.9^{0}C in summer, and same results found with (Singh and Gupta, 2004) in Yamuna river. In the present investigation pH recorded lowest 6.8 in monsoon and highest 8.2 in summer. That shows fluctuation slightly acidic to Alkaline conditions. MaryBai (1989) reported that pH of polluted water fluctuates in the range of 8.0-9.0. Dissolved Oxygen was recorded minimum 6.1mg/l in winter and maximum 9.8mg/l in monsoon. May be due to the low solubility at high temperature and high degradation of organic substances by Rajgopal *et al.*, findings of Tidame and Shinde (2012). CO_2 showed lowest 25mg/l in winter and highest 88mg/l in summer. Silmilar result observed by Sahni and Yadav (2012). CO_2 level increases in summer season may be due to decay and decomposition of organic matter observed by Joshi *et al.*, (1995). Alkalinity of water shown minimum 87mg/l in winter and maximum 200 mg/l in summer. This result supported observation by Assam and Khanna *et al.*, (2011) in Ganga river. Total hardness values ranges lowest 85mg/l in monsoon and highest 214mg/l in summer. Same results observed by Angadi *et al.*,(2005). Chloride values were found lowest 42.4mg/l in mosoon and highest 234.3mg/l in summer. Same result observed by Shiddamallayya and Pratima (2008). Total Dissolved Solids shown minimum 104mg/l in summer and maximum 218mg/l in monsoon. The same result also observed by Trivedy and Goel(1984). Biological Oxygen Demand was miaximum 9.8mg/l in summer and minmum 6.5mg/l in winter. And results are also reported by Seenaya and Zafar (1979).

