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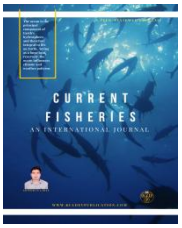

Research Article

Diversity of Gastropods of Godavari River from Jayakwadi Dam, Aurangabad district, Maharashtra State

[*1]Priyanka Shejwal, [2]Soni Shaikh, and [3]Balaji D. Shinde

[*1,3]*Department of Zoology, Millind College of Science, Chhatrapati Sambhajinagar-431004, India*

[2]*Department of Zoology, Sunderrao Solanke Arts, Commerce and Science College, Majalgaon, 331101, India*

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ABSTRACT

A total of 250 fish specimens from four Godavari River sampling stations in Kaygon, Toka were gathered. These specimens belonged to six families, eleven genera, and 14 total species were reported, comprising three species of bivalves and eleven species of fish., *B. dissimilis Bellamya bengalensis, L. luteola, Lymnaea acuminata, Tarebialineata, Melanoids tuberculata, Melaniascabra, Indoplanor bisexustus, Planorbis planorb, Physaacuta, Gyrauluscon vexiculus*, were the identified gastropod species. *Bellamya and Lymnaea acuminata* were extremely prevalent in a few snail species. The diversity indicators of gastropod species were investigated, including the Berger-Parker (DBP), Evenness (E), Shannon-Weiner (H), Richness (S) and Simpson (D) indices. According to the Shannon index (2.143) and Simpson index (0.138), Kaygon toka had a population with a high degree of diversity. Water quality measures, including nitrate content, pH, turbidity, temperature, dissolved oxygen, alkalinity and total hardness were also examined. For each water parameter, the findings were presented as the mean and standard deviation.

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Introduction:

Soft-bodied creatures with and without calcareous shells that are adaptable to nearly every type of environment and ecology are grouped together under the phylum fishes. Given the enormous diversity of the gastropod group, categorization may prove to be a challenging task. They are separated into Prosobranchia, Opisthobranchia, and Pulmonates, which are the three main subclasses. The two classes that make up the freshwater groupings, the gastropod and plecypoda, are the prosobranchia, which breathes underwater via its gills, and the pulmonates, which breathe aerially through their lungs.. Between 80,000 to 1,35,000 species of mollusks are thought to exist, with a potential total variety of up to 200,000 species. There are 5070 species of molluscs known to exist in India, making them the second most species rich phylum after arthropods (Strong et al., 2008).

* Corresponding author.
E-mail address: priyankashejwal80@gmail.com (Priyanka M. Shejwal)

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The species of freshwater gastropods have been described worldwide was 4167 approximately. Surveys have revealed that species are more numerous in their environments (Subba Rao, 1989).The decline in the biodiversity of freshwater gastropods can be attributed to a number of variables (Dudgeon et al., 2006), as can the variety of aquatic habitats that snail species inhabit (Rathore and Bohra, 1987; Choubisa, Sharma, 1982 and 1986 and Ray and mukharjee, 1963). Because many species of mollusks can tolerate harsh conditions on the physical-chemical parameters of water quality, they are frequently used as bio-indicators for pale habitats, water quality, and pollution control (Edmondson et al., 2010; Harmon, 1974 and Druat et al., 2011). Also, according to certain researchers, specific Pelecypoda species are found in lotic and lentic habitats as well as the various tropical stages (Eutrophic, Mesotrophic, and Oligotrophic) (Clarke, 1979 and Choubisa, 1992). Certain gastropods play a crucial role as intermediate hosts for infectious trematodes and other parasites that affect both humans and animals (Brown, 1994).

They offer many different kinds foods of fish, birds, and humans by feeding on algae, zooplankton, and organic wastes. Freshwater snails are crucial to the health of the freshwater ecosystem and act as intermediate hosts for a number of dangerous diseases that can affect both humans and animals, including Flatworm, *Fasciola hepatica*, Schistomiasis, *S. indica*, Swimmer's Itch, *S. eduardiensis* and *S. hippopotomus*. Very little attention has been paid to garden snails and slugs from Maharashtra, despite the fact that molluscan gastropods—especially freshwater species—have been the subject of much investigation. (Pawar, 2011; Jadhao, 2015; Chavhan). As a result, people must constantly assess how this activity is affecting the natural freshwaters. In Many species of freshwater snails have been documented from different parts of India. Provenance: In a survey on aquatic and terrestrial molluscs in the Pune district of Maharashtra,

