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CORRELATION OF MOLLUSCAN DIVERSITY WITH PHYSICO-CHEMICAL PARAMETERS OF WATER IN KARANJA RESERVOIR, BIDAR DISTRICT, KARNATAKA, INDIA

JYOTHI [1], ZEBA PARVEEN [2], K VIJAYKUMAR [3], ROMANA AFREEN [4]

[1] Research Scholar, Department of Zoology, Gulbarga University, Kalaburagi. Research Centre Bi Bi Roza Degree College for Women's Kalaburagi, Karnataka, India.
[2] Associate Professor, Department of Zoology, Gulbarga University, Kalaburagi. Research Centre Bi Bi Roza Degree College for Women's Kalaburagi, Karnataka, India.
[3] Research Scholar, Department of Zoology, Gulbarga University, Kalaburagi. Research Centre Bi Bi Roza Degree College for Women's Kalaburagi, Karnataka, India.
[4] Associate Professor, Department of Zoology, Gulbarga University, Kalaburagi. Research Centre Bi Bi Roza Degree College for Women's Kalaburagi, Karnataka, India.

ABSTRACT:

Aim of the present study is to assess the species diversity of molluscsans impact of physico-chemical parameters on their diversity from Karanja reservoir on monthly basis. During present investigation, a total of 24 species of molluscs representing 05 orders, 10 families and 14 genera were recorded from the Karanja reservoir. Gastropods substituted a dominant group of macro-invertebrates present throughout the study period. 15 species of gastropoda recorded were representing 03 orders, 07 families, 10 genera and 9 species of Bivalvia recorded were representing 02 orders, 03 families, 04 gerera were present as macro-invertebrate benthos. The α- diversity indices for molluscan species that are like Shannon- Weiner index calculated and correlated with physico-chemical parameters that are Atmospheric and Water Temperature, Rainfall, Dissolved Oxygen, Dissolved CO2, Alkalinity, Total Hardness(Calcium and Magnesium), Chloride, TDS and B.O.D.

Keywords: ***Karanja reservoir, Molluscs, Physico-chemical parameters, diversity indices.***

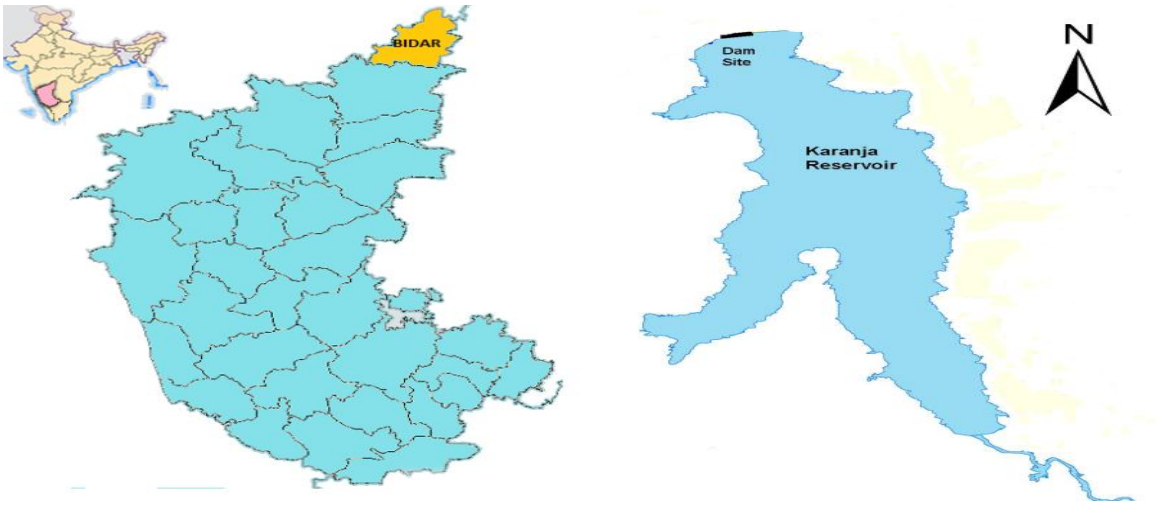
INTRODUCTION:

Water is elixir of life. It is the greatest gift of nature and necessity of living organisms. Hence water is called "Mother of all living world. All the water resources that are found on the earth includes Oceans. Rivers, lakes, ponds, polar ice-caps, underground water etc. Without water life will cease to exist on earth. Nearly seven-tenths

of the earth's crust is composed of water. Five percent of this water is potable and useful to man. However only one percent of the water resources available on the earth can be used by man to fulfill his various purposes. It is a very precious resource. Karanja reservoir is the precious aquatic ecosystem playing significant role in supplying potable water to Bidar city as well as sustain a rich aquatic fauna. Among the macro-invertebrates, molluscs are an integral component of aquatic ecosystem and are very sensitive to changes in water quality, making them an excellent indicator species, thus assessing the trophic status of freshwater systems (Choubisa, 1992). In India, till today, 5070 species of molluscs have been recorded of which, 3370 species are from marine habitats (SubbaRao, 1991). There are 1671 species of non marine molluscs 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).

