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Research Article

Malacofauna diversity in Godavari river from Jayakwadi backwater, district Aurangabad (MS), India

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ABSTRACT

In all 2520 specimens of molluscan species were collected from the four sampling stations of Godavari river at Kaygon toka, the collected species belonging to 6 families 11 genera and total 14 species were recorded, which was 11 species of gastropods and 3 species of bivalves. The identified gastropod species were that is *Bellamya bengalensis*, *B. dissimilis*, *Lymnaea acuminata*, *L. luteola*, *Tarebilineata*, *Melanoids tuberculata*, *Melaniascabra*, *Indoplanorbis bisexustus*, *Planorbis planorbis*, *Physaacuta*, *Gyrauluscon vexiculus*, and Bivalve species *Lamellidens marginalis*, *L. corrianus*, and *Indonaia caeruleus*. In a few gastropods highly dominant species was *Bellamya*, *Lymnaea acuminata*, and Bivalve was *Lamellidens marginalis*. Diversity indices Simpson index (D), Shannon-Weiner index (H), Evenness (E), Richness (S) and Berger-Parker Index (DBP) of gastropod species were studied. As per Simpson index (0.138) and Shannon index (2.143) high diversity population was observed at Kaygontoka. In addition, water quality parameters were also studied such as water temperature, pH, dissolved oxygen, total hardness, alkalinity, turbidity and nitrate content. The results were expressed as mean and Standard deviation for each water parameters.

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1. Introduction

The phylum Molluscan comprises the soft bodies' animals with or without calcareous shell adapted to almost all habitats with varied ecology. The gastropods are an extremely diverse group, potentially making classification a difficult undertaking. They are divided into three major subclasses: Prosobranchia, Opisthobranchia, and Pulmonates. The two freshwater groups Gastropod and Pelecypoda, the former are divided further into two subclasses: Prosobranchia having gills for water respiration and the other Pulmonates possess lungs for that use aerial respiration. The estimated number of mollusc varies from 80,000 species to 1, 35,000 species and the total diversity possibly as high as 2, 00,000. They are second only phylum to arthropods in species richness (Strong et al., 2008), 5070 species of molluscs are reported from India. The global freshwater gastropod fauna is estimated at approximately 4,000 species described.

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The surveys have shown easily available that species in more abundantly to find out now in their habitats (SubbaRao, 1989). There are many causes for the decline in freshwater gastropods biodiversity, (Dudgeon et al., 2006), also snail species belonging to diverse aquatic habitat have been reported (Ray and mukharjee, 1963; Choubisa, Sharma, 1982, 1986, Rathore and Bohra, 1987). Many Molluscans species are also used as bio-indicators for the pale environments as well as water quality or pollution control on the basis of their power tolerance against the extremes condition on physico-chemical parameters of water quality (Harmon, 1974; Edmondson et al., 2010, Druat et al., 2011). Some workers have also reported that certain gastropods species Pelecypoda for the different regions tropic stages (Eutrophic, Mesotrophic and Oligotrophic) as well as lotic and lentic environments (Clarke, 1979 and Choubisa, 1992). Some gastropods are of great importance for being intermediate hosts of infectious trematodes and other parasites of animals and human beings (Brown, 1994). They feed on algae, zooplankton and organic wastes and provide food for many types of fish, birds and human beings. Freshwater snail plays an important role in freshwater ecosystem and intermediate host for serious diseases to humans and animals like *Schistosomiasis* (Snail fever) *Flat worm*, *Swimmer's Itch Fascioliasis/ Fasciolahepatica*, *S.indicus*, *S. eduardiensis* and *S. hippopotomus*. etc. Lot of research has been done in molluscans gastropods particularly freshwater species and very less attention has been paid on garden snail & slugs also studied from Maharashtra. (Chavhan; Pawar, 2011; Jadhao, 2015). Therefore, humans are bound to monitor the impact of this activity and natural freshwaters continuously. In India, various several freshwater snails species have been reported from different geographical areas. provenance, SubbaRao and Mitra (1979) made a survey on land and freshwater molluscs of Pune district (Maharashtra) and collected a total of about 130 species of snails belonging to varieties falling into 22 families and 51 genera from Pune district (Maharashtra). Thus for a proper understanding of freshwater reservoir ecosystem and its production potential it is necessary to study the inter relationship among Physico-chemical and biological factors of the given environment (Sreenivasulu et al., 2014) are very scarce; especially no research work has been undertaken on molluscan, gastropod fauna of kaygontoka village previously. Thus our present studies mostly concentrated on species composition, population diversity and its percentage, physico-chemical parameters and ecology of gastropods of freshwater mollusc fauna from Godavari River at kaygontoka village, Aurangabad was undertaken.