Subba Rao and Mitra (1979) collected a total of over 130 species of snails from the region, which vary or belong to 22 families and 51 genera. Accordingly, there is a dearth of research on the physical, chemical, and biological aspects of the given environment that must be studied in order to properly understand the freshwater reservoir ecosystem and its potential for production (Sreenvisasulu et al., 2014); in particular, no prior studies have been conducted on the molluscan and gastropod fauna of Kaygontoka Village. Therefore, the primary focus of our current research was on the physico-chemical characteristics, species composition, population diversity, and its proportion as well as the ecology of the gastropods found in the freshwater fish fauna of the Godavari River in Kaygontoka Village, Aurangabad.

Material and method:

Sampling sites and map:

(A)

(B)

Figure 1. The GPS Godavari River Jayakwadi backwater map (GPS-19°37'38.19"N, 75°01'46.82"E) is displayed in (A). (B) Shows the sampling location

Collections, Identification and Maintenance of samples

The distribution of the sampling sites, the amount of shoal habitat with a depth of less than one meter, and accessibility were taken into consideration. Using a hand-held GPS device, specific sampling locations were measured for latitude and longitude (Fig. 1 a and b). Species of gastropods were collected by touch and sight. Four stations were chosen using the quadrate method to compare the diversity of gastropods with that of the rest of the river. According to Crail et al., (2011), gastropod samples were taken monthly from June 2016 to May 2017 from four collection points along the Godavari River in the backwater of Paithan Village, Jayakwadi. The specimens were hand-picked from the dry areas where shallow scoop nets were utilized, and then delivered to the laboratory while wearing gloves. In accordance with Subba Rao et al. (1979; 1989), the gastropods were counted, cleaned with tap water, and kept in a plastic trough with aerators in a laboratory setting. They were also photographed and identified.

Determine certain indices using formulas in order to gain an understanding of a specific biotic community.

A) Simpson index (D)

$$D= N (N-1)/ \Sigma ni (ni-1)$$

Where,
D- Simpson's Index
Ni-Total number of species (n) in an area
N- Total number of species within a community

B) Shannon Weiner's index (H)

$$H= \Sigma pi (lnpi),$$

Where,
H- Shannon-Weiner Index.
S- Number of individuals in each species
Ni-Total population of that species within the community
n- Total population of all of the species

C) Marglef's Species Richens (S)

$$S= N-1/ln (n)$$

Where,
N- Total number of species in a community
S- Richness index

D) Pielou's Species Evenness (E)

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

Where,
E- Evenness index
H-Weiner-Shannon index

S-Total number of members in each species

E) Species dominance Berger parker Index (DBP)

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

Where,
Nmax- Number of members of the most numerous species individually
S- All of the species that have been seen

In the selected collection centers, standard techniques were used to ascertain the physico-chemical properties of water samples (APHA, 1992; 2005 and Tirvedi and Goel, 2005). Such as water temperature, dissolved oxygen, pH, alkalinity, and total hardness. The dissolved oxygen was fixed on the field by using Winkler's a and b solution. Each parameter was built up in a lab environment.

Calculation for statistical analysis was performe using Minitab Software V.14 and MS-Excel. The population density and percentage, correlation coefficient, diversity indices, mean, and standard deviation were all calculated.

Result and discussions

A total of 2230 big carp specimen is gathered from 4 sampling station located near in the Jayakwadi backwater of the Godavari River in Paithan Village. Expert ZSI Pune recorded and recognized fourteen species of molluscan gastropods, out of six families, eleven genera, and more. (Table 1). The majority of the species population was made up of the *B. dissimilis* (85.8%) and *B. bengalensis* (51.1%) being widely spread across all sites. The greatest number of molluscan gastropods was recorded in June, the least number was recorded in mont of april & May. (Plates 1 and 2, Table 1). Species *B. bengalensis* and *B. dissimilis* is the highest dominant species in comparison to other specimens, Figure-2. Other species included such as *Planorbis planorbis* (8.58%), *Melania scabra* (3.6%), *Gyraulus convexiculus* (4.9%), *Tarebia lineate* (36.9%), *Melanoids tuberculata* (36.8%) and *Lymnaea luteola* (26.9%), *L. acuminata* (37.7%), *Indoplanor bisexustus* (17.4%) and *Physa acuta* (5.75%). In terms of population density, *L. acuminata*, *Tarebia lineata*, and *Melanoids tuberculata* constituted the second dominance.