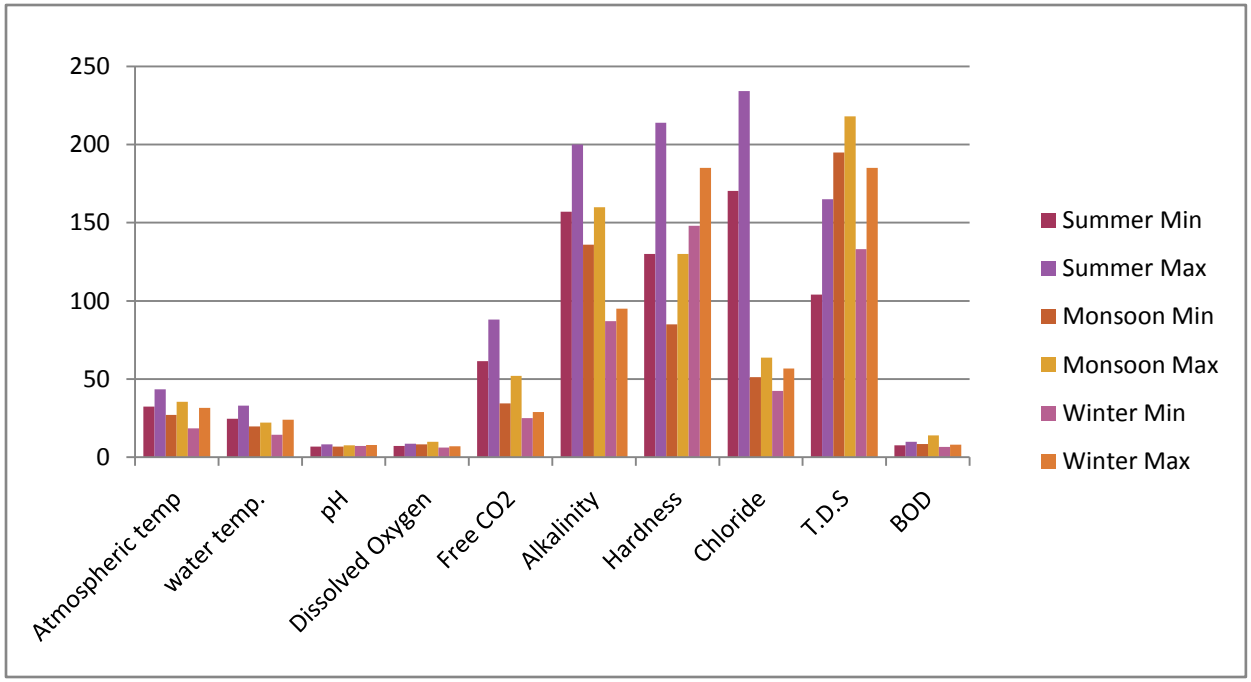
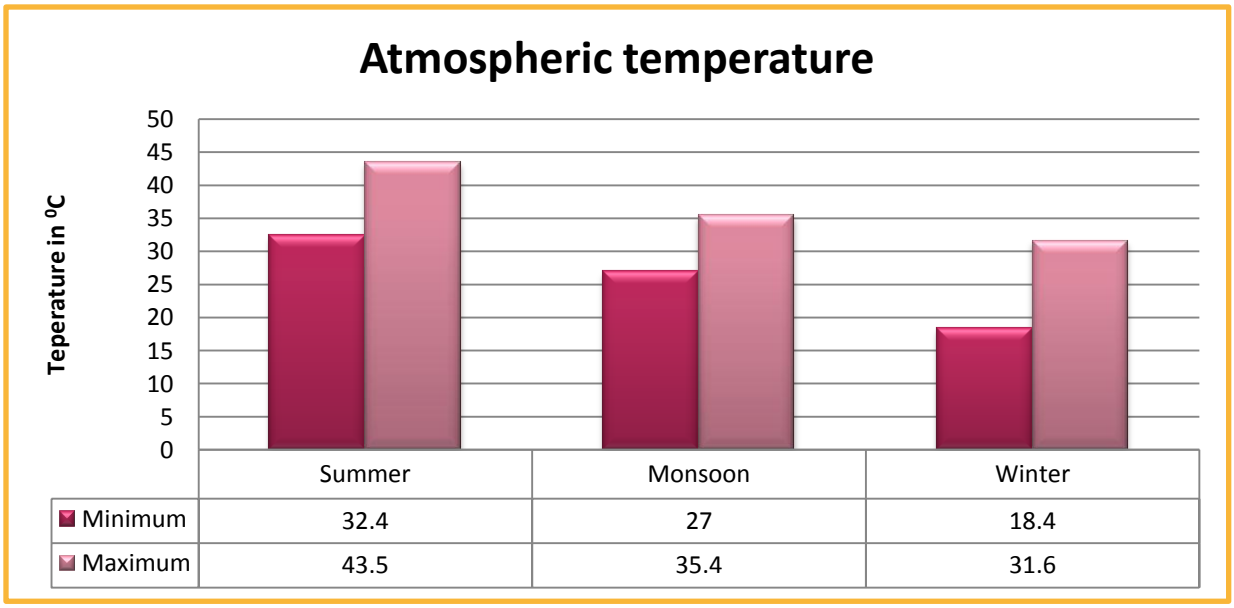