MATERIALS AND METHODS:

1. STUDY AREA:



Bidar district falls under both the basins of Krishna and Godavari. 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 1,989Km^2 and Karanja up to 2,422Km^2. The present study is performed in Karanja River which co- ordinates latitude N 17^o 49', E 77^o 20' and N 18^o 02', E77^o 12' longitude at an elevation of 554-575 mtrs above sea level. Bidar district, Karnataka. The average rainfall is 830mm and average temperature ranges between 35^{o}c-42^{o}c. Maximum depth of reservoir is 22.23mtrs. The relative humidity is high during the southwest monsoon, being between 65% to 75%. Summer is the driest part, when the relative humidity is between 30% to 40%. Karanja river a major perennial river of Bidar district irrigate drought prone area of Bidar and Bhalki taluks. It is medium reservoir having water spread area of 5,673 ha with gross irrigation potential of 1, 62818 hectares. Agricultural lands and villages surround the river. The availability of food throughout the year made the perennial river a favorite 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.

2. METHODOLOGY:

Water sampling: Present research Studies were conducted for the period of one year January 2013 to December 2013. The samlpling 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 physicochemical parameters were estimated according to the methods for examination of pure water and waste waters.

Collection of Molluscan fauna: Molluscans, both benthic and peripheral forms are collected from the reservoirs 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), N. V. and Mitra, S. C.[1979], Tonapi(1980), Adoni et al.(1985), Subba Rao (1989,1993), Pennak(2004), Ramakrishna and Anirudha Dey (2007) and Aravind, N. A. (2008)every molluscan specimen was characterized, identified with its class, subclass, family, genus and species.

Statistical Analysis

The correlation coefficient matrix between each pair of parameters were estimated to identify the highly correlated and interrelated water quality parameters and different α-diversity molluscan indices. Statistical analysis was carried out using Statistical Package for Social Sciences (SPSS 10.0).

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.

RESULTS AND DISCUSSION:

A total of 24 species of molluscs representing 06 orders, 08 families and 10 genera were recorded from the Karanja reservoir. The recorded species are represented in Table 1.

Table 1: Molluscan fauna recorded in Karanja reservoir, during January 2013 to December 2013.

S. No	Class	Order	Family	Genus	Species
1	Gastropda	Mesogastropoda	Viviparide	Bellamya	bengalensis (Lamarck, 1822)
2					dissimilis (Mueller,1774)
3		Caenogastropoda	Ampullariidae	Pila	globosa (Swainson,1822)
4		Caenogastropoda	Bithyniidae	Bithynia	pulchella (Benson, 1836)
5				Gabbia	orcula (Frauenfeld, 1862)
6					stenothyroides (Dohrn, 1857)

7			Thiaridae	Thiara	scabra (Mueller,1774)
8				Melanoides	nevilli (Brot, 1874)
9					tuberculata (Mueller,1774)
10				Tarebia	granifera (Lamarck ,1822)
11					semigranosa (Vondem Busch, 1842)
12		Basommatophora	Lymnoiidae	Lymnaea	accuminata (Martens, 1884)
13					luteola (Lamarck,1822)
14			Planorbidae	Gyraulus	convexiusculus (Hutton,1849)
15			Bullinidae	Indoplanorbis	Exustus (Deshayes, 1834)
16	Bivalvia	Trigonoida	Uninoidae	Lamellidens	marginalis (Lamarck)
17					consobrinus (Lea, 1859)
18					corrianus (Lea,1834)
19					narenporensis Preston (Lea, 1834)
20				Parreysia	corrugate (Mueller,1774)
21					caerulea (Lea,1831)
22					nuttalliana (Lea, 1856)
23		Veneroida	Corbiculidae	Corbicula	striatella (Deshayes, 1854)
24			Psidiidae	Sphaerium	indicum (Deshayes, 1854)