Population density, the species *L. luteola* and *Melania scabra* is the third dominant species. *I. exustus*, is the species that rank fourth in dominance. *Planorbis, Physa* and *P. planorbis* is the species is te wery lowest position of dominance. In comparison to another species, *G. convexicaulus* is notes that the extremely small quantities. The size of the gastropod population varied significantly over the course of the investigation. The population of gastropods was found to be highest from month of july to December and lowest from month February to May (Fig. 2). The study focused on the diversity indices of gastropod species found in the Evenness (E), Shannon-Weiner index (H), Simpson index (D), Berger-Parker index (DBP) and Richness (S). According to the Simpson index (D) (0.138) and Shannon index (H) (2.143), Kaygontoka had a very diverse population. Accordingly, high Simpson index values indicated poor population diversity of the species, whereas low Simpson (D) index values showed significant population diversity.(Figure 3) Similar to the Richness (S), Shannon Wiener's index (H), Berger Parker (DBP) index and Evenness (E) suggested that low values indicated little population diversity and high values meant strong population diversity.(Figure 3.)

Fig. 2. Yearly Percentage population diversity of gastropod species at Jayakwadi backwater paithan between June 2016 and May 2017.

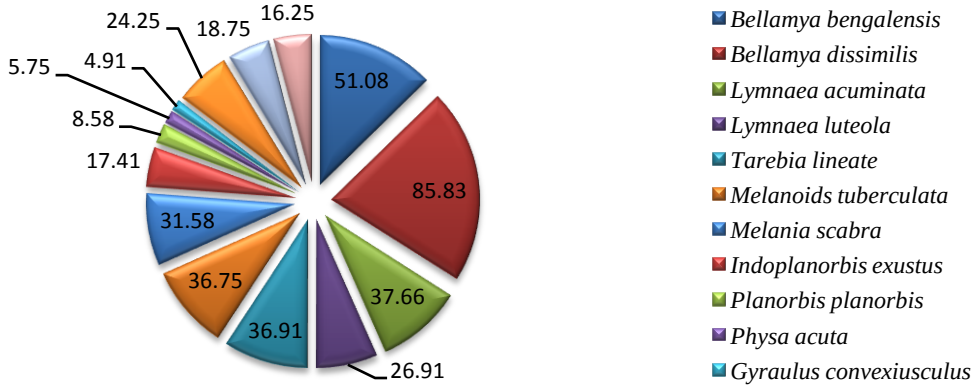


Fig.3. Shows average values of diversity indices from the Jayakwadi backwater June 2016 to May 2017.

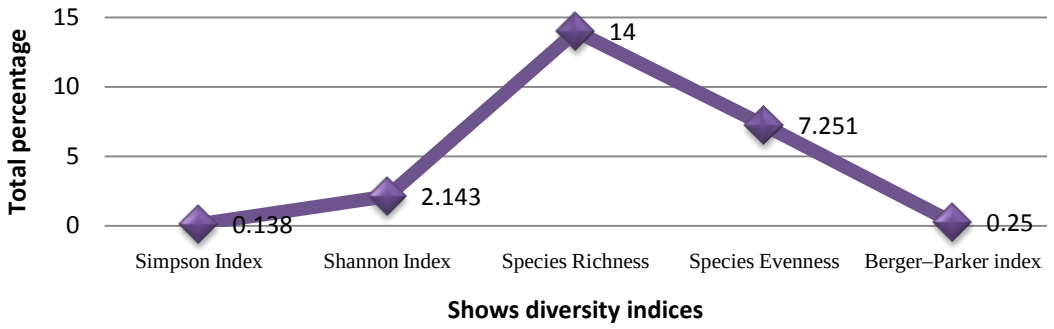


Table 1. List of species of gastropod with an average yearly contribution to diversity (%)

