

Population Dynamics and Ecological Study of Freshwater Gastropods from Jayakwadi Dam, Aurangabad Maharashtra

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ABSTRACT

The present study that deals with freshwater gastropods and population density from Jayakwadi dam, Paithan. Gastropods were collected from June 2015 to May 2016. A total 3550 gastropod specimens were collected out of 5 family 9 genera and 11 species were recorded and calculate the population density and total percentage i.e. *Bellamya bengalensis* (22.5%), *Bellamya dissimilis* (21.25%), *Tarebia lineate* (19%), *Melanoids tuberculata* (18.5%), *Melania scabra* (12.25%), *Lymnaea acuminata* (12.25%), *Lymnaea luteola* (10.5%), *Indoplanorbis exustus* (8.5%), *Planorbis planorbis* (36.5%), *Physa acuta* (3.25%) and *Gyraulus convexiusculus* (2%). Gastropod population was higher in monsoon season while low population was evident in winter as compared to summer season. And to relevant study that physico-chemical parameters show different seasonal fluctuations.

Keywords: Gastropod, Occurrence, Ecology, Jayakwadi Dam.

1. INTRODUCTION

Jayakwadi dam is the largest freshwater bodies in Maharashtra. It is at a distance of about 45 Km from nearby Aurangabad city. The physicochemical parameters are very important to understand any kind of aquatic ecosystem. Freshwater mollusks have been known to play significant roles in the public and veterinary health and thus need to be scientifically exploring more extensively (Supian & Ikhwanuddin, 2002).

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, however, the total number of species is probably 8,000 (Strong et al., 2008) with 213 species was reported from India (Subba Rao, 1989). The surveys have shown easily available that species in more abundantly to find out now in their habitats (Subba Rao, 1989)

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. (Dillon, 2000) described that distribution of freshwater gastropods depends on their abilities to colonize a habitat and survive there. Survival of gastropods is regulated by various Physico-chemical factors that play major role to determine the ecological traits associated with a particular species. Various Physico-chemical parameters of water bodies, pollution, diseases and vegetation are among the significant aspects influencing the distribution and abundance of gastropods. According to (Russell-Hunter and Ever sole, 1976) calcium salts in both food and water are important for growth of gastropods.

Therefore, humans are bound to monitor the impact of this activity and natural freshwaters continuously. 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 (Sreenvis asulu *et al.*, 2014). The fate and transport of many anthropogenic pollutants are determined by not only hydrological cycle, but also Physico-chemical processes. In order to mitigate the impact human societies have natural water. It is becoming in creating important to implement comprehensive monitoring regimes so monitoring water resources will quality the water quality. The dam's water has tremendous importance, as they are for drinking water, domestic use and as infrastructure for pisciculture. Eutrophication has become widely recognized problem water quality deterioration (Kim *et al.*, 2001).

The aim of present study was freshwater mollusc fauna of Jayakwadi dam at Paithan, Aurangabad (MS) India are very scarce; especially no research work has been undertaken on mollusc, gastropod fauna of

Jayakwadi dam previously. Thus our present studies mostly concentrated on species composition, physico-chemical parameters and ecology of gastropods.

2. MATERIALS AND METHODS

2.1 Sample Site:



(A)



(B)

Figure 1. (A) Satellite view of Jayakwadi Dam and Fig. (B) Actual collection site at Paithan, (GPS)(L-19°24'41.106''N, Long-75 °18'51.192''E).

2.2 Physico-chemical parameters:

Physico-chemical parameters were carried out at monthly intervals. Water temperature, Atmospheric temperature, pH, Alkalinity, B.O.D, Hardness, Chloride, Sulphate, Turbidity, Nitrate, Electrical conductivity, Total Dissolved Solids (TDS). Dissolved oxygen was determined by (Winkler's Azide method). All parameters were determined in laboratory by using (APHA, 2005).

2.3 Collection and Identification of Gastropods:

Monthly gastropods samples were collected from June 2015 to may 2016. 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.1A&B). Gastropods were collected by sight and touch (Crail *et.al.* 2011). In order to compare the gastropods diversity with the rest of the dam, four stations were selected by using Quadrata method. Specimens were collected by hand picking with wearing hand gloves from the dry areas and where water was shallow scoop net was used. All samples were brought to the laboratory in large plastic bottles. The gastropods were counted and washed in tape water and maintain a plastic trough with aerators in laboratory conditions, photograph and identified by expert ZSI at Pune and using the keys “Molluscan key characters books (Subba Rao,1989 &1959) .