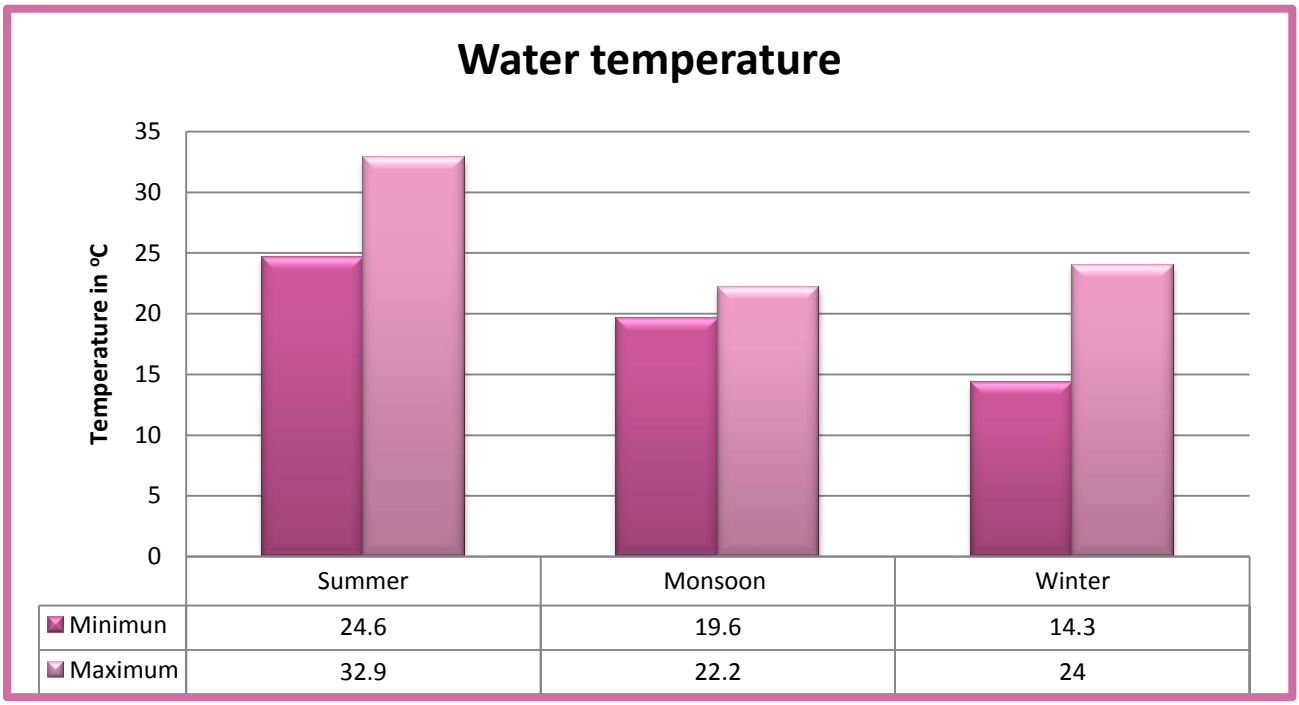
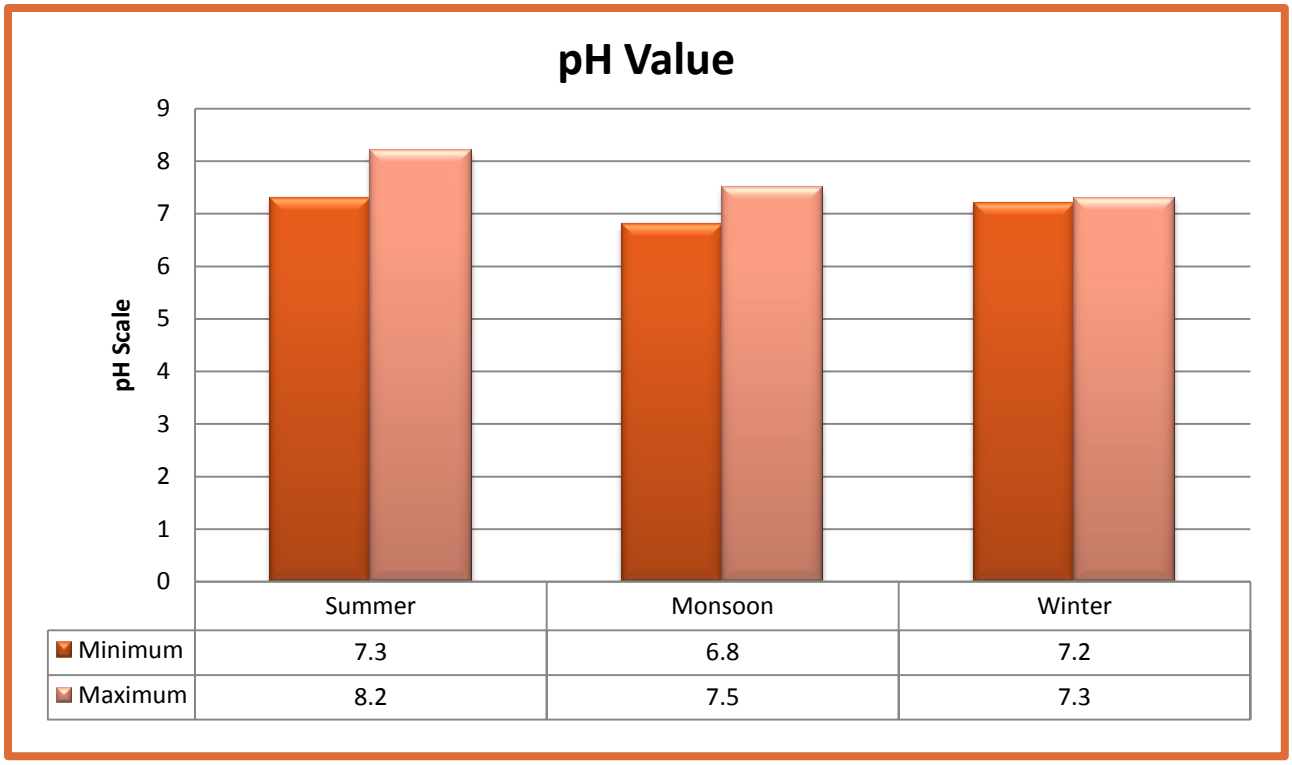