Sr. No	Name of species	Sample collection station				Mean ± S.D	Percentage %
		i	ii	iii	iv		
1.	*Bellamay bengalensis*	37.66	41.33	61.33	65	46.77±3.82	51.08%
2.	*Bellamay dissimilis*	7.66	68	95	109	56.88±44.8	85.83%
3.	*Lymnea acuminata*	34	37	40.66	39	37.22±2.86	37.66%
4.	*Lymnea luteola*	22	29.68	34.66	21.33	28.78±4.42	26.91%
5.	*Tarebia lineata*	25	31.66	46.66	44.33	34.44±10.3	36.91%
6.	*Melanoids tuberculata*	36.33	26.33	43.66	46.66	35.44±9.05	36.75%
7.	*Melania scabra*	25.66	25.66	39.66	35.33	30.32±7.05	31.58%
8.	*Indoplanorbis exustus*	8.33	17.66	18	15.66	14.66±4.50	17.41%
9.	*Indoplanorbis planorbis*	9.33	11.33	11	2.66	10.55±4.04	8.58%
10	*Physa acuta*	8.33	8	4.66	2	6.99±2.99	5.75%
11	*Gyrulus convexiculus*	6.33	6.33	4.66	2.33	5.77±1.893	4.91%

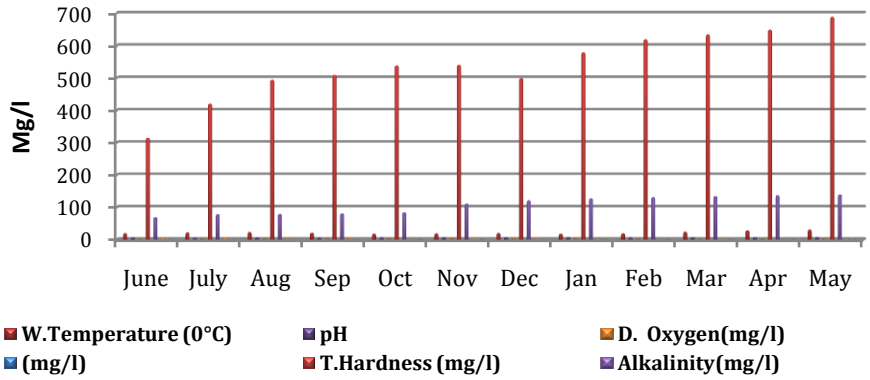
Analysis of Physico-chemical parameter

The data were expressed utilizing the mean, standard deviation, and monthly observation for each water parameter. 0.966 ± 0.96 mg/l of dissolved oxygen (D.O.), 541.3 ± 104.84 mg/l of total hardness (TH), 108.58 ± 27.15 mg/l of alkalinity, and 22.96 ± 4.5 °C were the average water temperature and pH and 0.622 and 7.91 ± 0.622, respectively. The average nitrate was 1.075 ± 0.522 mg/l, and the average turbidity was 3.45 ± 1.173 NTU. In terms of turbidity and nitrate, June had the highest recorded values, whereas April had the lowest (Table 2).

Table 2. Showed the mean and S.D value of monthly changes in the Physico-chemical parameters at Jayakwadi dam in Paithan.

Parameters	june	july	agust	sept	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

Fig. The physicochemical characteristics from Jayakwadi backwater Paithan village are shown together with their monthly fluctuation, mean, and standard deviation.



The Godavari River's freshwater gastropod population is spread out and numerous due in large part to the availability of ovipositor sites, food sources, and refuge. Due to the decrease in water circulation, it is known that rich water bodies for silt matter along organic support robust macro invertebrate populations. As a result, the substratum frequently obscures mollusks from their natural lentic habitat (Whitton, 1975). Mollusca are the most diverse and well-known benthic aquatic creatures, represented in freshwater waters by the Gastropoda and Pelecypoda groups. Mollusks were abundant in the Godavari stream, particularly along its banks. As previously stated by Gupta (1976) and Manoharan et al. (2006), their abundance can be attributed to the presence of flora in the shallow depths that appeared during the post-monsoon period when the stream was dry and produced a rich diet, resulting in their multiplication. Patterns of molluscan abundance and diversity. Because of its rough waters, the dammed estuary contains the greatest species diversity. The great species richness may be explained by the optimal growth of freshwater mollusks in hard waters (Okland 1982). The canal's highest molluscan abundance was most likely due to its harsh waters and high pH. Mollusks mature and reproduce faster because there is more calcium available for shell building.

From June 2017 to May 2019, 14 taxa were recorded from the Godavari River in India's Jayakwadi backwater (MS). The molluscan community was divided into two groups: bivalvia and gastropoda, including 17 gastropod species and three bivalve species. One family, two genera, and three species documented bivalve, while five families, nine genera, and eleven species reported gastropods. A comparable study found that the molluscan community of Kerala's Bharathpuzha River had 13 species of molluscs from five orders, eight families, and 10 genera (Bijukumar et al., 2001). 1988 saw Farida identify 65 species from Layari river.