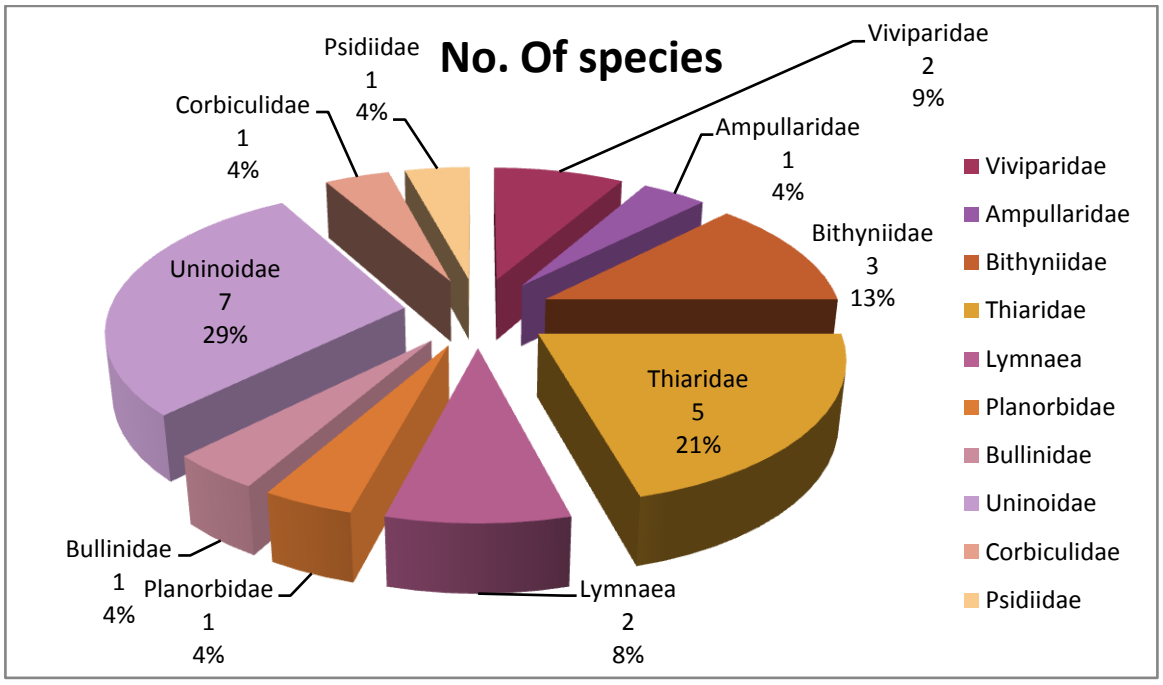


Figure 1. Graphical presentation of Molluscan species found in the Karanja reservoir Bidar Dist. Karnataka.

Gastropods substituted a dominant group of macro- invertebrates present throughout the study period. 15 species of gastropods are Bellamyabengalensis, Bellamyadissimilis, Pilaglobosa, Bithyniapulchela Gabbiaorcula, Gabbiastenothyroides, Thiarascabra, Melanoidesnevilli, Melanoidestuberculata, Tarebiagranifera, Tarebiasemigranosa, Lymnaeaaccuminata, Lymnaealuteola, Gyraulusconvexiusculus, Indoplanorbisexustus representing 03 orders Mesogastropoda, Caenogastropoda and Basomatophora; 07 families Viviparidae , Ampullariidae, Bithyniidae, Thiaridae, Lymnoiidae, Planorbidae and Bullinidae. And 10 genera Bellamya, Pila, Bithynia, Gabbia, Thiara, Melanoides, Tarebia, Lymnaea, Gyraulus and Indoplanorbis were recorded during present study. Among gastropods species were recorded abundantly during entire study period. The density of order Gastropoda ranged between 55 to 95 organisms.m^{-2} with maximum density in summer and minimum in winter season. Bivalvia were represented by 9 species Lamellidensmarginalis, Lamellidensconsobrinus, Lamellidenscorrianus, Lamellidensnareporensis, Parreysiacorrugate, Parreysiacaerulea, Parreysianuttalliana, corbiculastriatella, Sphaeriumindicum are belonging to 02 orders Trigonoida, Veneroida, 03 families Unionidae and Corbiculidae and Psidiidae 04 Lamellidens, Parreysia, Corbicula, Sphaerium. Among pelycypods Corbiculastriatella was recorded as a most dominant species. Density of Pelecypoda group was recorded and represented by 25 to 45 organisms/m2 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 reservoir (Malhotra et al., 1996).

Table2: Range of variation of the physico-chemical parameters of water in reservoir.

S.No	Parameter	Unit	Range of Varition		
			Season	Min	Max
1	Atmospheric temp	^{0}C	Summer	31.8	37.5
			Monsoon	29.0	33.4
			Winter	27.4	29.6
2	Water temp.	^{0}C	Summer	26.7	33.2
			Monsoon	18.6	23.2
			Winter	13.8	25.0
3	pH	--	Summer	6.80	7.60
			Monsoon	7.2	7.90
			Winter	6.90	7.3
4	Dissolved Oxygen	mgL^{-1}	Summer	4.5	6.53

			Monsoon	6.64	10.4
			Winter	7.3	8.5
5	Free CO_2	mgL^{-1}	Summer	45	55
			Monsoon	0.8	44
			Winter	15	35
6	Alkalinity	mgL^{-1}	Summer	123	225
			Monsoon	168	285
			Winter	165	200
7	Hardness	mgL^{-1}	Summer	110	150
			Monsoon	85	100
			Winter	100	140
8	Chloride	mgL^{-1}	Summer	63.9	184.6
			Monsoon	42.6	252.6

			Winter	56.8	63.7
9	TDS	mgL^{-1}	Summer	104	165
			Monsoon	285	325
			Winter	185	208
10	BOD	mgL^{-1}	Summer	5.8	9.8
			Monsoon	4.6	6.5
			Winter	5.3	7