Materials and methods

Maps and Sampling sites



(A)



(B)

Figure 1. (A) Shows map of GPS Godavari River Jayakwadi bacwater (GPS-19°37'38.19"N, 75°01'46.82"E), (B) Shows Actual sample collection site

Collections, Identification and Maintained of gastropods:

Sampling sites were selected based on their distribution, extent of shoal habitat with depth less than one meter, and accessibility. Specific sampling localities were recorded by latitude and longitude using a hand held Global Positioning System (GPS), (Fig.1 A&B) gastropods species were collected by sight and touch (In order to compare the gastropods diversity with the rest of the river, four stations were selected by using Quadrate method. Gastropod samples were collected from Godavari river at Jayakwadi backwater Paithan village monthly during June 2016 to May 2017, as described by Crailet al., (2011) from 4 collection stations. The specimens were collected by hand picking and brought to the laboratory with wearing hand gloves from the dry areas and where water was shallow scoop net was used. The gastropods were counted washed with tap water, and maintain a plastic trough with aerators in under laboratory conditions, photograph and identified following SubbaRao et al., (1979; 1989).

To understand a particular biotic community it is very important to work out certain indices with formulas.

➤ **Simpson index (D),**

$$D = \frac{N(N-1)}{\sum ni (ni-1)}$$

Where,

D=Simpson’s index

ni= Total number(n) of ith species in a community

N= Total population of all species in a community

➤ **Shannon Weiner’s index(H)**

$$H = -\sum pi(\ln pi),$$

Where,

H= Shannon-Weiner index

S= Number of individual of each species

ni= Total population of ith species in community

n= total population of all species.

➤ **Marglef’sSpecies Richens(S)**

$$S = \frac{N-1}{\ln (n)}$$

Where,

S=Richness index

N=Total no. of species in a community

➤ **Pielou's Species Evenness (E)**

$$E = H / \ln(S)$$

Where,

E=Evenness index

H=Shannon-Weiner index

S=Number of individual of each species

➤ **Species dominance Berger parker Index(DBP)**

$$D = \frac{N_{\max}}{S}$$

Where,

N_{\max} = the number of individual of most abundant species

S = the total number of observed species.

Physico-chemical parameters of water samples at the selected collection centers were determined carried out using standard methods (Tirvedi&Goel, APHA, 1992 2005). As Water Temperature, pH, Dissolved Oxygen, Total Hardness, Alkalinity etc. The Dissolved oxygen was fixed on the field by Winkler's A & B solution (Winkler's Azide method). All parameters were determined under the laboratory condition. Statistical analysis the calculation done was Mean and SD, Population density and total percentage, Diversity indices, correlation coefficient by using MS-Excel & Minitab Software V.14.