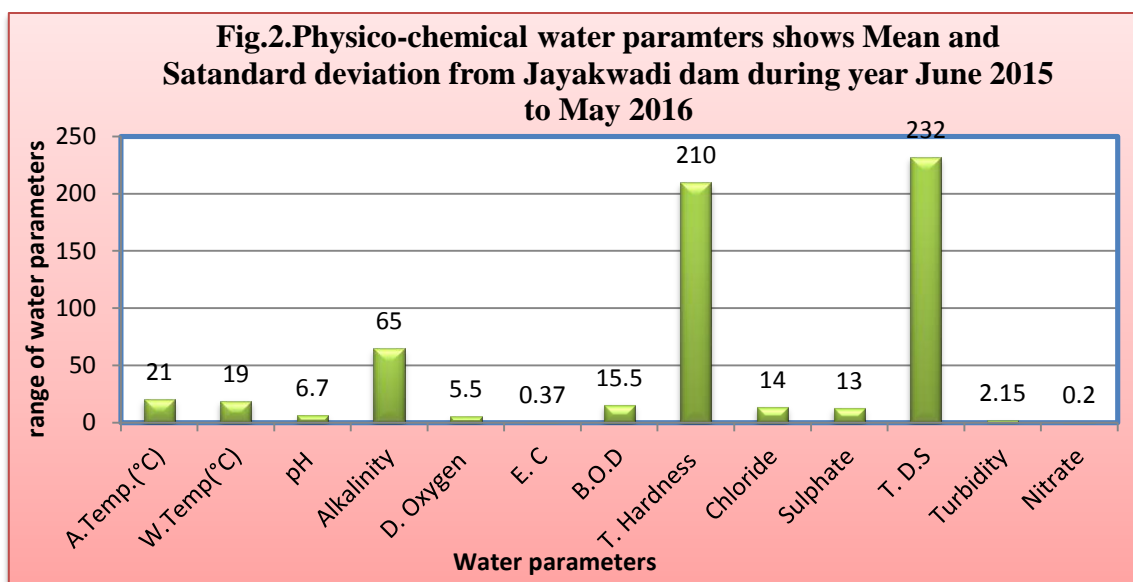
3. RESULTS

3.1 Physico-chemical parameters:

The results were expressed as mean and Standard deviation for each water parameters (Table 1 & fig 2) The Atmosphere temperature (°C) mean was (21 ± 6.34608), Water temperature (°C) mean was (19 ± 4.2067), PH mean was (6.7 ± 0.5484), Alkalinity mean was (65 ± 17.1435 mg/l), Dissolved Oxygen (DO) mean was (4.39 ± 0.980 mg/l), Electrical Conductivity (EC) mean was (0.37 ± 0.199 μ mhos/cm), Biological Oxygen Demand (BOD) mean was (15.5 ± 2.078 mg/l), Total Hardness (TH) mean was (210 ± 109.870 mg/l), mean was (14 ± 6.2643 mg/l), Sulphate mean was (13 ± 4.7926 mg/l), Total Dissolved Solid (TDS) mean was (232 ± 29.709 mg/l), Turbidity mean was (2.15 ± 1.239 NTU) and Nitrate mean was (0.2 ± 0.2380 mg/l).

Table1. Physico-chemical parameters shows Mean and standard deviation from jayakwadi dam during year June-2015 to May 2016

PARAMETERS	Minimum	Maximum	MEAN \pm SD
Atm. Temperature(°C)	21	40	21 ± 6.346
Water temperature(°C)	19	33	19 ± 4.206
pH	6.7	8.4	6.7 ± 0.548
Alkalinity(mg/l)	65	115	65 ± 17.143
Dissolved Oxygen (mg/l)	3.1	6.0	5.5 ± 0.653
Electric Conductivity (μ mhos/cm)	0.37	0.90	0.37 ± 0.199
B.O.D(mg/l)	2.1	5.5	15.5 ± 2.078
Total Hardness (mg/l)	210	510	210 ± 109.87
Chloride(mg/l)	14	30	14 ± 6.264
Sulphate(mg/l)	13	26.3	13 ± 4.792
Total Dissolved solid(mg/l)	248	318	232 ± 29.70
Turbidity(NTU)	2.15	6.10	2.15 ± 1.239
Nitrate(mg/l)	0.20	0.91	0.2 ± 0.238



