Visit us at www.ardij.org Applied Research And Development Institute Journal
RNI: MAHENG12834 ISSN : 2249-8346

Zooplankton Community Structure AtKurnur Dam

#1PATIL.SAHEBAGOUDA.S.,
#2DR. VITTHAL R. MORE
[1]sspatildpre@gmail.com ,
[2]vitthal67@gmail.com

#1DEPARTMENT OF ZOOLOGY, SANGAMESHWAR COLLEGE, SOLAPUR. MAHARASHTRA (INDIA) PIN; 413 003,
#2DEPARTMENT OF ZOOLOGY, GOVERNMENT COLLEGE OF ARTS AND SCIENCE, AURANGABAD PIN; 431 005

ABSTRACT

Environmental factors influence the distribution, density and diversity of zooplanktons. A case study was made at Kurnur dam in Solapur district Maharashtra (India) to find out influence of various factors affecting community structure of zooplanktons. The influence of qualitative parameters of water like temperature, dissolved solids, pH, hardness, dissolved oxygen etc were studied over abundance of Rotifera, Copepoda, Cladocera and Ostracoda, members of zooplanktons community structure. The study was made through monthly observation for one year in 2014. Through out the study it was found that Rotifera dominated the Zooplankton community followed by Copepod, Cladocera and Ostracoda. The population of zooplankton was abundant during May low in August, March and December. August and March low was because of dilution effect of habitat which was due to addition of runoff water from monsoonal rainfall and pre-monsoon (Awakali) rainfall respectively, while December low was associated with temperature. The quality of influx water depends on the economic activities practiced in the catchment area. The influx of water induce the qualitative changes in the reservoir of water which affect community structure of zooplanktons. Thus rainfall and influx of water were important factors that influence the community structure of zooplanktons.

Keywords-*Zooplanktons, Rotifera, Freshwater, Maharashtra*

ARTICLE INFO

Received:23th JAN 2017

Received in revised form : 27th JAN 2017

Accepted : 28thJAN , 2017

Published online : 1st FEBRUARY 2017

PDFARDIJ [PRINT] 2016, 23(7);(P) 32 –38

I. INTRODUCTION

Lakes and rivers are the important sources of water. In the world most of the human settlements are associated with water reservoirs. The quality of water is influential over the peoples surrounding to the reservoir as well as organisms existing in the lake or surrounding lakes. The healthy aquatic ecosystem should have healthy food chain. Zooplanktons are the parts of food chain. Zooplanktons are the heterotrophs that consume algae, phytoplanktons and grow in number as well as size. They are the food of small fishes, larva, tadpoles etc. The large fishes feed on small fishes and completes the food chain. As small fishes, larva and tadpoles are the food of large fishes, therefore the fish production is associated with phytoplankton production. (Ryder

Visit us at www.ardij.org Applied Research And Development Institute Journal
RNI: MAHENG12834 ISSN : 2249-8346

et al., 1974). The quality parameters of water are very much influential over diversity and abundance of zooplanktons. There is a relation between the chemical and physical properties of water with quality and abundance of phytoplanktons and zooplanktons (Odum et al., 1971).

Zooplanktons community include Rotifera, Copepoda, Cladocera and Ostracoda. The relative abundance of each other is influential over community structure, which depends upon the relative range of tolerance towards changing seasonal physico chemical properties of water as well as relative abundance of resource available. Planktons feeding on same resource in a homogenous environment can notco exist because of competitive exclusion (Hutchinson 1961). The species abundance is not same through out the year. The question arises which factor is more influence and lead to fluctuation in species. According to Huisman abundances allow the coexistence of many species on a handful of resources (Huisman and Weissing 1999). Species richness and abundance of zooplanktons are inversely related. Richness of species was highest in summer season and abundance is recorded in rainy season. In rainy season Cladocera dominate while in summer season Rotifera dominate, which was fond in a study of Nigerian flood plain (Okogwu OI1, 2010)