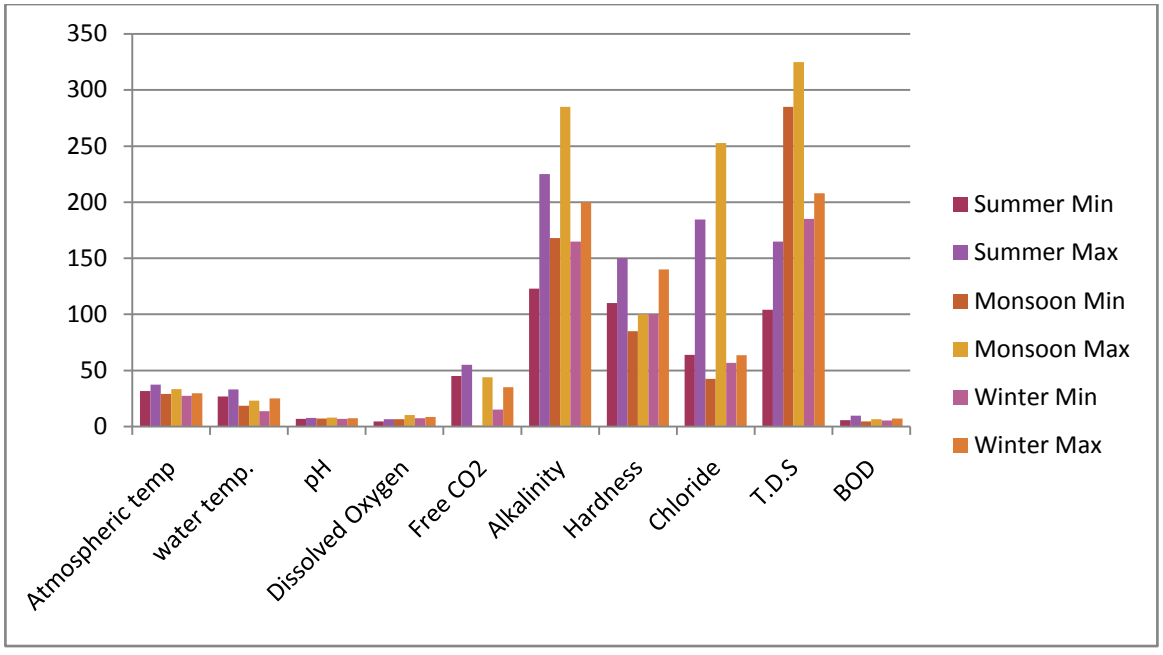
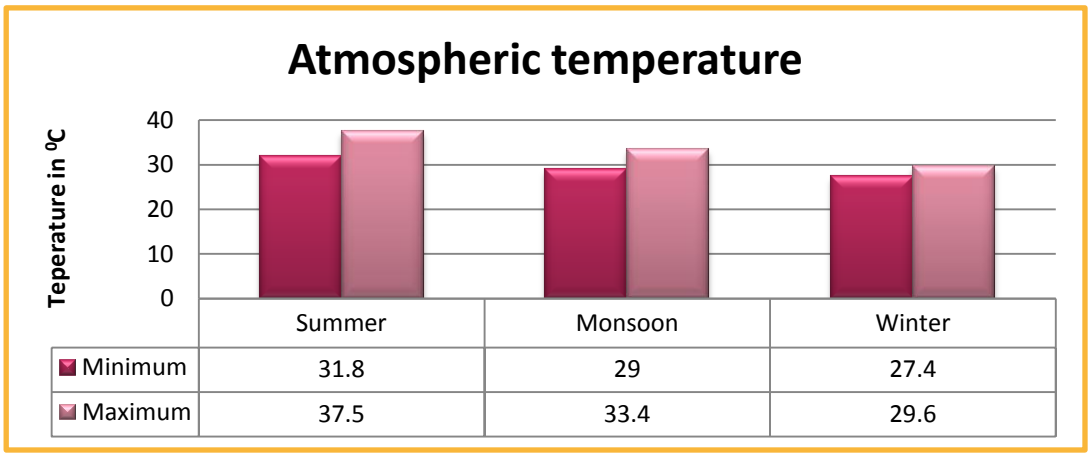
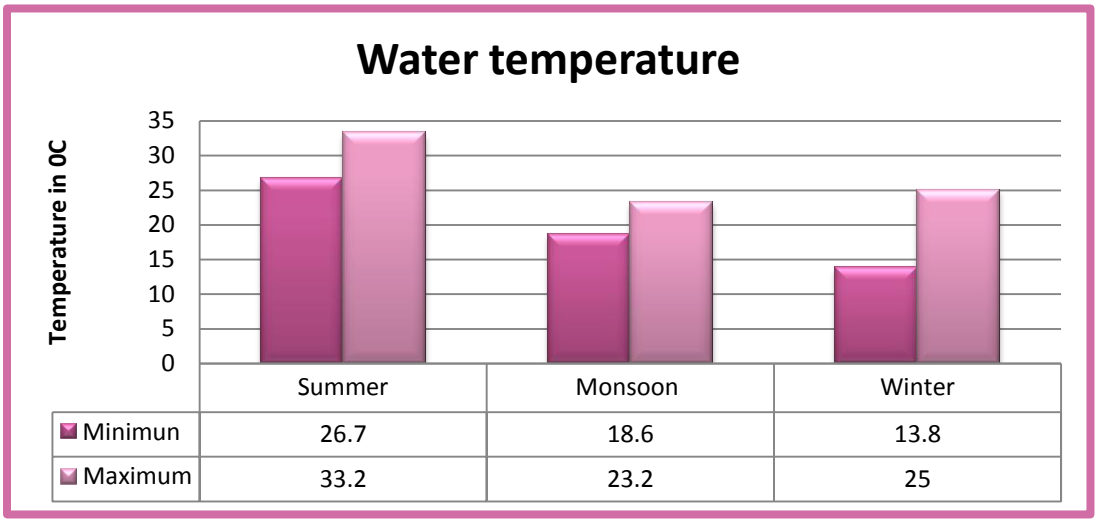
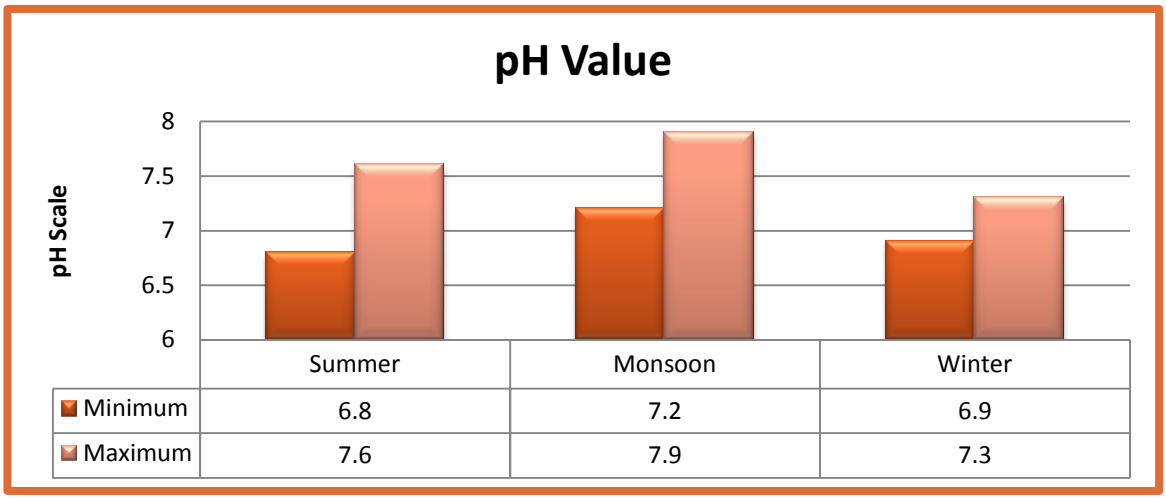