3.2 Population density of gastropods:

During the June 2015 to May 2016, a total of 3550 Specimens were collected from the four sampling stations of Jayakwadi dam. Out of including five family nine genera and eleven species of gastropods were recorded and identified by the expert ZSI Pune. (Table-2 & Fig-3). The gastropod species population was dominated by Genus *Bellamya* in which *B.dissimilis* (22.5%) and *B.bengalensis* (21.25%) were abundantly found at all stations. Family Thiridae, was most diverse having three species including *Tarebia lineate*, Gray-1828, (19.00%), *Melanoids tuberculata*, Muller-1774, (18.5%) & *Melania scabra*, Muller-1774, (12.25%), (13.5%). in which family thiridae was dominant among three getting second position, in terms of population density. Genus *Lymnaea* in which having two species *L. acuminata* Lamarck (12.25%)

and *L. luteola* Lamarck. (10.5%) *L. acuminata* was dominant among in terms of Population density and it ranked third position in dominance in this data.

The population of *Indoplanorbis exustus* (8.5%), *Planorbis planorbis* (6.5%), *Physa acuta*, *Draparnaud-1801*, (3.25%) and *Gyraulus convexiusculus*, *Hutton 1849*, (2.00%) was dominant among in terms of Population density and it ranked fourth position in dominance. were found in very less numbers its compared to another species. The gastropods population size fluctuated markedly during the study period. The gastropod population showed higher number from June to November and lower number from December to May The peak of gastropods were noted in June and lowest number in the month of February. (Fig-4).

Table 2. List of gastropod species and their average annual density contribution (%).

Sr. No	NAME OF SPECIES	Sampling Station				Mean \pm SD	Percentage %
		I	II	III	IV		
1.	<i>Bellamya dissimilis</i> (Muller 1774)	21.2	23.1	22.3	23	21 \pm 1.2909	22.3%
2.	<i>Bellamya bengalensis</i> (Lamarck-18822)	19.2	21	23	22.1	19 \pm 1.707	21.25%

3.	<i>Tarebia lineate</i> (Gray-1828)	18.1	19.2	20	19.1	18 ±0.8164	19.00%
4.	<i>Melanoids tuberculata</i> (Muller-1774)	17.2	18.3	20.1	19	17 ±1.2909	18.5%
5.	<i>Melania scabra</i> (Muller-1774)	13.1	12.2	14	15.2	12 ±1.2909	13.5%
6.	<i>Lymnaea acuminata</i> (Lamarck-1822)	11.2	13.1	12.4	13.3	11 ±0.9574	12.25%
7.	<i>Lymnaea luteola</i> (Lamarck-1822)	9.1	11.3	10.2	10	9 ±0.8164	10.5%
8.	<i>Indoplanorbis exustus</i> (Deshayes-1834)	10.1	8.2	7.3	9.1	7 ±1.2909	8.5%
9.	<i>Planorbis planorbis</i> (Linnaeus-1758)	6.2	5.4	8.1	7.2	5 ±1.2909	6.5%
10.	<i>Physa acuta</i> (Draparnaud-1801)	4.2	2.4	3.2	4.2	2 ±0.9574	3.25%
11.	<i>Gyraulus convexiusculus</i> (Hutton, 1849)	2	3	1	2	1 ±0.8164	2.00%

