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Research Article

Diversity and Population Density of Molluscans in Two Water Bodies Karnataka, India

Shashikanth H Majagi[1*], Anitha S. M.[2], Jayadeva Naik[3], Dhanajaya S. G.[4] and Somshekar[5]

[1]Vijayanagar Sri Krishnadevaraya University, Ballari-583105, Karnataka-India

[2]Department of Zoology, Gulbarga University, Kalburagi

[3]Kidwai Cancer Hospital, Benagaluru, Karnataka-India

[4]Department of Zoology, Government Degree College, Chitradurga

[5]Department of Zoology, IDSG Govt. First Grade College, Chikkmagalur

*Corresponding Author E-mail: smajgi@rediffmail.com

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ABSTRACT

The present study deals with the comparative account of water quality, diversity and population density of molluscans in two water bodies of Gulbarga and Bidar districts. This study was undertaken for a period of two years from October 2001 to September 2003. Eleven species of molluscan identified for both reservoir of which eight are gastropods and three belongs to bivalves. Among the gastropds Lymnaea luteola, Lymnaea acuminate, Melania (Palitia scabra), Melania scabra var elegans species and among bivalves Parreysia corrugate var nagvorensis, Lamellidens corrianus species were dominant in Karanja reservoir. While, in Khaji Kotnoor reservoirs, Melania scabra var elegans, Diogoniostoma pulchella, Lymnaea luteola, Lymnaea acuminate species, Bivalves Parreysia corrugate, Lamellidens corrianus were dominant species. All the physico chemical parameters are within the permissible limit. Statistical analysis for Correlation and Shannon Weiner diversity index is also discussed in the paper.

Keywords: *Karanja Reservoir, Khaji Kotnoor Reservoir, Diversity, Physico-Chemical Parameters Gastropods and Bivalves.*

INTRODUCTION

Biodiversity is one of the important life supporting system on earth. Molluscs are mostly microbenthic organisms. They also found attached with floating vegetation in the fresh waterbodies. The faunastic survey of molluscs in any ecosystem provides crucial information about ecology and food chain of the ecosystem (Magare et al., 2016).

Molluscans are the environment as well as bio-indicators and they play a very important role in maintaining aquatic ecosystem by recycling nutrients and surviving as nutrition for certain aquatic organisms.

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Freshwater molluscs play a significant role in aquatic ecosystem, and some of them are edible. Also, they serve an important source of food for other animals i.e. fishes, birds and mammals even for human being. Wagh (2019). The taxonomic study of Indian fresh water molluscs has been done by Zoological Survey of India, Subba Rao (1989), Also in Maharashtra, freshwater Mollusca reported by Rao (1925), Tonapi and Mulherkar (1963), Tonapi ((1971), Magare et al. (2016), Kambale, (2018), Kumar et al. (2019).

Benthic organisms constitute an important component in the food web of a freshwater ecosystem. A detailed and complete knowledge of the bottom fauna is an essential pre-requisite not only for the determination of productivity but also for an assessment of the dermersal fisheries of any area. (Shibu et al., 2006). However, species diversity of molluscan has not yet been investigated in Indian tropical lentic waters of semi arid region of north Karnataka. In recent years the literature on molluscan distribution, occurrence, ecology and population density is rare. Earlier surveys on the ecology of benthos, though several investigations were made on the occurrence and distribution of benthic communities of most of the freshwater bodies. Fresh water molluscs are known to play significant role in the public and veterinary health and therefore needs to explore their diversity. (Magare et al., 2016). The current investigation deals with the comparison of the distribution, abundance and relationship of two of the reservoirs. The study also provides data on the molluscan fauna in Khaji Kotnoor reservoir a topic that has received little attention as yet.

MATERIALS AND METHODS

The Karanja reservoir is major perennial reservoir of the Bidar district and located at Byalhalli village, which is 100 kms away from the Gulbarga University campus which falls under 17^0-55' N latitude and 77^0-32' E longitude. The Khaja Kotnoor reservoir is also one of the major perennial reservoir of the district and located at about 20 km away from Gulbarga University campus which falls under 17º-22' N latitude and 76 º -59' E longitude.