The relative abundance of zooplanktons is also considered as indicators of pollution. In a study at Sadatpur reservoir Sinantherina species, Rotaria and Asplanchuna were found relatively abundant which is indicator of water pollution (Avinash B. Gholap, 2014). Few members of rotifer when present in abundant number is indication of eutrophication of lakes, for example Brachionusforficula, Brachionusnilsoni, and Trichocercasp (AzmaHanim Ismail et.al, 2016). In a study of lakeParqueAtalaia in America, Rotifera diversity was markedly low during dry season under the influence of pollution of water by inlet of domestic sewage (Neves. Et.al., 2003)

The inlet water quality during rainy season depends on the economic activity practised in catchment area, which alters the physical chemical properties of water in the reservoir. Rainfall not only influence the surface water but also ground water. In a study of ground water quality with respect to various phyco chemical factors at f Sabour block of Bhagalpur district the Water Quality Index showed that very few amount of water is excellent which can be potable and nearly 6.77% samples surveyed found unsuitable for drinking and remaining amount of water is classified to good category that can be potable(D.K. Verma., 2016). The changes induced by inlet of water influence the community structure of zooplanktons. In a study at SinaKolegaon Dam Rotifera density is found to be less in rainy season, while Copepoda and Cladocers were abundant but bottom dwellers Ostracoda were least affected by any fluctuation (Swati Jadhav, et al, 2012). Kedar studied Rishi lake of Karanja (Lad) in Maharashtra where he found similar results where zooplanktons were more in summer season than rainy season (Kedar G.T. et al 2008). Vanjare at Pune university found positively correlation between abundance of Rotifera with rainfall and temperature and negatively correlation with pH and conductivity. The objective of this research to study influence of seasonal variation on zooplankton community structure.

II. PREVIOUS WORK

SITE SELECTION AND STUDY AREA

Figure 1 Google map of Bori Reservoir

Kurnur Dam which is also known as BoriDharan, which is a small gated dam ,exactly located at 17°37'0"N latitude and 76°13'2"E longitude. It is a earthfill dam which was constructed at confluence of Harna and Boririver, both are the tributaries of Bhima river. The dam covers the catchment area of 1,254 km2 fromAkkalkot and TuljapurTehasil. Kurnur Dam located in drought prone area of rain shadow region of Western Ghats in Marathwada. The volume of water in the reservoir depends upon monsoonal rainfall in catchment area. As there is no certainty in monsoonal rainfall and drought in

Visit us at www.ardij.org Applied Research And Development Institute Journal
RNI: MAHENG12834 ISSN : 2249-8346

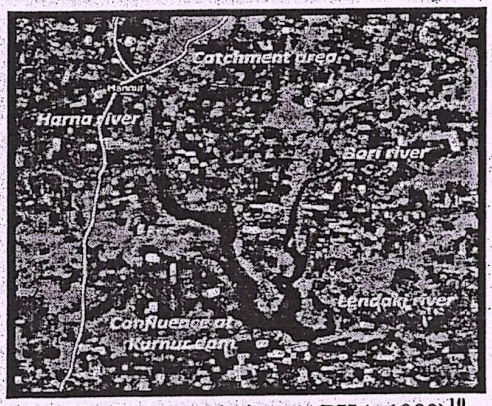
the catchment area has no certainty of annual inflow of water in the reservoir.

In 2014, there was better rainfall as compared to normal rainfall in the month of March and August, both of these months are marked by different agricultural activity in catchment area. The good amount of rainfall from western disturbance locally known as ' Awakali ' in the month of February (13.9 mm) and March (19.9 mm) in catchment area almost made the reservoir full. This reduced the drought effect as in the month of April and May as it happened every year earlier. The good amount of rainfall intense the agriculture activity in the catchment area, frequent tilling, use of fertilizers and pesticides that dissolve in agricultural runoff and flow in to the reservoir. There is no industrial belt in the catchment area so no question of industry effluent related pollution but some settlements are present on the bank of Harna river which is the main source domestic sewage and pollution of reservoir water.