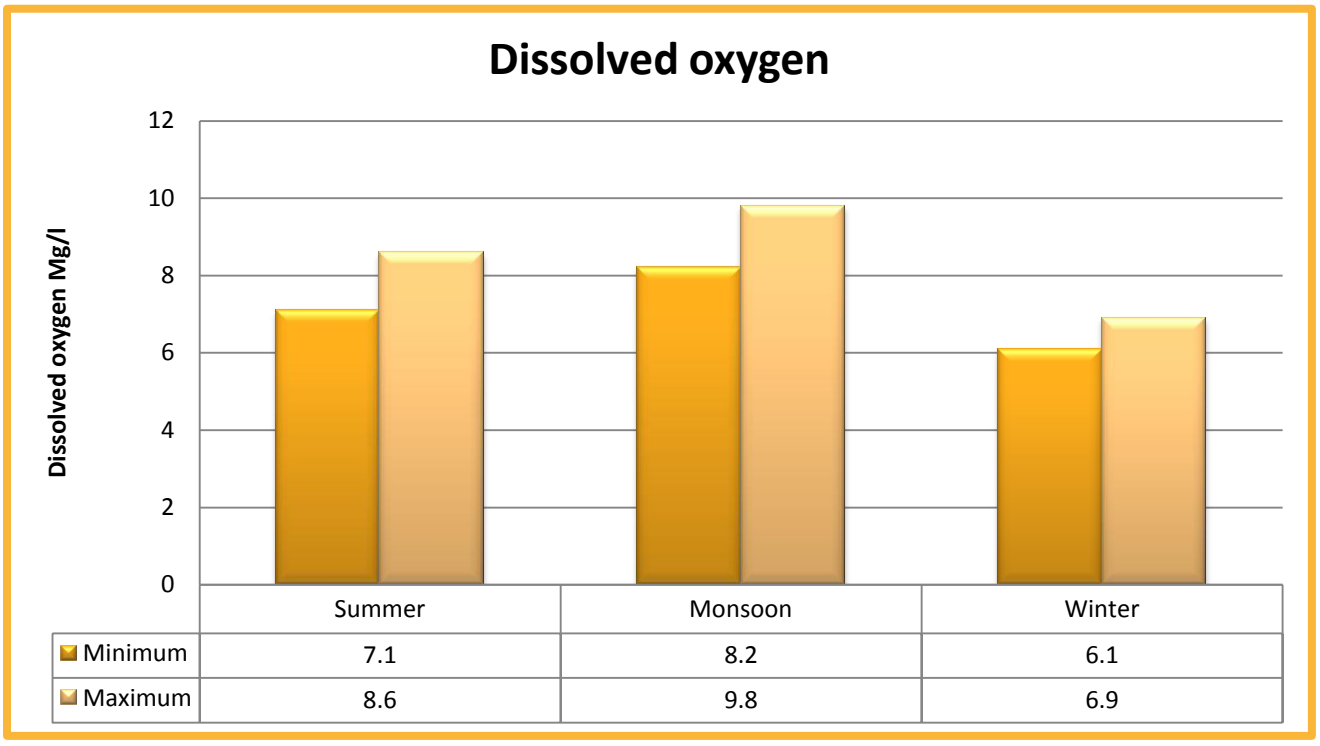
Figure 2 Graphical representation of Physico- chemico characters in the Manjra River, Bidar District, Karnataka.