Water samples were collected from October 2001 to September. 2003 on monthly basis. Collections were made on specific dates of every month. Surface samples were collected using a clean plastic container for the study of various physico-chemical and biological parameters. Water samples were colleted from eight stations in Karanja reservoir and Kahaji Kotnoor reservoir. Water samples collected were subjected to analysis by using Standards Methods for Examination of Water and Waste Waters (20thEdition (APHA., AWWA, 1998).

Collection of Molluscan fauna

Molluscans both benthic and peripheral forms were collected from the reservoir with the help of dipnet or dredges and live ones and shells were collected by hand. The live ones were cleaned and preserved carefully in 4% formalin and the collected shells were thoroughly washed with methyl alcohol and water before they were subjected to identification. The molluscans were separated and enumerated group wise. The specimens are identified as per Subba Rao (1989).

RESULT AND DISCUSSION

The seasonal occurrence and species diversity of molluscans in Karanja and Khaji Kotnoor reservoirs are summarized in Table. No. 1 and 2. Average values of molluscans collected at different regions and different seasons of the reservoir are presented in this paper. In both reservoirs two groups of mollusca viz., gastropoda and bivalve were identified during the course of the study. Total eight species were in gastropoda and three species were in bivalves identified. Gastropoda of mollusca contributed the main bulk of the fauna. About 75.43% of gastropoda and 24.57% bivalves were represented. Comparatively second year represented more gastropoda population. The bivalve population restricted to shallow zones of the reservoir where macrophytic vegetation was dense. This could be attributed to availability of food and substratum for attachment. In the present study, *Lymnea luteola, L. acuminata, Melania* (Palitia scabra)

and *Melania scabra var elegans* were the more dominant species in Karanja reservoir. *Melania tuberculata* and Viviparous variata were the second dominant species. Similarly in Khaji Kotnoor reservoir *Melania scabra var elegans, Digoniostoma pulchella, Lymnea luteola, L.* acuminate were more dominanat, widely distributed and also observed in all the seasons during the study period. However, *Melana scabra, M. tuberculata, Faunus ater* and *Planorbis exustus* were second dominant species during the study period. The total gastropoda population was more during northeast monsoon season and southwest monsoon season. In both reservoirs an inseparable association between gastropods and macrophytes in four different ponds have been observed by Dudani et al. (1987). Hence, the quality and quantity of macrophyte vegetation appear to play a vital role in determining the variations in gastropoda (Soszkal, 1975). Molluscans were found throughout the year indicating their tolerance to varied environmental conditions. Abundance of gastropods might be due to dense vegetation and shallow zone coupled with plenty of dissolved oxygen optimum range of pH and alkalinity. Almost all the bivalves are aquatic and great majority of freshwater forms occurs in shallow banks of reservoirs and rivers. Bivalves representing three genera were found throughout the study period. *Parreysia corrugate var nagvorensis*, *Lamellidens corrianus* and *Indonia coeruler* were the dominant species of bivalves in Karanja reservoir. Similarly, in Khaji Kotnoor reservoir *Parreysia corrugate* and *Lamellidens corrianus* were more dominant and these species are more abundant during northeast monsoon season and summer season of the two years of the study period. *Indonia coeruler* were also observed in the present study but they are relatively low when compared to other two species.

The maximum and minimum concentration of different physico-chemical parameters of water samples are presented in Table No.3 and 4. From the results of analysis, it has been observed that the atmospheric and water temperature was between 31.5 to 39.91 and 26.13 to 34.16 respectively in Karanja reservoir. Similarly, 30.6 to 41.0 and 24.82 to 33.9 in Khaji Kotnoor reservoir. The pH values were recorded between 6.9 to 8.5 in Karanja reservoir and 7.2 to 8.6 in Khaji Kotnoor. The DO values varied between 2.6 to 10.7 in Karanja reservoir and 2.4 to 9.0 in Khaji Kotnoor reservoir. The total alkalinity values were recorded between 70.7 to 249.3 in Karanja Reservoir and 75.2 to 260.8 in Khaji Kotnoor reservoir. The total hardness, calcium hardness and magnesium hardness varies from 50.5 to 162.0, 33.25 to 131.33 and 6.04 to 70.93 respectively in Karanja reservoir. Likewise, 72.0 to 161.3, 34.92 to 96.8 and 23.32 to 64.6 in Khaji Kotnoor reservoir indicating the hardness. The chloride content was from 67.69 to 126.86 in Karanja reservoir and 17.78 to 80.84 in Khaji Kotnoor reservoir.