III. PROPOSED METHOD

MATERIAL AND METHODS

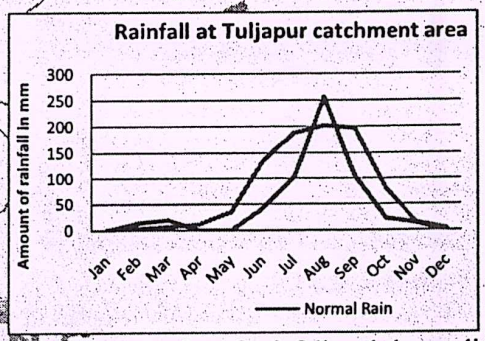
The study was carried to correlate and analyse physico chemical factors and Zooplanktons. The samples were collected according to standards and procedure for examination of water and waste water American



Public Health Association (APHA-1989)[10] and 17th edition of Beuro of Indian standard methods of Sampling and Test (Physical and Chemical) for water and waste water (BIS-3025)[11] as a manual for analysis. The water samples were collected at confluence of Harna, Bori and Lendakiriver through suction pump method. The field parameters that includes Temperature, pH, conductivity and Nitrate, that need to be analysed immediately after sample collection weregathered at site only. General parameters that were to be analysed in laboratory which includes Total Hardness, Turbidity, TDS(Total Dissolved Solids) BOD, COD etc. Cations and anions include Ca, Mg, Sulphates, Nitrate, Phosphate were analysed as per procedure mentioned in USGS manual and EPA government manuals (USGS Manual and eps.gov)[12](epa.gov manual)[13].

For the collection of Zooplanktons 125 mesh size net was used and 50 litter of water was filtered though net to collect planktons in sample bottle tied at the end. The net was properly rinsed to assure full sample collection from filtered water.

IV. DATA PREPARATION



The quantity of rainfall and the quality of the run off from the catchment area important factor that governs various physico-chemical parameters of reservoir water. Some of the physic-chemical parameters are to be noted immediately while sampling, for example temperature, pH, Electric conductivity and Nitrate concentration etc. In 2014 rainfall status in Tuljapurtehasil (Fig.2), had a good amount of pre-monsoon (Awakali) rainfall in months of February and March as compared to normal which made the reservoir almost full. The addition of water diluted the habitat in terms of concentration. The reservoir water was used extensively for agriculture and domestic purpose,

Visit us at www.ardij.org Applied Research And Development Institute Journal
RNI: MAHENG12834 ISSN : 2249-8346

that depleted water level by May and June. The onset of Monsoonal rainfall in June enriched the reservoir with water. Monsoon observed good amount of rainfall with 524.4 mm of rainfall having peak in month of August (Fig. 2)
Figure 2 Rainfall Tuljapur catchment area

Temperature is easily measured with help of glass thermometer. It was measured during sampling and recorded throughout the year. The temperature is recorded after two hours of sunrise while collecting water sample and the same time is maintained through the year. Temperature of water was recorded maximum in June and minimum in November, which is congruent with atmospheric temperature (Table.1). Turbidity and Electric conductivity (EC) follow the rainfall and maximum during rainy season with the addition of water

Therefore Turbidity and Electric conductivity (EC), both of these parameters are high in month of August and March which correlates ith maxima of rainfall(Table.1). pH decreases with addition of rain water and during summer season at warmer temperature the pH is high which decreases with influx of fresh water during monsoon but even though it never reach below 7 or acidic level that is the fluctuation occurred within the range of basic pH(Table.1). Dissolved Oxygen (DO) follows the pattern of combined effect of temperature and rainfall. In summer season the dissolved oxygen decreases, while during monsoonal rain water running through various rapids enhance concentration of DO in water, therefore in 2014 it shows dual peaks one in March and other in August (Table.2). Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) though follow the same pattern but too low values of BOD over COD indicates the level of organic pollution in the reservoir from domestic sewage, human intervention and that too in summer season when quantity of water in reservoir was less(Table.2)..