Amanullah and Hameed (1996) found thirteen species of mollusk after studying Kaveri river, of which eight were gastropods and five were bivalves. The five families that made up the gastropod species were the Viviparidae, Thiridae, Pillidae, Lymneidae, and Planorbidae. Of these taxa, the Thiridae family was the most prevalent, making up half of the total gastropod population. Five bivalve mollusk species were separated into two families: Uniondale and Corbiculidae.

Durga Prasad et al., (2001) found 48 mollusk species from the Gosthani Estuary, including 29 gastropods and 25 plecypoda. Dahegaon et al. (2011) studied mollusks from the Wardha and Zarpat rivers and established their dominance by introducing two Pelecypoda species and six Gastropod species. Suryawanshi et al. (2012) identified 27 species of freshwater molluscs from the Godavari River, reservoir, and pond. The Godavari River produced the fewest species, whereas the Derla Tank produced the biggest amount. The discovery of 14 different types of mollusks in the river indicates considerable productivity. The bottom-dwelling species play an important role in converting meiobenthos and organic materials into biomass for the fish to consume. Thus, mollusks contribute to secondary productivity and are an important component of the river ecosystem's food chain and web. According to the current study, the water temperature range in Kaygontoka, Aurangabad (M.S.) is 33°C to 22°C at its lowest and highest points. Salve and Hiware, (2006) reported comparable outcomes. The water temperature ranges from (25°C) to (31°C), with Nagapur, near Parli Vaijnath in the Beed district, reporting the lowest temperature in the winter and the highest temperature in the summer. Mane and Pawar published comparable findings from Manar River Nanded district in 2007. From June 2015 to May 2016, water temperatures fluctuated from the lowest in the winter and the highest in the summer.The photoperiod could be linked to this temperature shift. Muley and Patil (2006) discovered that the pH of the Pauna River in the Puna district ranged from 7.0 in July to 8.3 in March. From June 2016 to May 2017, the pH in the current experiment ranged between 6.9 in June and 8.5 in May. Singh (2000), Salve and Hiware (2006), Korai et al. (2008), and Mishra et al., (1989) all reported similar findings and conclusions. Sakhare and Joshi (2002); Surve et al., (2005) and Jhingran, (1982).

According to the current study, the Godavari River in Kaygontoka, Mississippi, has dissolved oxygen levels ranging from 4.54 mg/l at its highest to 2.47 mg/l at its lowest. Kharadkhele et al. (2008) reported similar findings, stating that D.O. levels ranged from 5.1 mg/l to 3 mg/l at Nana Nani Park in Latur, Maharashtra. Solanki (2006) found a concentration range of 6.47 mg/l to 1.45 mg/l in Pandu Lake in Bodhan, (A.P.).Patil, Yeole (2005).In Yedshi Lake, the D.O. reported a range of 7.8 to 4.0 mg/l. During the study period of June 2016 to May 2017, the total alkalinity of the Godavari river Kaygon toka (M.S.) ranged from 7 mg/l to 140 mg/l at its maximum and minimum. Similar observations were obtained in Pakhal Lake in Warangal, Andhra Pradesh, where the total alkalinity ranged from 96 mg/l to 174 mg/l (Reddy et al., 2009). Total alkalinity of the Anjanapura reservoir in Karnataka ranged between 38.56 mg/l to 61.45 mg/l, according to Narayana et al., (2008). According to the current study, the turbidity of the Godavari River near Kaygontoka, Aurangabad (M.S.) ranges between 6.4 and 2.5 NTU. Similar results were discovered in the Tasik Chinis Feeder River in Pahang, Malaysia, where turbidity ranged from 28.67/NTU to 4.67/NTU, according to Muhammad-Barzaniet al.'s 2007 study. According to the current study (M.S), nitrate levels in the Godavari River near Kaygontoka, Aurangabad, ranging between 0.92 and 0.60 mg/l. Reddy et al., (2009) distributed the same information, revealing that the mangur dam in Jalgaon (M.S.) has a nitrate range of 0.89 mg/l to 0.24 mg/l. Rajashekhar et al., (2007) found nitrate values ranging from 1.8 mg/l to 0.9 mg/l.

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