In the present study, the occurrence of molluscans directly correlated with calcium and total hardness, similar correlation was noticed by Sitaramaih (1966) and Sampath et al. (1981). In general based on the molluscan population recorded for the period of two years in Karanja and Khaji Kotnoor reservoirs cannot be compared to other reservoirs located in different parts of India, because the reservoirs are moderately productive. However, from the present findings it is obvious that molluscan diversity and density are in close association with microphytes, water and sediment types for their normal life.

In the hitherto study we have subjected the data, for some diversity indices. The similarity index between Karanja and Khaji Kotnoor reservoirs is 0.68. Similarly the values of each species of Shannon Weiner diversity index is given in Table No. 5 and 6. In Nutshell, Karanja reservoir has shown the almost similar diversity index in all season. The values are 2.942 (NEM), 2.977 (Summer) and 2.483 (SWM). While, Khaja Kotnoor shown 2.927(NEM), 2.907 (Summer) and 2.920 (SWM). The result indicates that NEM and Summer seasons of Karanja showed slightly higher diversity than the Khaji Kotnoor. While, in summer season of Karanja shown slightly lesser diversity than the Khaji Kotnoor reservoir.

Table 1: Seasonal variation of Molluscan species in Karanja Reservoir

SPECIES	NEM (SE)	SUMMER (SE)	SWM (SE)
GASTROPODA			
Lymnaea luteola	374±1.0	174±0.8	141±0.7
Lymnaea acuminata	256±0.9	197±0.8	137±1.3
Melania scabra	47±0.9	27±0.8	12±1.3
Melania (Palitia scabra)	221±0.9	164±0.8	126±1.4
Melania(Straitella) tuberculata	57±0.9	43±0.8	28±1.4
Melania scabra var elegans	321±1.0	214±0.8	161±1.4
viviparius bengalensis	23±0.6	12±0.5	05±1.4
Viviparous variata	41±0.6	31±0.5	15±1.4
BIVALVES			
Parreysia corrugate var nagvorensis	113±0.6	88±0.6	52±1.4
Lamellidens corrianus	94±0.6	73±0.6	41±1.4
Indonia coeruler	22±	11±	04±1.4

Table 2: Seasonal variation of Molluscan species in Khaji Kotnoor Reservoir

SPECIES	NEM (SE)	SUMMER (SE)	SWM (SE)
GASTROPODA			
Melania scabra var elegans	412±1.1	314±0.9	197±0.8
Melania scabra	53±1.0	28±0.8	17±0.8
Melania tuberculata	25±1.1	16±0.8	09±0.8
Diogoniostoma pulchella	236±1.0	107±0.9	87±0.8
Lymnaea luteola	275±1.1	146±0.9	129±0.8
Faunus ater	10±1.1	25±0.9	33±0.8
Lymnaea acuminata	236±1.1	172±0.9	155±0.8
Planorbis exustus	35±1.2	21±0.9	18±0.8
BIVALVES			
Parreysia corrugate	289±1.2	203±0.9	133±0.9
Lamellidens corrianus	338±1.3	227±0.9	189±0.9
Indonia coeruler	33±	19±0.8	06±1.0