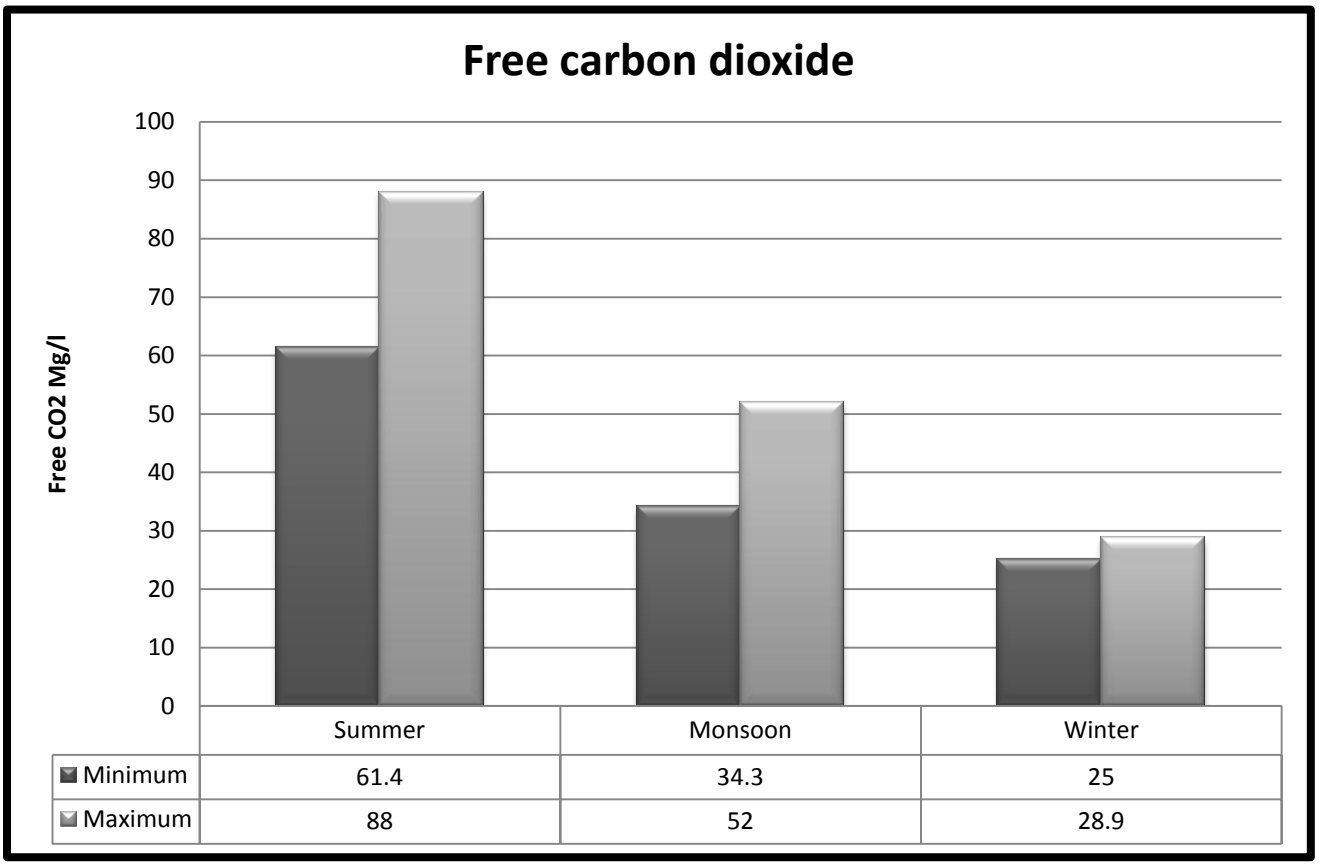


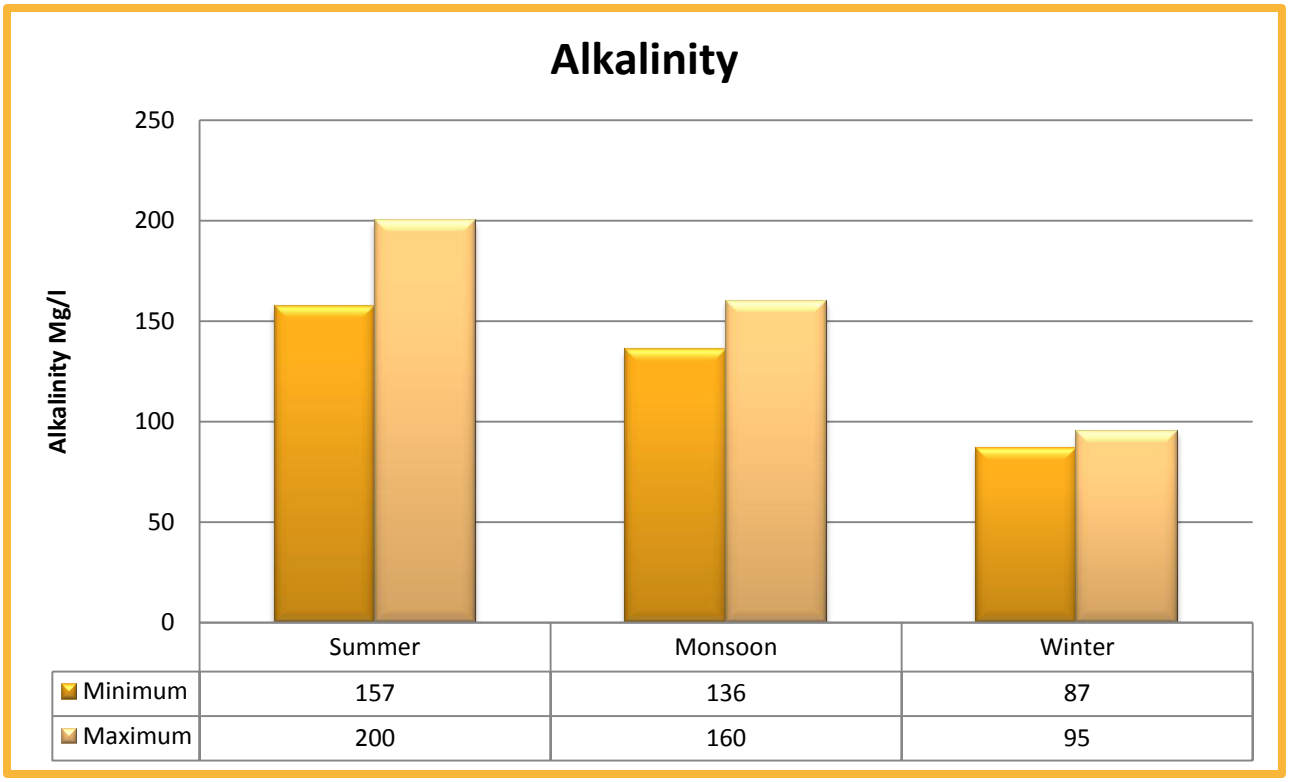
	Summer	Monsoon	Winter
Minimum	32.4	27	18.4
Maximum	43.5	35.4	31.6


Water temperature
Temperature in °C
35
30
25
20
15
10
5
0
Summer
Monsoon
Winter
Minimun 24.6 19.6 14.3
Maximum 32.9 22.2 24