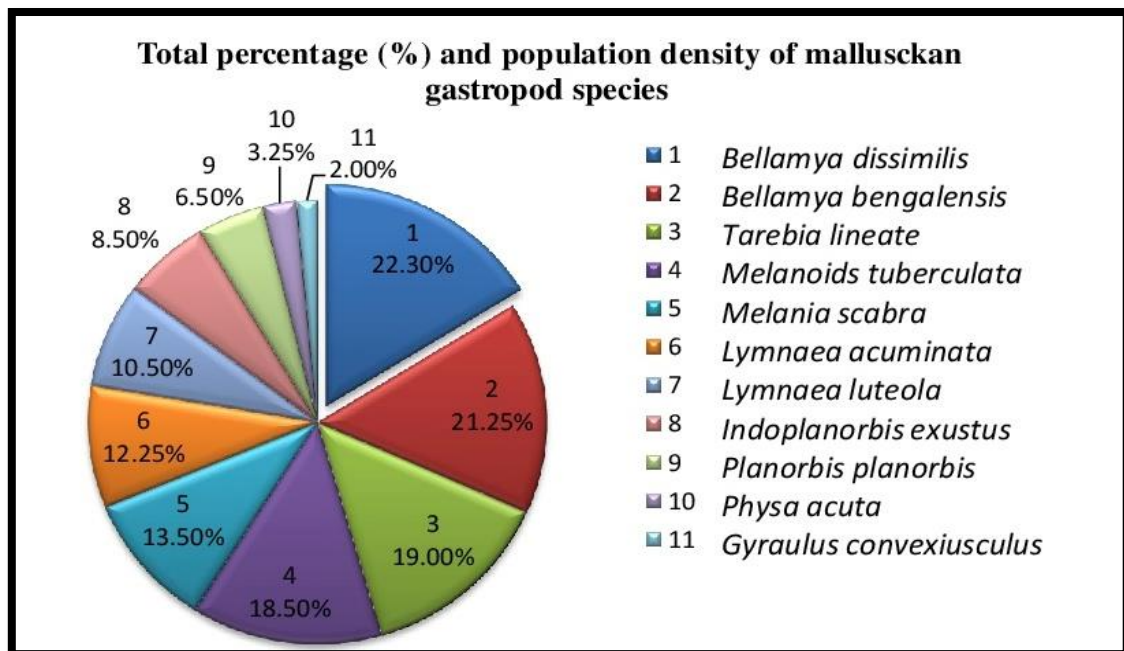


Figure 4.Total percentage (%) and population density of molluscan gastropod species from Jayakwadi dam year June 2015 to May 2016.

The population gastropod density showed positive correlation with density vs. Electric conductivity ($R^2=33.2\%$), density vs. B.O.D ($R^2=60.5\%$) and density vs. Turbidity ($R^2=60.2\%$) (Fig.6-d & 7-i) The similarly observed negative correlation of gastropod density vs. W.Temperature ($R^2=76.6\%$), density vs. Atm.Temperature ($R^2=66.7\%$), Density vs. Alkalinity ($R^2=82.7\%$), density vs. Dissolved Oxygen ($R^2=54.2\%$), density vs. T.Hardness ($R^2=37.7\%$), density vs. T.D.S ($R^2=54.9\%$), density vs. Chloride ($R^2=47.9\%$), density vs. Sulphate ($R^2=33.5\%$) and density vs. Nitrate ($R^2=6.2\%$).

4. DISCUSSION

The present study shows Atm. Temperature and water temperature range is maximum and minimum (40°C to 21°C) and (33°C to 19°C) in Jayakwadi dam Paithan, Aurangabad (M.S). Similarly results recorded by (Salve and Hiware., 2006) reported Atm. Temperature and Water temperature range between 27(°C) to 35 (°C) and 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 Parli Vaijinath, Beed district. (Mane and Pawar. 2007) reported similar results from Manar river Nanded district. Air 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 6.7 in June and maximum in 8.4 May during study period June-2015 to May 2016. 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).

During study period from June 2015 to May 2016 the Total alkalinity range was recorded maximum and minimum is (115 mg/l to 65 mg/l) in Jayakwadi dam (M.S). Similarly results shows (Reddy *et al.*, 2009) observed total alkalinity range maximum and minimum was (96 mg/l to 174 mg/l) in Pakhal lake Warangal (A.P). Narayana *et al.* (2008) observed total alkalinity range (38.56 mg/l to 61.45 mg/l) in Anjanapura reservoir, Karnataka.

In present study shows dissolved oxygen range varied from maximum and minimum is (6.0 mg/l to 3.1 mg/l) in Jayakwadi dam (MS). Similarly results recorded by Kharadkhele *et al.*, (2008) observed D.O range (5.9 mg/l to 3.0 mg/l) in Nana Nani Park, Latur (M.S). Solanki,

(2006) studies on Pandu Lake of Bodhan, (A.P) and reported range (6.60 mg/l to 1.70 mg/l). Yeole and Patil. (2005). D.O recorded range (7.5 mg/l to 6.0 mg/l) in Yedshi lake.

In present study shows electric conductivity varied range from maximum and minimum is (0.90 umhos/cm to 0.37 umhos/cm). Similarly results shows Sharma *et al.*, (2007) recorded Electric conductivity range varied from (0.16 umhos/cm to 0.63 umhos/cm) reported in Sagar village pond, Bikaner, Rajasthan. Khabade *et al.*, (2002) observed the range of electric conductivity (0.420 umhos/cm to 0.602 umhos/cm) in Lodhe water reservoir.

In present study shows B.O.D range (5.5 mg/l to 2.1 mg/l) recorded in Jayakwadi dam, Paithan Dist. Aurangabad (M.S). Similarly results recorded by Ingole *et al.*, (2008) observed B.O.D range (8.0 mg/l to 3.2 mg/l) in Majalgaon dam, Dist. Beed (M.S). The B.O.D was recorded range (6.94 mg/l to 2028 mg/l) in Wanparakalpa reservoir Nagapur, near Parli Vaijinath, Beed by Salve and Hiware, (2006).