Table 3: Average values of Physico-chemical parameters of Karanja reservoir

Months	**Physico-chemical parameters**									
	Atm. Temp in ºC	Water Temp in ºC	pH	DO	CO_2	Total Alkalinity	Total Hardness	Ca++	Mg++	Chloride
Oct.2001	32.23	27.2	7.4	6.5	5.5	113.1	126.7	89.51	37.23	87.07
Nov.	33.12	28.33	7.4	5.4	8.2	124.3	124.7	100.80	23.94	80.17
Dec.	32.63	27.66	7.4	6.2	5.2	140	118.6	121.25	15.24	73.69
Jan.,2002	32.53	28.16	7.8	8.4	6.6	181.2	164	123.92	40.07	76.29
Feb.	36.42	30.13	8.0	9.7	1.1	216.2	50.5	33.25	16.99	98.02
March	38.66	33.07	8.2	10.1	4.7	235	51.6	44.98	6.88	103.65
April	39.91	33.56	8.5	10.7	1.3	230.6	54.12	47.51	6.60	114.12
May	39.9	34.11	8.1	8.8	1.3	247.5	56.8	54.60	6.04	126.86
June	32.15	27.15	6.9	3.7	2.4	95	138.7	83.10	55.65	77.06
July	31.58	26.56	7.15	3.6	2.3	87.6	162.0	91.81	70.93	79.54
August	31.16	26.03	6.9	2.6	2.8	70.7	143.5	79.09	64.21	71.94
Sept.	34.1	28.11	7.0	3.2	2.3	86.8	129.2	75.40	53.84	67.69

Oct.	32.28	26.13	7.4	6.8	5.2	136.8	124.5	90.63	33.86	85.07
Nov.	33.28	26.55	7.4	5.3	4.9	136.8	124.7	117.50	7.95	84.21
Dec.	32.25	27.16	7.5	5.5	5.5	146.25	140.8	131.33	12.03	73.96
Jan.2003	33.4	28.2	7.7	8.2	5.9	188.1	165.6	116.52	44.05	74.69
Feb.	36.5	29.21	8.1	8.9	1.3	215.	53.7	34.56	19.18	98.20
March	39.1	32.95	8.3	8.4	1.6	232.5	57.6	45.08	14.57	103.41
April	34.22	33.16	8.4	9.6	1.3	240	65.62	53.82	11.08	108.7
May	34.28	34.16	8.2	10.1	1.3	249.3	128.75	89.93	39.12	113.8
June	32.61	26.86	6.9	4.0	2.4	113.12	137.5	87.026	50.47	79.35
July	31.5	26.73	6.9	4.0	2.6	87.37	136.2	99.97	36.27	77.99
August	31.08	26.13	7.0	4.3	1.9	78.6	143.3	86.88	56.86	72.72
Sept.	34.62	27.85	7.1	3.7	2.8	75.6	129.2	75.98	52.77	68.90

All values expressed in mg/l except pH and Atmospheric and Water Temperature.

Table 4. Average values of Physico-chemical parameters of Khaji Kotnoor reservoir

Months	Physico-chemical parameters									
	Atm. Temp in ^oC	Water Temp in ^oC	pH	DO	CO_2	Total Alkal inity	Total Hardness	Ca ++	Mg ++	Chloride
Oct2001	36.6	31.4	7.6	6.0	5.4	98.6	133.2	79.9	53.3	22.0
Nov.	36.5	31.8	7.3	6.3	3.8	112.9	129.8	77.9	51.9	21.6
Dec.	30.7	24.8	7.5	4.9	6.6	134.3	144.9	87.0	55.1	20.08
Jan2002	34.7	28.4	7.9	6.4	6.8	172.9	160.6	96.4	57.4	23.54
Feb.	36.6	31.4	8.1	7.4	2.4	185.8	62.2	37.2	24.8	52.40
March	39.7	33.7	8.5	8.5	3.2	224.3	66.3	39.8	26.6	60.72
April	40.8	33.9	8.7	8.6	1.1	250	58.2	34.9	23.3	67.92
May	41.0	33.9	8.4	7.7	0.8	254.3	75	45	30	78.29
June	32.2	27.8	7.5	4.4	3.7	107.9	135	81	54.0	19.07
July	30.6	28.4	7.3	3.4	2.9	95.8	129	77.4	55.4	19.76
August	32.5	28.9	7.2	2.9	2.9	82.9	121.2	72.7	48.5	17.78
Sept.	33.7	27.7	7.3	2.5	4.1	77.9	117	70.2	46.8	20.70
Oct.	35.4	30.4	7.8	5.3	4.8	105.8	136.5	81.9	54.6	22.72
Nov.	36.1	29.8	7.4	6.0	4.9	124.3	132.5	79.5	53.0	22.52
Dec.	32.5	27.5	7.6	4.2	7.0	129.3	150.5	90.3	60.2	21.92
Jan2003	33.8	28.3	7.7	6.3	8.2	160.8	161.3	96.8	64.6	24.96
Feb.	35.4	30.9	8.2	8.5	2.1	197.9	67.2	40.3	26.9	55.24
March	39.0	33.0	8.4	9.0	3.7	239.3	67.5	40.5	27.0	62.08
April	40.0	33.2	8.6	7.7	1.8	236.5	59.5	35.7	23.8	67.72
May	40.6	33.5	8.2	8.2	0.7	260.8	72	43.2	28.8	80.84
June	33.2	27.1	7.7	5.0	4.0	95.8	137.8	82.7	55.1	21.3
July	31.3	28.4	7.5	3.6	3.93	87.9	128.9	77.4	51.6	21.3
August	33.05	29.2	7.2	3.2	3.15	87.9	121.8	73.1	48.7	19.89
Sept.	34.4	27.1	7.4	2.4	3.93	75.2	119.5	71.7	47.8	21.57