Results and discussion

In all 2520 specimens were collected from the four sampling stations belonging to of Godavari River Jayakwadi backwater at Paithan Village. Out of including six families and 11 genera. and fourteen species of molluscan gastropods were recorded and identified by the expert ZSI Pune. (see the Plate 1, 2 & Table-1). The molluscan gastropod species population was dominated by the Genus *Bellamya*, in which *B. dissimilis* (85.8%) and *B. bengalensis* (51.1%) were abundantly found at all stations. Maximum molluscan gastropods were observed in the month of June and while lowest number in the month of April and May. (Table 1, Plates 1 and 2). Species *Lymnaea acuminata* (37.7%), species *Tarebia lineata*, (36.9%), *Melanoids tuberculata*, (36.8%), *Melaniascabra*, (3.6%), *Lymnaea luteola* (26.9%), *Lamellidens marginalis* (24.3%), *Lamellidens corrianus* (18.8%), *Indoplanor bisexustus* (17.4%), *Indonaiacaeruleus* (16.3%), *Planorbisplanorbis* (8.58%), *Physaacuta* (5.75%) and *Gyraulus convexiculus* (4.9%) see the Fig-2, in which species *Bellamya dissimilis* and *B. bengalensis* was first dominant species as compared to another species. Second dominance was species *Lymnaea acuminata*, *Tarebia lineata* and *Melanoids tuberculata* in terms of population density. Species *Melaniascabra*, *L. luteola*, *Lamellidens marginalis* was third dominant species among in terms of Population density. Fourth position species *L. corrianus*, *I. exustus*, *I. carelueus* in dominance. Fifth position of dominance species is *P. planorbis*, *P. acuta* and *G. convexicaulus* were found in very less numbers as compared to another species. The molluscan gastropods population size fluctuated markedly during the study period. The molluscan gastropod population showed higher number from July to December and lower number from February to May (Fig.2). Diversity indices in Simpson index (D), Shannon-Weiner index (H), Evenness (E), Richness (S) and Berger-Parker Index (DBP) of gastropod species were studied. As per Simpson index (D) (0.138) and Shannon index (H) (2.143) showed high diversity of population was observed at Kaygontoka. That means the low Simpson (D) index values indicated high population diversity and high Simpson index values indicated the low population diversity of the species. (Fig.3) Similarly Shannon wiener's index (H), Richness (S), Evenness (E) and Berger parker (DBP) index indicated high value means high population diversity and low value indicated low population diversity. (fig.3.)