The present study shows Chloride range (30 mg/l to 14 mg/l) in Jayakwadi dam, Paithan Dist. Aurangabad (M.S). Similarly results recorded by Salve and Hiware, (2006) observed Chloride range (26.6 mg/l to 19 mg/l) in Wanparakalpa, Reservoir, Parli Vaijinath, Beed (M.S). Bhatnagar *et al.*, 2007) observed Chloride range (25.03 mg/l to 9.2 mg/l) in Jhumri dam, Udaipur, Rajasthan. In present study shows sulphate range (26.3 mg/l to 13 mg/l) in Jayakwadi dam, Paithan, Aurangabad, (M.S). Similarly results recorded by Reddy *et al.*, (2009); Telkhade *et al.*, (2008).

In present study shows T.D.S shows range (318 mg/l to 248 mg/l) in Jayakwadi dam, Paithan. Aurangabad, (M.S). Similarly results recorded by Jawale and Patil the T.D.S. observed range (320 mg/l to 110 mg/l) in Mangrul dam, Jalgaon. Kadam *et al.*, (2007) recorded

T.D.S range (330mg/l to 110mg/l) in Masoli reservoir Dict. Parbhani.

In present study shows Turbidity range (6.10/NTU to 2.15/NTU) in Jayakwadi dam, Paithan, Aurangabad (M.S). Similarly results recorded by Muhammad-Barzani *et.al.*, (2007) observed turbidity range (28.67/NTU to 4.67/NTU) in Tasik Chinis Feeder River, Pahang, Malaysia. In present study shows Nitrate range (0.91mg/l to 0.20mg/l) In Jayakwadi dam, Paithan, 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 Rajeshkhae *et.al.*, 2007).

Lodge *et al.*, (1987) concluded that at large biogeography scales the important variables were colonization ability and water chemistry, and at local scales disturbance regimes, competition, and predation were stronger explanatory variables.

The temperature plays a vital role in the physiology of molluscan fauna. Aziz *et al.*, (1996) also reported that the degree of interaction was higher with the rise of

temperature from 20 °C to 35 °C, especially effect of 30 °C was highly significant as far as the duration of reproduction of a gastropods.

According to Pennak (1953) 30 °C is the critical temperature at which mostly the species survive. The population of gastropod was higher in summer which agrees with previous studies (Nazneen *et al.*, 1994). There was a positive correlation of gastropods with the hardness unlike Burdi *et al.*, (2008), Chatterjee *et al.*, (2008) found a negative correlation in between hardness and gastropods from running water (lotic) environment. Our studies differ because of the medium and source of water.

The great majority of molluscan species and the largest number of individuals occur under alkaline conditions (Smith, 2001).

The annual contribution of *B. bengalensis* and *B. dissimilis* was highest among all species the other prominent contributors were *Tarebia lineate*, *M. tuberculata*, *M. scabra* *L. acuminata*, *L. luteola*, *Indoplanorbis exustus*, *Planorbis planorbis*, *Physa acuta*, and *Gyraulus convexus*.



(a)



(b)



(c)



(d)



(E)



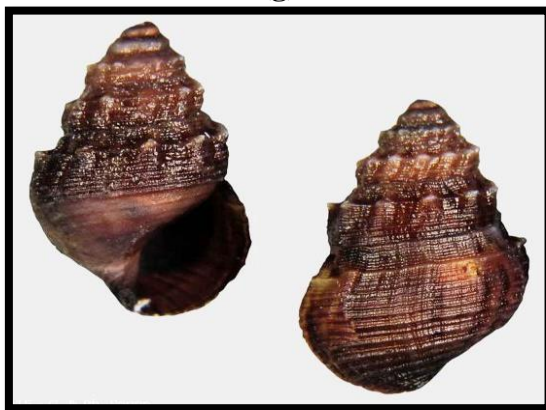
(f)



(g)



(h)



(i)