Total Dissolved Solids (TDS), Total Suspended Solids (TSS) and Total Solids (TS) seems to follow the rainfall rather than temperature therefore premosoon tillage and agriculture runoff in rainy season may be responsible for increased TDS, TSS and TS. In comparison to TDS, Total Suspended Solids (TSS) is very less therefore values of TDS and TS almost appears to be same. In 2014 TDS, TS show two peaks corresponding to rainfall, one in March and other in August (Table.1). Calcium (Ca), Magnesium (Mg) and Total Hardness (TH) also follow the rainfall pattern as they are contributed by dissolution of soil particles(Table.2). The concentration of Nitrate and Nitrite inversely related. Nitrite concentration is related with bacterial and algal concentration that convert them in to either nitrate or ammonia fixing bacteria etc. Nitrate concentration is maximum during rainy season and minimum during summer season (Table.2).

The Phosphate concentration is maximum during summer when volume of water is less due to evaporation losses. It means during rainy season the concentration of Phosphate is diluted and with gradual accumulation, its concentration gradually increases (Table.2) due to decrease in water volume. Sulphate concentration gradually decreases in summer which reach minimum level in May and increases with influx rainwater which peak in August after that it start deplete gradually both in winter and summer (Table.2).The concentration of Chlorine also follow the rainfall, it is maximum in rainy season in proportion to influx of water in the reservoir and gradually depletes in winter and further in summer reaching minimum level in March and April(Table.2).

Among zooplanktons Rotifera, Copepoda, Cladocera and Ostracoda are studied as mentioned in Table.no.4,5,6 and 7. Rotifera dominates the community, 43 species of Rotifera are studied from collected water samples (Table.4). Brachinus species dominate among the Rotifera. Among other zooplanktons 10 species of Copepodes (Table.5), 18 Cladocera (Table.6), and 12 species of Ostracoda (Table.7), are found in the collected water samples. Rotifera dominated the community throughout the year.

In summer season especially in the month of May all the zooplanktons counted highest in number that is organisms per litter.In winter season that is in December organisms count is less

Visit us at www.ardij.org Applied Research And Development Institute Journal
RNI: MAHENG12834 ISSN : 2249-8346

(Table.3). In June, with the onset of monsoon, and because of rainfall in catchment area (Graph. No. 2) habitat is diluted by influx of rain water as well as agricultural runoff, therefore the organisms count shows drastic low.

V. EXPERIMENTAL RESULTS

Table. 1 Physico-chemical parameters of water samples collected in 2014 at Kurnur Dam,

Months	Temp.	pH	EC	Sechi Depth
January	23	7.9	461.44	98.20
February	20	7.8	488.17	94.66
March	26	7.6	552.88	87.02
April	27	7.9	541.78	83.60
May	29	7.5	482.62	84.50
June	31	7.7	579.21	77.80
July	28	7.1	633.72	76.59
August	23	7.1	769.26	71.60
September	26	7.3	729.10	54.40
September	19	7.5	695.07	67.18
October	22	7.6	646.28	75.83
November	19	7.8	538.50	79.39
December	20	8.0	502.69	76.70

Months	Turbidity	TDS	TSS	TS
January	7.7	335	9.48	343.86
February	8.9	354	10.80	364.55
March	9.3	400	11.46	412.10
April	8.5	392	10.67	403.27
May	8.3	349	10.28	360.00
June	9.6	420	12.12	431.84
July	12.6	459	14.75	473.97
August	15.6	558	23.49	580.93
September	15.0	528	23.18	551.51
September	13.6	504	17.65	521.32
October	11.7	468	14.75	483.07
November	11.5	390	14.09	404.31
December	10.4	364	13.12	377.39