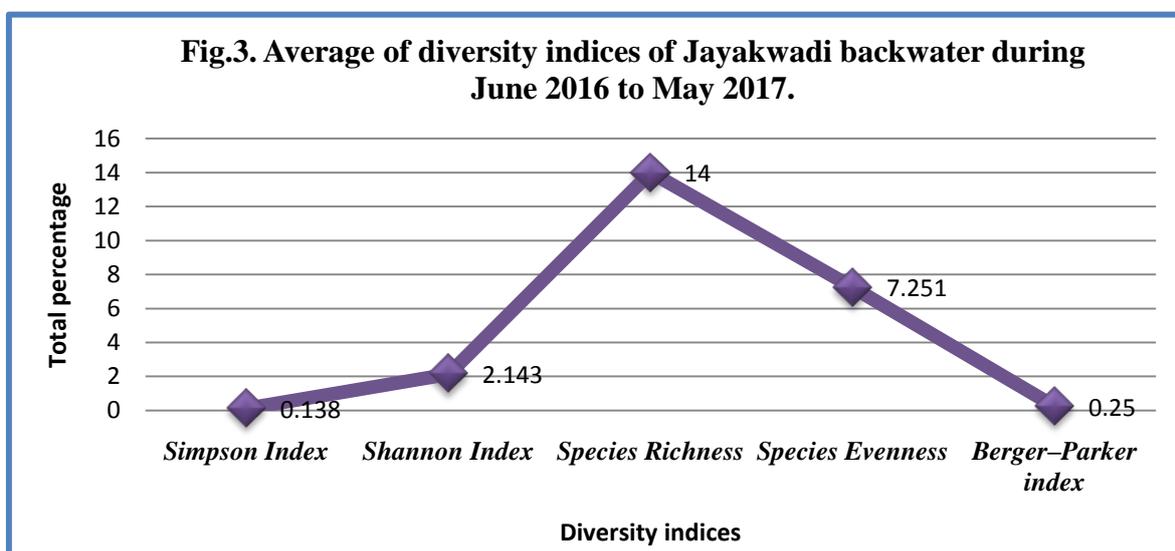
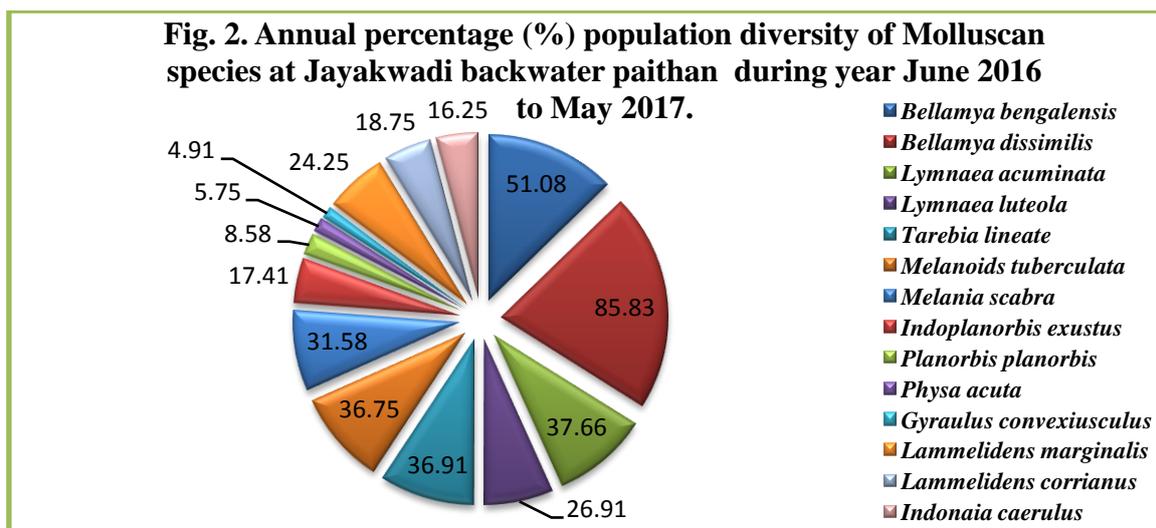


Table 1. List of Molluscan gastropod species and their average annual diversity contribution (%)

Sr. No	NAME OF SPECIES	Sampling Station				Mean ± S.D	Percentage %
		I	II	III	IV		
1.	<i>Bellamyadissimilis</i> (Muller 1774)	37.66	41.33	61.33	65	46.77±3.82	51.08%
2.	<i>Bellamyabengalensis</i> (Lamarck-18822)	7.66	68	95	109	56.88±44.8	85.83%
3.	<i>Tarebia lineate</i> (Gray-1828)	34	37	40.66	39	37.22±2.86	37.66%
4.	<i>Melanoidstuberculata</i> (Muller-1774)	22	29.68	34.66	21.33	28.78±4.42	26.91%
5.	<i>Melaniascabra</i> (Muller-1774)	25	31.66	46.66	44.33	34.44±10.3	36.91%
6.	<i>Lymnaea acuminata</i> (Lamarck-1822)	36.33	26.33	43.66	46.66	35.44±9.05	36.75%
7.	<i>Lymnaea luteola</i> (Lamarck-1822)	25.66	25.66	39.66	35.33	30.32±7.05	31.58%
8.	<i>Indoplanorbisexustus</i> (Deshayes-1834)	8.33	17.66	18	15.66	14.66±4.50	17.41%