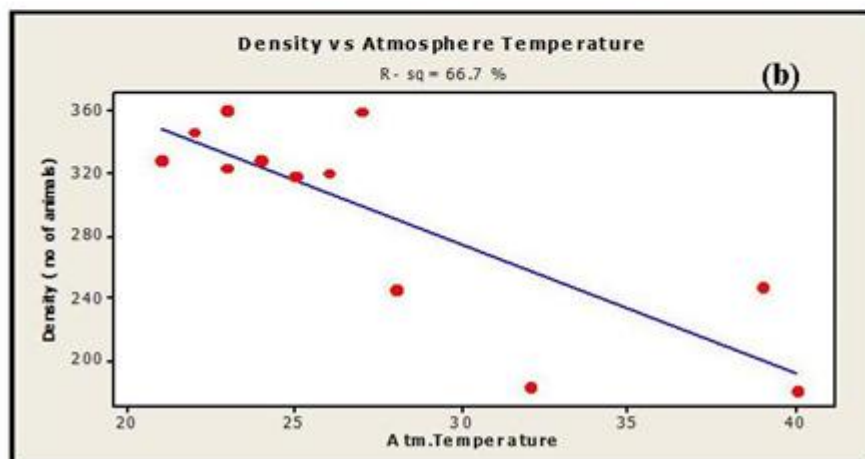
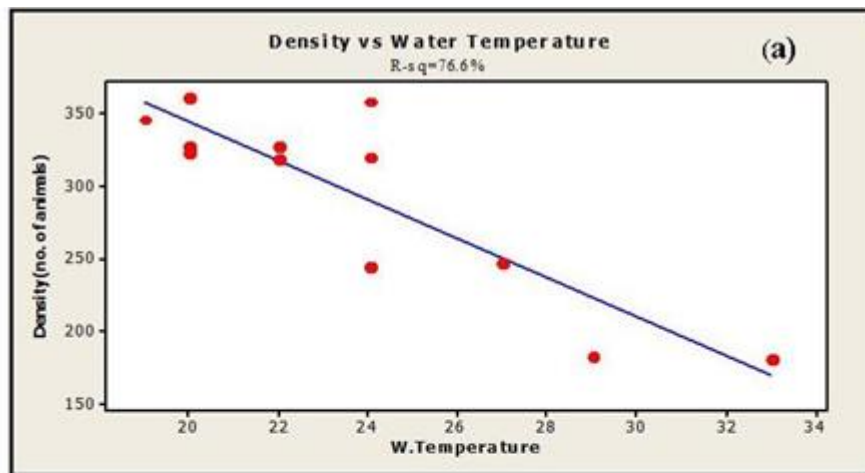


(j)



(k)

Fig. 3. (a) *Bellamya Bengalensis*, (b) *Bellamya dissimilis*, (c) *Lymnaea acuminata*, (d) *Lymnaea luteola* (e) *Tarebia lineate*, (f) *Melanoids tuberculata*, (g) *Melania scabra* (h) *Indoplanorbis exustus* (i) *Planorbis planorbis* (j) *Physa acuta*, (k) *Gyraulus convexiusculus*