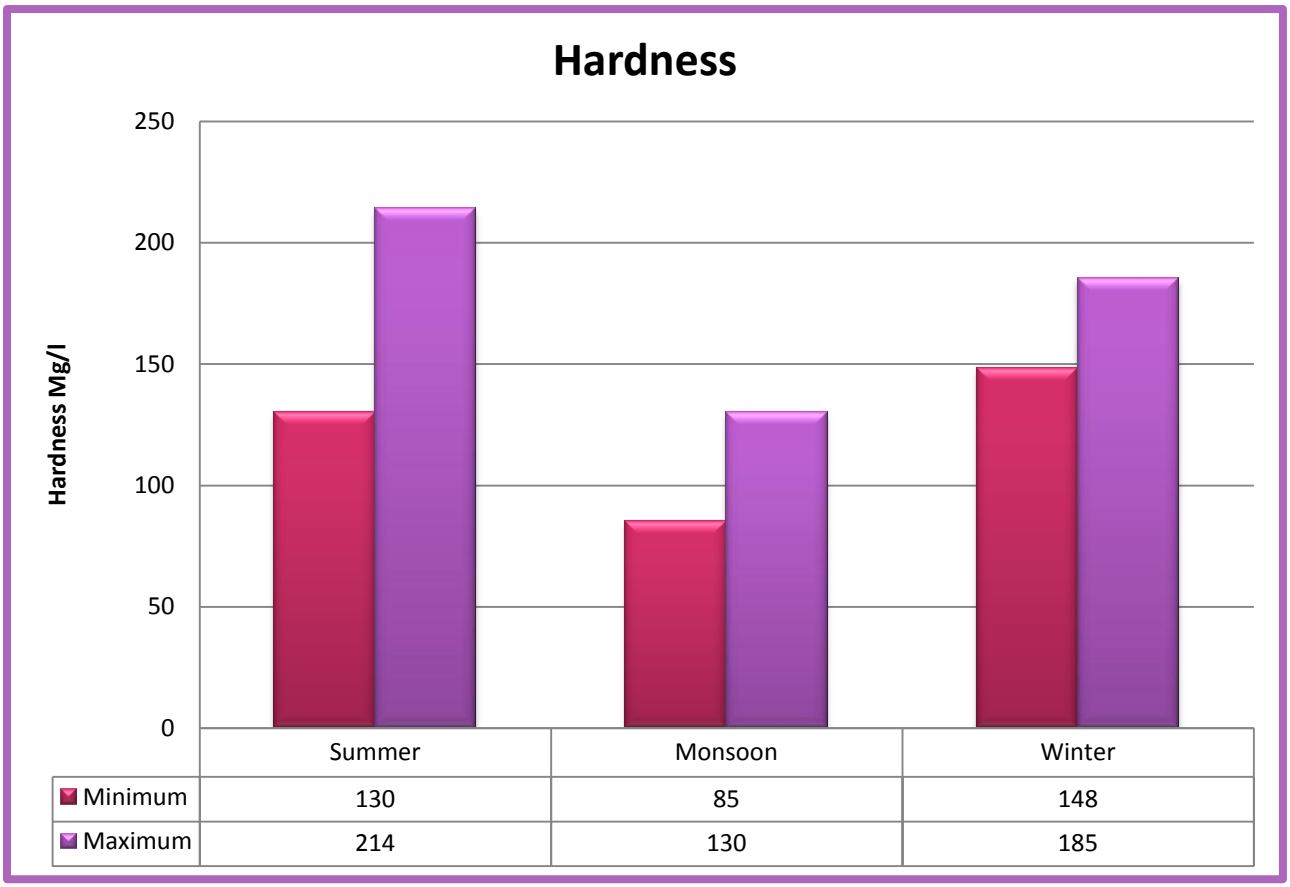

pH Value
pH Scale
9
8
7
6
5
4
3
2
1
0
Summer
Monsoon
Winter
Minimum 7.3 6.8 7.2
Maximum 8.2 7.5 7.3


Dissolved oxygen
Dissolved oxygen Mg/l
12
10
8
6
4
2
0
Summer
Monsoon
Winter
Minimum
7.1
8.2
6.1
Maximum
8.6
9.8
6.9