All values expressed in mg/l except pH and Atmospheric and Water Temperature.

Table 5: Shannan Weaver Diversity index for Molluscans in Karanja reservoir

SPECIES	NEM	SUMMER	SWM
Lymnaea luteola	0.493	0.433	0.110
Lymnaea acuminata	0.426	0.456	0.455
Melania scabra	0.151	0.137	0.098
Melania (Palitia scabra)	0.398	0.421	0.440
Melania(Straitella) tuberculata	0.173	0.191	0.182
Melania scabra var elegans	0.468	0.470	0.483
viviparius bengalensis	0.089	0.075	0.050
Viviparous variata	0.137	0.152	0.116
Parreysia corrugate	0.273	0.303	0.273
Lamellidens corrianus	0.243	0.270	0.235
Indonia coeruler	0.086	0.070	0.042
Total	2.942	2.977	2.483

Table 6: Shannan Weaver Diversity index for Molluscans in Khaji Kotnoor reservoir

SPECIES	NEM	SUMMER	SWM
Melania scabra var elegans	0.475	0.498	0.467
Melania scabra	0.142	0.121	0.102
Melania tuberculata	0.081	0.079	0.062
Diogoniostoma pulchella	0.370	0.300	0.311
Lymnaea luteola	0.399	0.358	0.386
Faunus ater	0.039	0.111	0.166
Lymnaea acuminata	0.370	0.389	0.422
Planorbis exustus	0.104	0.097	0.106
Parreysia corrugate	0.409	0.422	0.392
Lamellidens corrianus	0.439	0.443	0.459
Indonia coeruler	0.100	0.090	0.045
Total	2.927	2.907	2.920

CONCLUSION

In the present study molluscan population showed significant positive correlation with Atmospheric Temperature, Total Alkalinity, Total hardness at $P<0.05$ level and Water temperature, Carbon dioxide, Calcium hardness and Chloride at $P<0.01$ level. Conservation of biological diversity is considered to be one of the major goals for sustainable management of marine renewable resource. The diversity of mollusks is mainly dependent on availability of suitable substrata, food and the degree of stress effect due to strong waves, tides, currents and anthropogenic pressure. The following are some of the steps recommend for the conservation of the molluscan diversity. Overexploitation by harvesting should be prevented and exploitation of juveniles should be curbed entirely. For controlling adverse impacts, study and field visits by students and publics should be under the supervision of forest officials. Local, national and international laws governing species and habitats should be strictly implemented in the interest of conservation. Species in reproductive stage (egg laying, breeding and developing stages) should not be collected. Empty and washed shells should be preferred for collection purpose. Since the mollusks are important resources as food, medicine and ornamental items, at present it is under intense anthropogenic pressure.

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