9.	<i>Planorbisplanorbis</i> (Linnaeus-1758)	9.33	11.33	11	2.66	10.55±4.04	8.58%
10	<i>Physaacuta</i> (Draparnaud-1801)	8.33	8	4.66	2	6.99±2.99	5.75%
11	<i>Gyraulusconvexiusculus</i> (Hutton, 1849)	6.33	6.33	4.66	2.33	5.77±1.893	4.91%
12	<i>Lamellidensmarginalis</i> (Lamarck-1891)	16.66	19.66	26.66	34	19.44±8.91	24.25%
13	<i>Lamellidenscorrianus</i> (Leanneus)	11	15	21	28	15±7.809	18.75%
14	<i>Indonaiacaeruleus</i> (Prashad, 1918)	9	13	17.33	25.66	13.16±8.33	16.25%

Physico-chemical parameters

The results were expressed as monthly observation, mean and Standard deviation for each water parameters. The Water temperature (°C) shows maximum in month of May and minimum in month of October and mean was (22.96 ± 4.5), pH values recorded maximum in May and minimum in month of June, the mean was (7.91 ± 0.622), Dissolved Oxygen (D.O), the monthly high values record month of May and low value recorded month of February and mean was (0.966±0.96 mg/l), Total Hardness (TH), mean was (541.3±104.84 mg/l), Alkalinity also mean was (108.58 ± 27.15mg/l), the total hardenss and Alkalinity values recorded highest in Month of May and lowest in month of June, Turbidity mean was (3.45±1.173 NTU) and Nitrate mean was (1.075±0.522 mg/l).The turbidity and Nitrate recorded maximum value in June and minimum value April, (Table. 2).

Table 2. Showed monthly variation and Mean and SD values of physico-chemical parameters from Jayakwadi backwater, Paithan village.

Parameters	June	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Mean ± SD
W.Temperature (0°C)	21	23	24	22	19	20	21	19	20	25	29	32	22.9 ±4.5
pH	6.9	7.0	7.2	7.5	7.8	8.0	8.3	8.5	8.4	8.3	8.5	8.6	7.91 ±0.62
D. Oxygen (mg/l)	3.11	3.13	3.20	3.31	4.20	4.32	4.45	4.50	2.14	2.19	2.31	4.85	0.966 ±0.96
T.Hardness (mg/l)	315	421	495	510	539	541	500	580	620	635	650	690	541.3 ±104.8
Alkalinity (mg/l)	70	79	80	82	85	112	122	128	132	135	138	140	108.5 ±27.1
Turbidity (NTU)	5.1	6.0	4.1	3.9	2.5	3.7	3.4	2.8	2.1	2.8	2.4	2.7	3.45 ±.173
Nitrate (mg/l)	1.85	1.80	1.92	1.45	0.74	0.92	0.80	0.85	0.76	0.62	0.60	0.60	1.07 ±.522