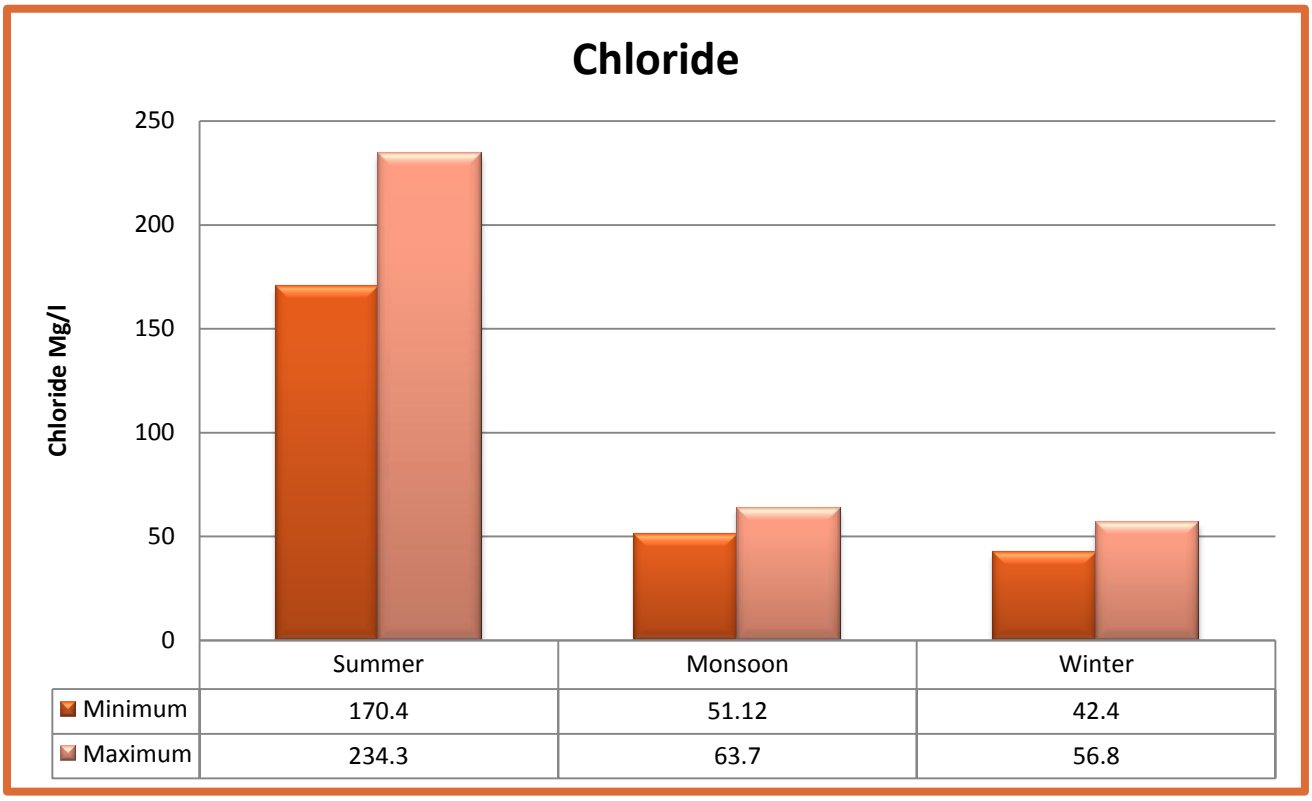

Free carbon dioxide
Free CO2 Mg/l
100
90
80
70
60
50
40
30
20
10
0
Summer
Monsoon
Winter
Minimum
61.4
34.3
25
Maximum
88
52
28.9



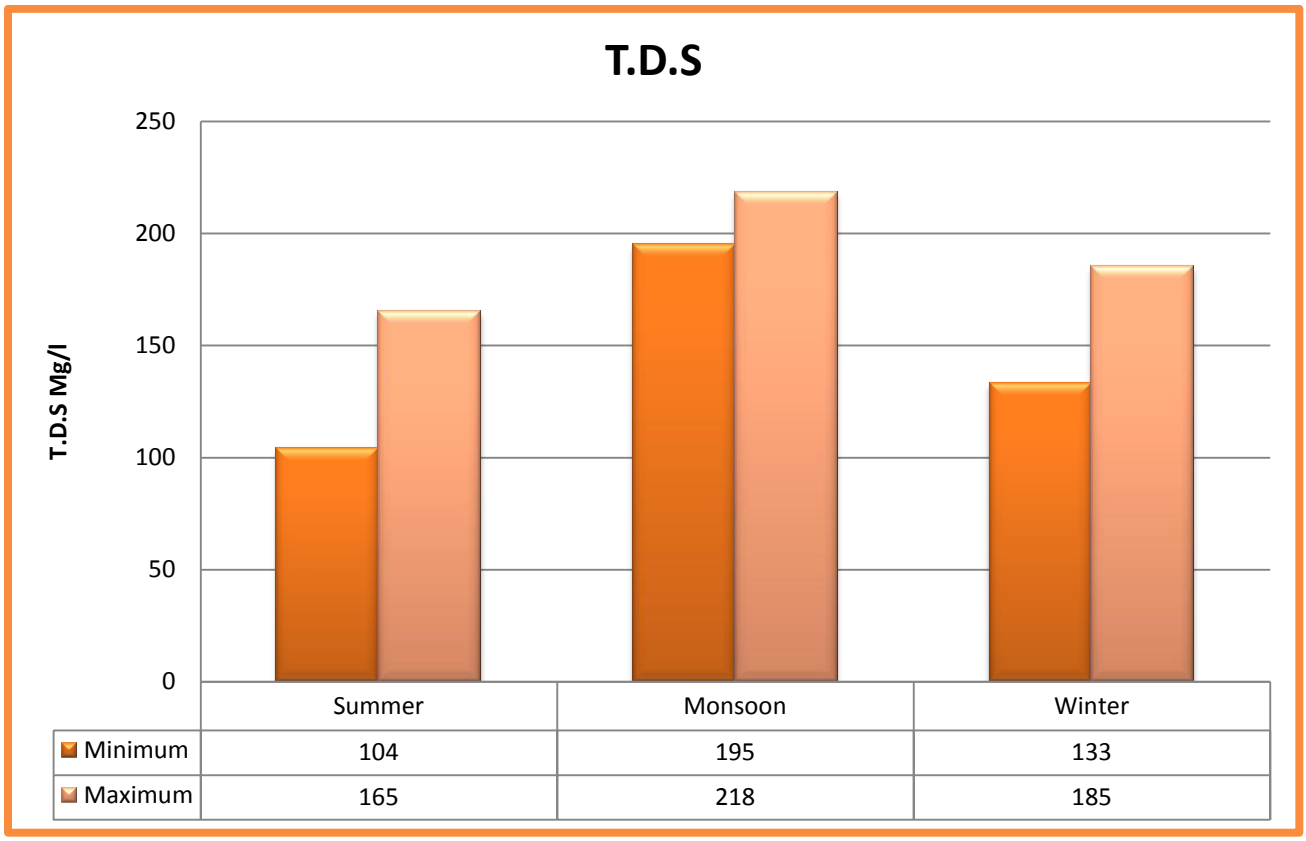
	Summer	Monsoon	Winter
Minimum	157	136	87
Maximum	200	160	95