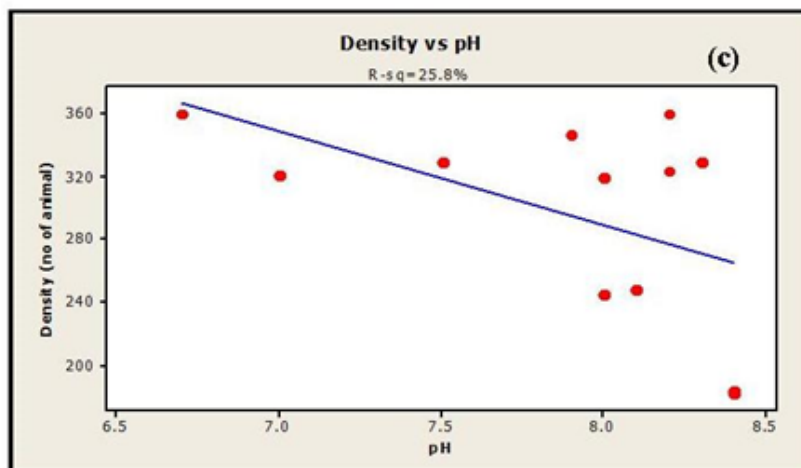
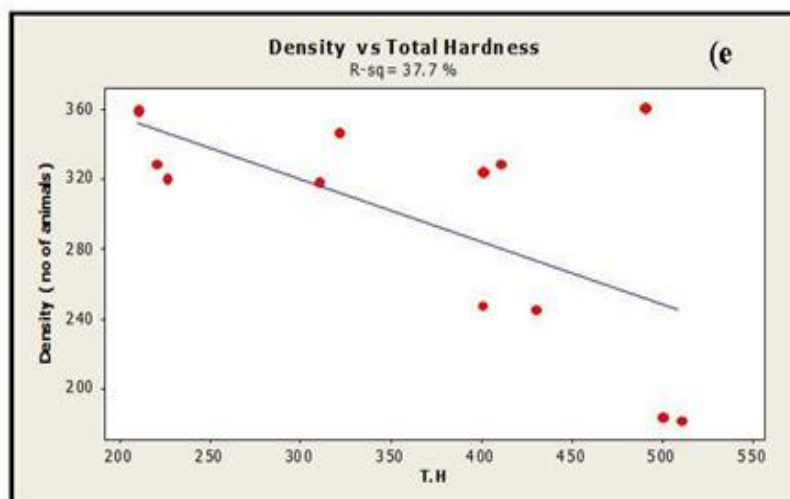
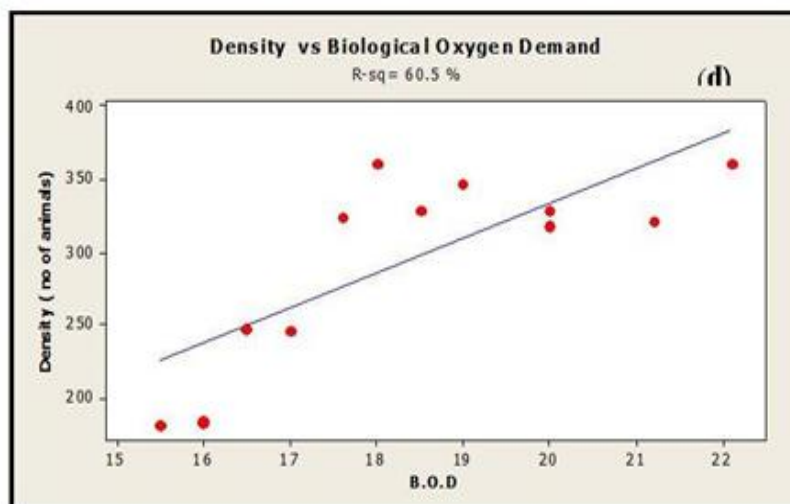


Fig.5. Relationship gastropod density with (a) Water Temperature (b) Atm. Temperature and © pH.



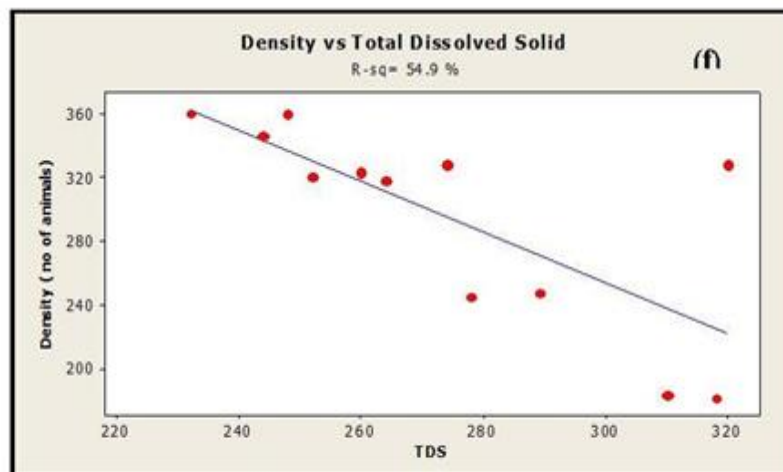
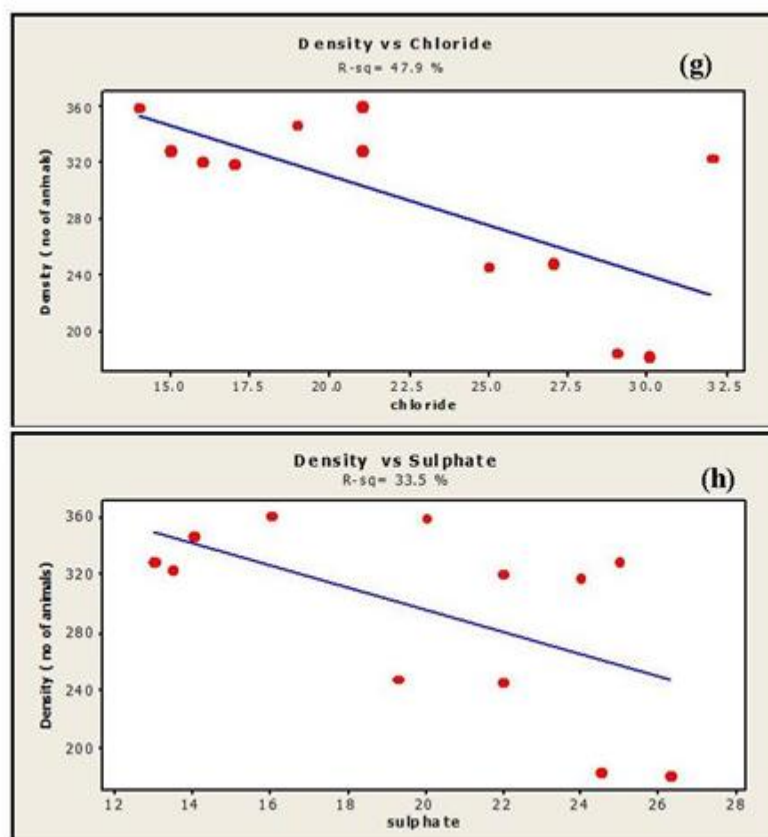