Figure 2: Graphical representation of Physico- chemico characters in the Karanja reservior Bidar Dist.Karnataka.


Atmospheric temperature
Teperature in ºC
40
30
20
10
0
Summer
Monsoon
Winter
Minimum
31.8
29
27.4
Maximum
37.5
33.4
29.6


Water temperature
Temperature in 0C
35
30
25
20
15
10
5
0
Summer
Monsoon
Winter
Minimun
26.7
18.6
13.8
Maximum
33.2
23.2
25


pH Value
pH Scale
8
7.5
7
6.5
6
Summer
Monsoon
Winter
Minimum
6.8
7.2
6.9
Maximum
7.6
7.9
7.3

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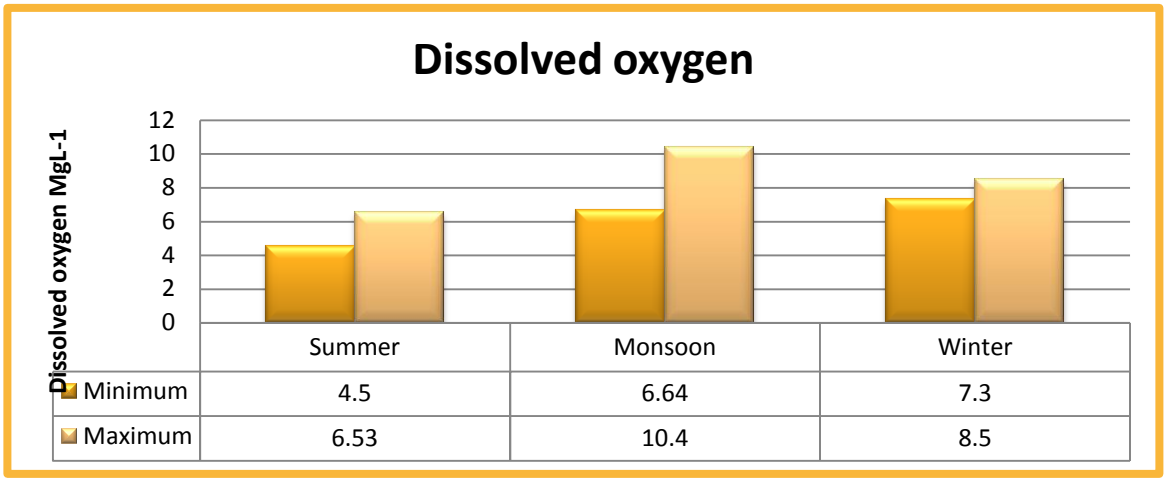
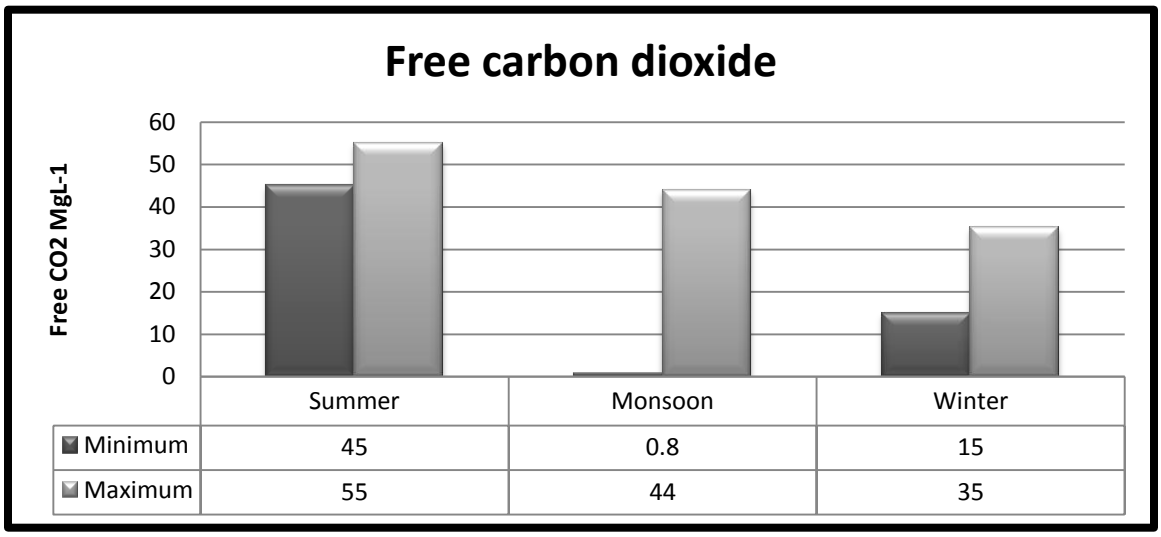
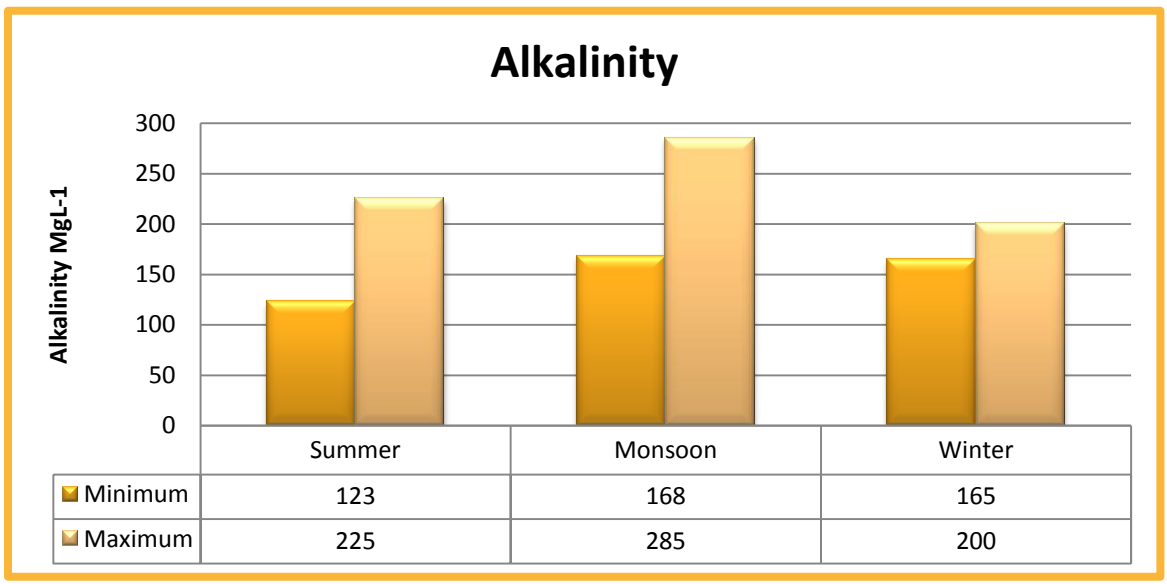
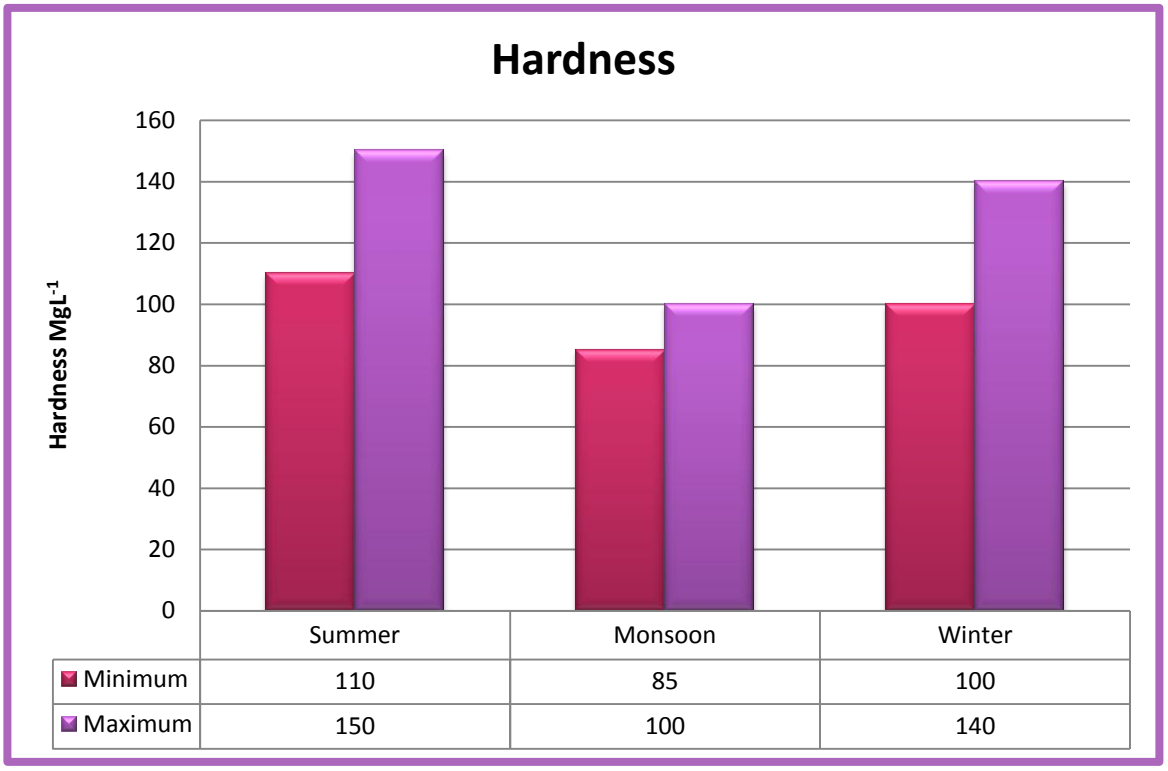
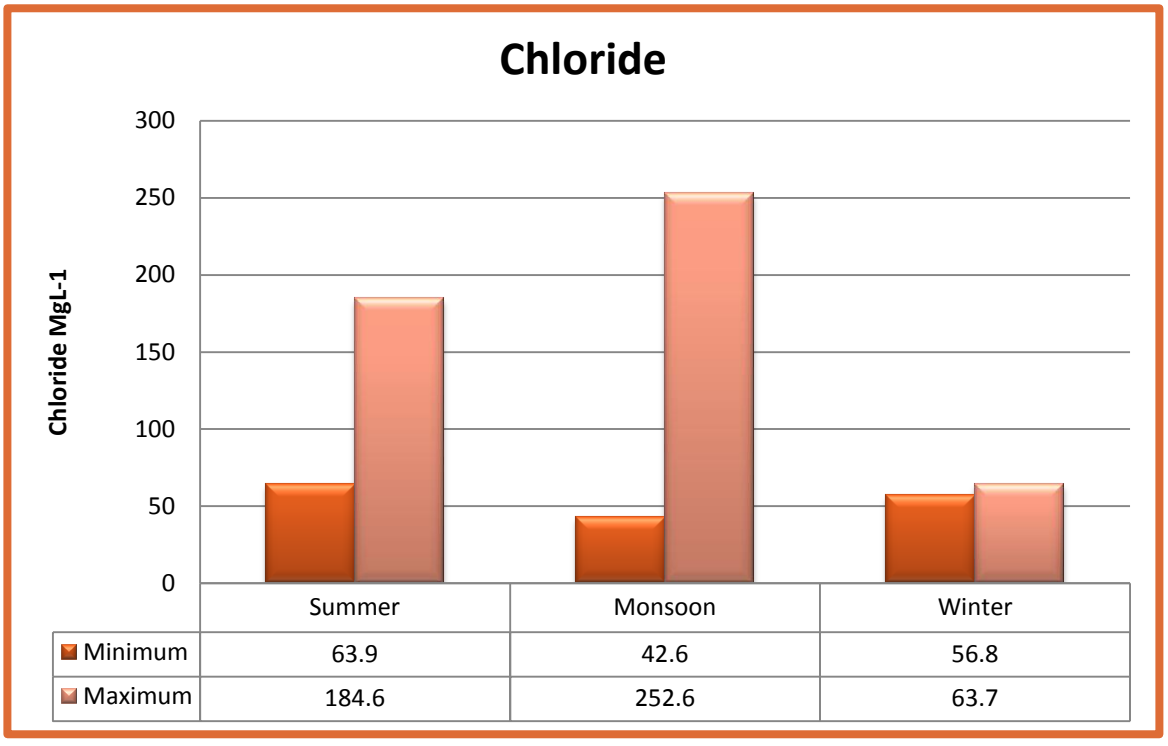
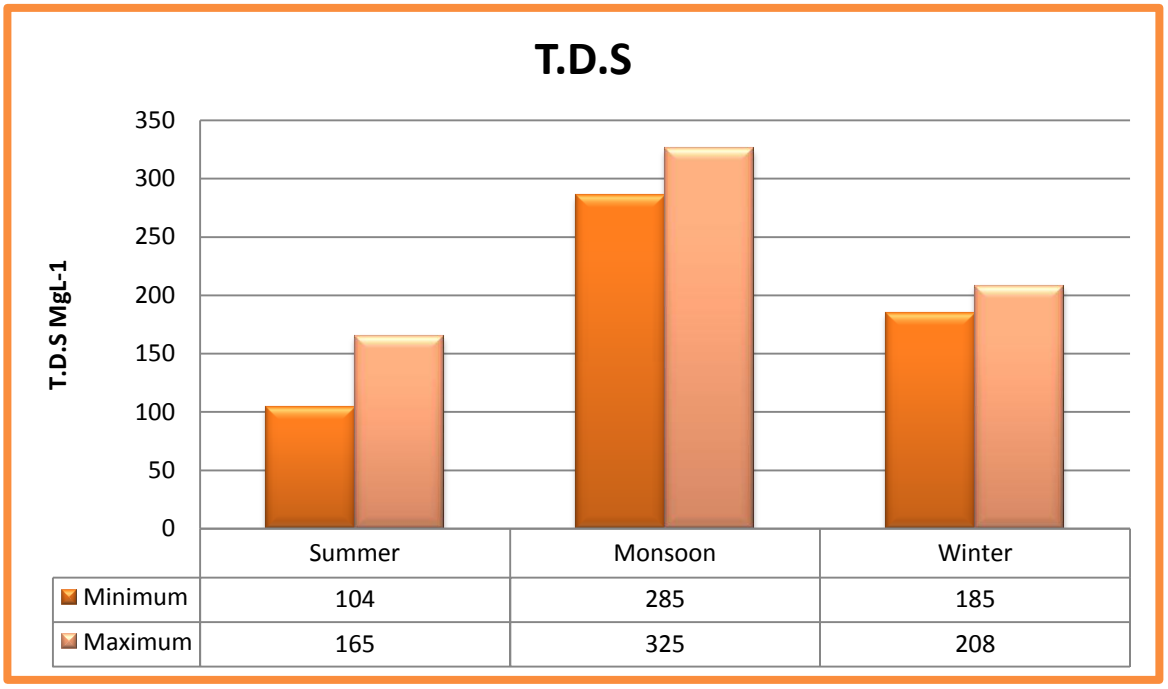