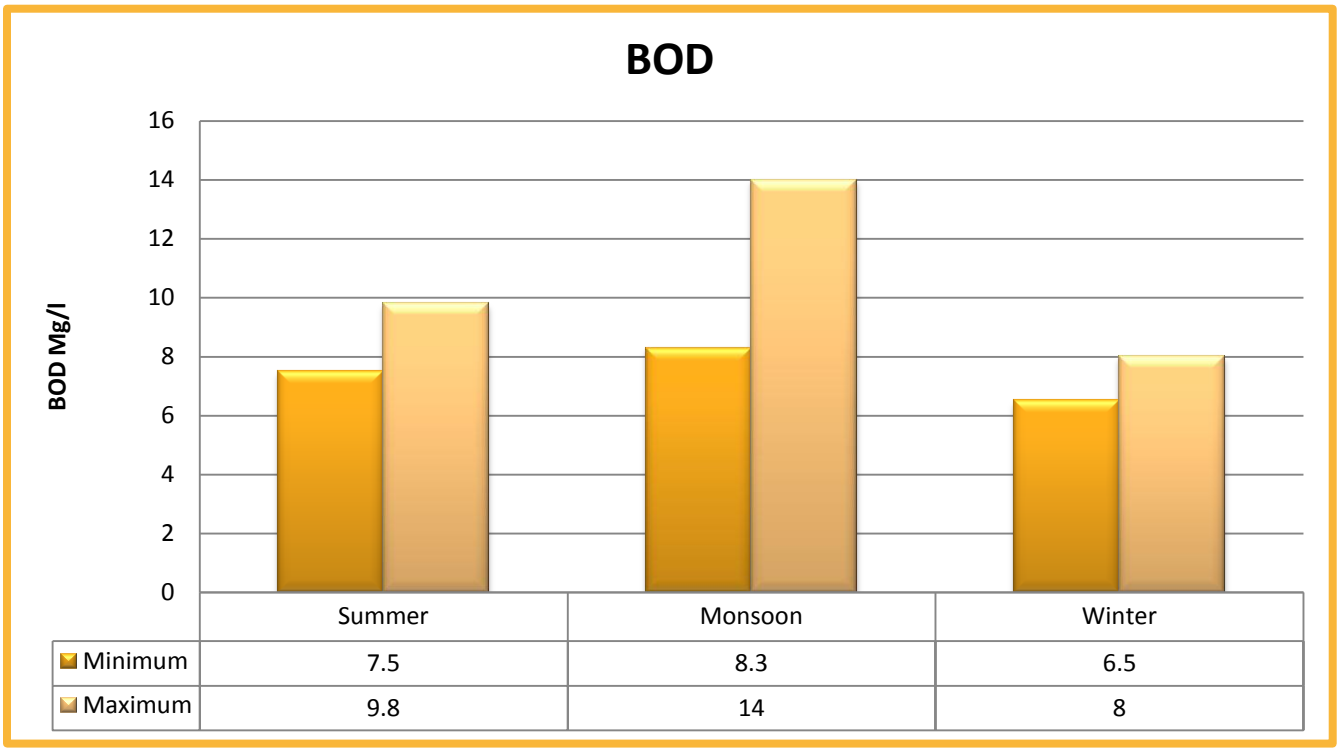
	Summer	Monsoon	Winter
Minimum	130	85	148
Maximum	214	130	185



	Summer	Monsoon	Winter
Minimum	170.4	51.12	42.4
Maximum	234.3	63.7	56.8



	Summer	Monsoon	Winter
Minimum	104	195	133
Maximum	165	218	185



CONCLUSION:

The freshwater molluscs play a massive role in nature and help in assessment of ecological status of the water bodies. Being herbivores, they form the lower strata of aquatic trophic linkages and perform many other ecological activities. Hence, studies pertaining to their diversity, distribution and ecology become imperative. The results of the present study indicated that the diversity and distribution of the malacofauna of Manjra river especially, Gastropodes a *Bellamya bengalensis*, *M. tuberculata* and Bivalves intimately correlated with the physico-chemical regime of the River. These species can be considered as bioindicators of pollution as they were found to respond prominently to nutrient inputs, discharge of sewage and Biological waste produced by animals and humans. The water of Manjra river is not so polluted. But simple primary treatment is necessary because the values of parameters are very close to the desirable limits specified by WHO and ISI. A progressive increase in their number with increasing pollution load indicates that they possess great tolerance against the contaminants present in water and flourish well in their presence.

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