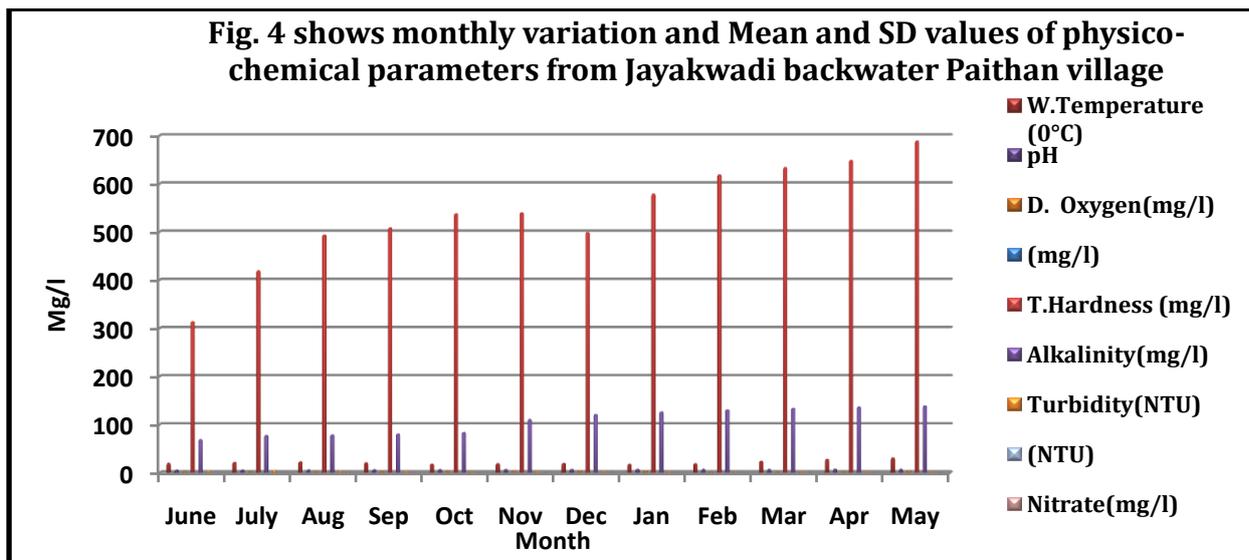


PLATE-1



Fig.(A) *Bellamya bengalensis*



Fig.(B) *Bellamya dissimilis*



Fig.(C) *Lymnaea acuminata*



Fig.(D) *Lymnaea luteola*



Fig.(E) *Tarebia lineata*



Fig.(F) *Melanoides tuberculata*

PLATE-2



Fig.(G) *Melania scabra*



Fig.(H) *Indoplanorbis exustus*



Fig.(I) *Planorbis planorbis*



Fig. (J) *Gyraulus convexciculus*



acuta



Fig.(L) *Lamellidens marginalis*

Fig.(K) *Physa*



Fig.(M) *Lamellidens corrianus*



Fig. (N) *Indonaia caeruleus*

Discussion

The distribution and abundances of freshwater mollusks in Godavari river stream may be attributed to the availability of food, shelter and ovipositor sites. Water bodies rich in organic and silt matter are known to support thriving populations of macro invertebrates because of reduction in water current and as such the substratum tends to make mollusks indistinguishable from their typical lentic habitat (Whitton, 1975). Mollusca are represented in freshwater bodies by classes Gastropoda and Pelecypoda and are a group of most diverse and dominant benthic water bodies. Molluscs were found abundant in Godavari stream particular the marginal areas. Their abundance might be attributed to the presence of vegetation in the shallow depth, which emerged when the stream was dry during the post monsoon period and formed a good feed leading to their multiplication as has also been observed by earlier workers Gupta (1976) and Manoharan et al., (2006). Molluscan species richness and molluscan abundance patterns. The impounded estuary had the highest species richness probably due to hard waters. This factor most likely contributes to its high species richness because hard waters are ideal for the development of freshwater molluscs (Okland, 1982). The canal had the highest molluscan abundance probably due to high pH and hard waters. Molluscs mature and reproduce faster due to larger amounts of calcium available for shell growth. A total of 14 (Fourteen) taxa were recorded from Godavari river Jayakwadi backwater (MS) India, during the period of study from June 2016 to May 2017. The molluscan community was represented by two classes, viz., Bivalvia and Gastropoda of which 11 species are gastropods and 3 species are Bivalve. Class gastropods were reported by 5 families; 9 genera and 11 species and Bivalve was reported by 1 family 2 genera and 3 species. A similar study was conducted on molluscan community of the Bharathpuzha River in Kerala and thirteen species of molluscs belonging to five orders, eight families and ten genera were reported (Bijukumaret.al. 2001). Farida (1988) recorded 59 species from Layaririver. Among them, 31 species belong to class Gastropoda, 27 species belong to Bivalvia and the class Scaphopoda contains only one species. Amanullah and Hameed (1996) studied Kaveririver and reported 13 species of molluscs of which 8 species were gastropods and 5 species bivalves. The gastropod species were grouped under 5 different families (Viviparidae, Thiridae, Pillidae, Lymneidae and Planorbidae) and family Thiridae was the most dominant group representing 50% of the total gastropod population. Five species of bivalve molluscs were classed under 2 different families namely Unionidae and Corbiculidae. Durga Prasad et.al.,(2001) recorded 48 species of molluscs from Gosthani estuary of which 27 species were gastropods and 21 species were