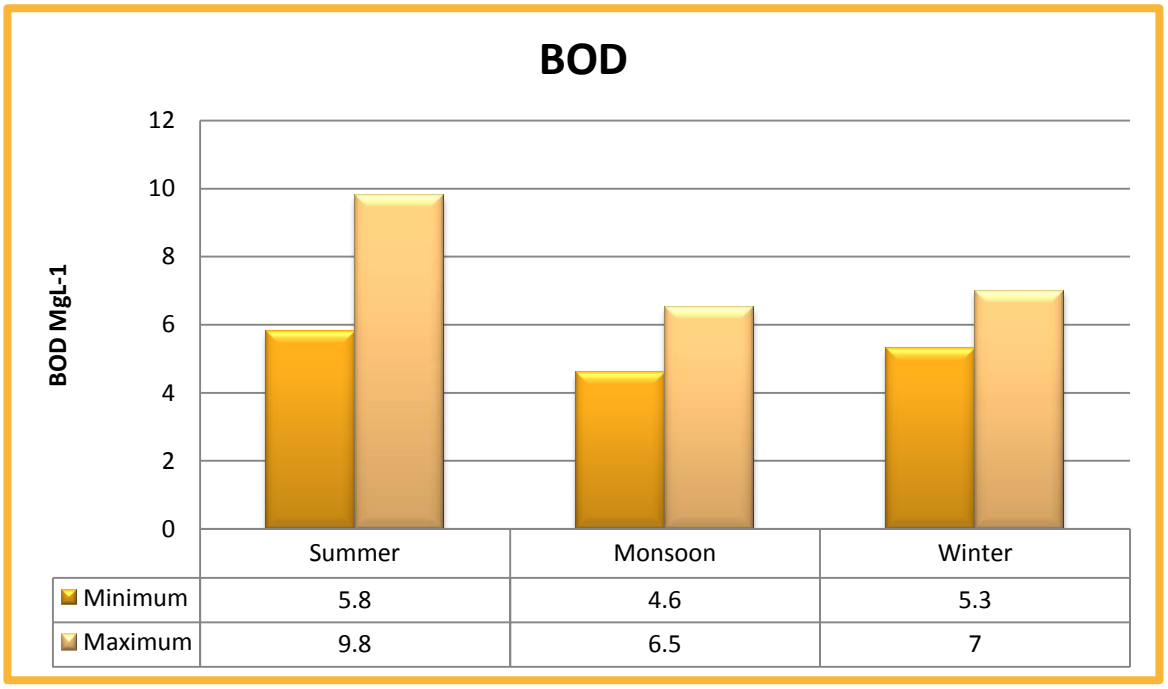





Hardness
Hardness MgL-1
160
140
120
100
80
60
40
20
0
Summer
Monsoon
Winter
Minimum
110
85
100
Maximum
150
100
140


Chloride
Chloride MgL-1
300
250
200
150
100
50
0
Summer
Monsoon
Winter
Minimum
63.9
42.6
56.8
Maximum
184.6
252.6
63.7





The pelecypods showed significant positive correlation between TDS and BOD level of significance while moderate positive correlation was observed in between pelycypods and temperature, CO2, alkalinity, hardness, chlorides. A moderate negative correlation exists between pelycypod population with TDS.

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 Karanja reservoir, especially, gastropodes a thiaridae, 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. 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. Findings of the present work shall be utilized by future researchers and ecologists as supplementary information in public and veterinary health sciences, ecotoxicology, water quality assessment and river management studies.

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