Fig. 6. Relationship of gastropod density with (d) Biological Oxygen Demand (e) Hardness and (f) Total Dissolved Solid



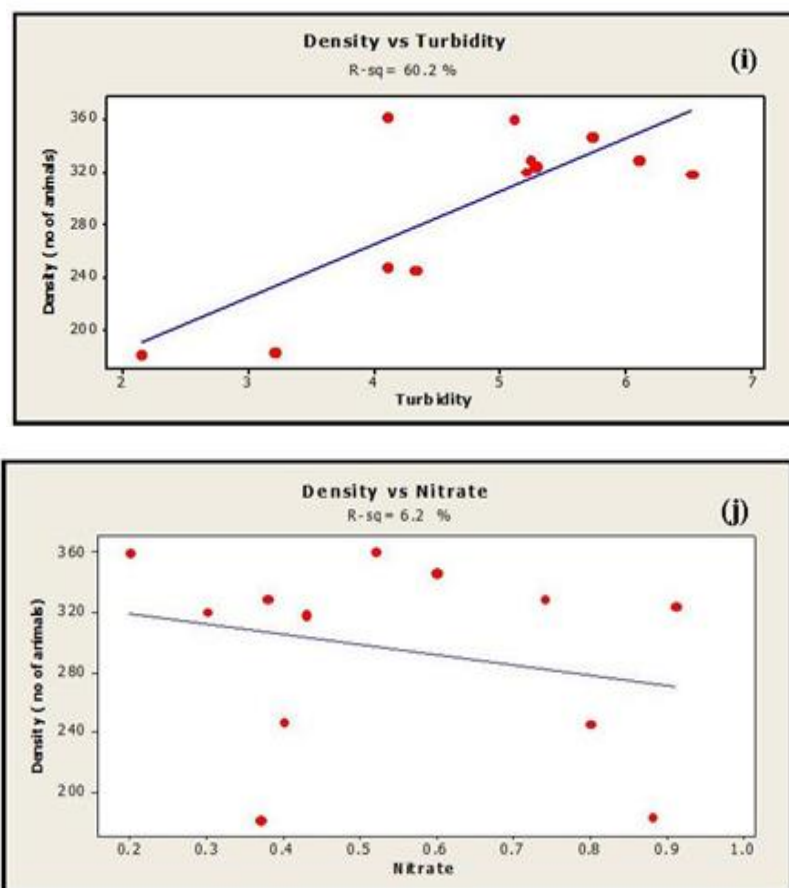


Fig.7. Relationship of gastropod density with (g) Chloride (h) Sulphate (i) Turbidity and (j) Nitrate.

5. CONCLUSION

The present study show detailed of physico-chemical characteristics and quality of water from Jayakwadi dam at Paithan, Aurangabad dist. (M.S) India. The summer, monsoon and winter seasons shows different seasonal fluctuations in various physico-chemical parameters. It can be concluded that physico-chemical parameters are important to determine the quality of aquatic environment.

In gastropods species population was highly dominant family in **Viviparidae** including two species in *Bellamya bengalensis* and *B.dissimilis*. Then second large dominant family **Thiridae** including three species was *Tarebia lineate*, *Melanoids tuberculata* and *Melania scabra*. Similarly family **Lymneidae** was observed including two species *Lymnaea acuminata*

And *Lymnaea lineate* in third number dominant. The fourth dominant family **Planorbidae** including two specie was *Indoplanorbis exustus* and *Planorbis planorbis* and lastly fifth number dominant family **Physidae** including two species was *Physa acuta* and *Gyraulus convexus*.

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