Pelecypoda. Dahegaonkaret.al. (2011) studied mollusc from Wardha and Zarpal river and shown their dominance by contributing, six species from the Gastropods and two from Pelecypoda. Suryawanshi et.al. (2012) studied biodiversity of molluscs from river Godavari, reservoir and pond, reported 24 species of fresh water molluscs. Maximum species were collected from Derla tank while minimum species were collected from Godavari River. Total 14 species of molluscs were identified from river & it indicates that productivity is rich. The species inhabiting at the bottom play an important role in converting organic matter together with the meiobenthos into biomass which in turn is consumed by the fishes. Thus the molluscs help in the secondary productivity and form an important component in the food chain & web of the river ecosystem. The present study shows water temperature range is maximum and minimum (32°C to 21°C) in kaygontoka, Aurangabad (M.S). Similarly results recorded by (Salve and Hiware, 2006) reported Water temperature range between (21°C) to (31.1°C) where minimum temperature was recorded in winter season and maximum temperature was recorded in summer season from Nagapur near ParliVajinath, Beed district. (Mane and Pawar. 2007) reported similar results from Manar river Nanded district. Water temperature was minimum in winter season and maximum in summer season during study period June -2015 to May 2016. This change in temperature may be related to photoperiod. Muley and Patil (2006) reported pH range minimum 7.0 in July and maximum was 8.3 in March from Pauna river, Puna district. The present study pH range minimum in 6.9 in June and maximum in 8.5 May during study period June-2016 to May 2017. Similar results finding have been reported (Korai et al.,(2008); Salve and Hiware (2006); Singh (2000); Mishra *et al.*, (1989). Jhingran,(1982); Sakhare and Joshi (2002); Surve et al.,(2005). In present study shows dissolved oxygen range varied from maximum and minimum is (4.85mg/l to 2.14mg/l) in Godavari river kaygontoka (MS). Similarly results recorded by Kharadkhele et al., (2008) observed D.O range (5.9mg/l to 3.0mg/l) in Nana Nani Park, Latur (M.S). Solanki,

(2006) studies on Pandu Lake of Bodhan, (A.P) and reported range (6.60mg/l to 1.70mg/l).Yeole and Patil.(2005).D.O recorded range (7.5mg/l to 6.0mg/l) in Yedshi lake. During study period from June 2016 to may 2017 the Total alkalinity range was recorded maximum and minimum is (7mg/l to 140 mg/l) in Godavari riverkaygontoka (M.S). Similarly results shows (Reddy et.al., 2009) observed total alkalinity range maximum and minimum was(96m/l to 174mg/l) in Pakhal lake Warangal(A.P). Narayana *et.al* (2008) observed total alkalinity range (38.56mg/l to 61.45mg/l) in Anjanapura reservoir, Karnataka.In present study shows Turbidity range (6.0/NTU to 2.1/NTU) in Godavari river Kaygontoka, Aurangabad (M.S).Similarly results recorded by Muhammad-Barzani *et.al.*,(2007) observed turbidity range(28.67/NTU to 4.67/NTU) in TasikChinis Feeder River, Pahang, Malaysia. In present study shows Nitrate range (0.92mg/l to 0.60mg/l) In Godavari river Kaygontoka, Aurangabad (M.S).Similarly results shows recorded by Reddy *et.al.*,(2009) observed Nitrate range(0.89mg/l to 0.24mg/l) in mangur dam,Jalgaon (M.S). The Nitrate observed range (1.8mg/l to 0.9mg/l) by Rajashekhar *et.al*, 2007).

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