Table.2 Physico-chemical parameters of water samples collected in 2014 at Kurnur Dam,

Mon	DO	BOD	COD	NO3	NO2	Ca
Jan	4.04	4.47	36.59	0.13	0.31	147.82
Feb	4.50	3.82	31.35	0.29	0.28	156.38
Mar	4.72	8.30	67.68	0.38	0.27	177.12
Apr	4.32	5.02	41.09	0.21	0.30	173.56
May	3.90	4.86	39.72	0.05	0.33	154.61
Jun	5.38	3.58	29.35	0.67	0.22	185.55
Jul	6.01	3.02	24.79	0.94	0.18	203.02
Aug	7.53	2.31	19.04	1.60	0.07	246.43
Sep	7.15	1.15	9.62	1.44	0.09	233.57
Sep	6.66	0.93	7.85	1.22	0.13	222.67
Oct	5.75	1.39	11.59	0.83	0.19	207.04
Nov	4.97	2.23	18.40	0.49	0.25	172.51
Dec	4.82	2.93	24.02	0.42	0.27	161.04
Mon	Mg	TH	P	S	Cl	Mg
Jan	104.93	252.76	2.58	12.37	17.97	104.93
Feb	111.75	268.14	2.30	13.64	20.48	111.75
Mar	128.26	305.38	2.30	15.12	18.58	128.26
Apr	125.43	298.99	2.58	16.02	17.29	125.43
May	110.34	264.95	2.67	15.09	16.66	110.34
Jun	134.97	320.53	1.93	17.19	19.65	134.97
Jul	148.88	351.89	1.65	18.18	23.92	148.88
Aug	183.45	439.88	10.92	19.33	38.09	183.45
Sep	173.20	406.77	1.11	18.53	37.58	173.20
Sep	164.52	387.19	1.29	16.21	28.62	164.52
Oct	152.08	359.12	1.84	14.45	27.96	152.08
Nov	124.59	297.10	2.11	12.69	26.71	124.59

Table.3 Zooplanktons count from water samples collected in 2014 at Kurnur Dam, (Organisms/lit)

Months	Rotifera	Copepoda	Cladocera	Ostracoda
January	103	42	37	36
February	123	47	42	36
March	136	41	36	31
April	143	62	55	42
May	153	89	79	58
June	158	70	62	47
July	139	59	52	38
August	111	32	28	21
September	86	55	49	36
September	116	64	56	40
October	121	63	55	41
November	133	51	45	43
December	106	49	43	30

Visit us at www.ardij.org Applied Research And Development Institute Journal
NI: MAHENG12834 ISSN : 2249-8346

Table.4 List of Rotifers observed from the sample collected from Kurnur Dam in 2013

Brachionusangularis	Filinialongiseta	Keratella sp.
Brachionuscalycifl orus	Keratellatropica	Kertellavalga
Brachionuscaudatus	Lecane bulla	Lecanebidentata
Brachionusquadridentatus	Notholcaacumin ata	lecanedepressa
Brachionusureceol aris	Rotaria spp.	Lecanepyriformis
Epiphanesclovulata	Trichocera spp.	Lepadellaovalis
Euchlanisdilatata	Asplanchna sp.	Lepadella patella
Filiniaopoliensis	Brachionusfalcatus	Monostyella sp.
Keratellacochlearis	Brachionusforficula	Notomatacopeus
Keratellaprocura	Brancionouscalciflorus	Proalesdecipiens
Brachionusdiversicornis	Cephalodellaexigna	Pseudoharringia similis
Brachionusfolculus	Cephalodellaforficula	Testudinella sp.
Brachionus spp.	Colurellaadriatica	Testudinella patina
Filina spp.	Dicranophorusdolerus	Trichocercatigris
Tripleuchlanisspp		

Table. 5 List of Copepoda observed in the sample collected from Kurnur Dam in 2013

Cyclops sp.	Cyclops viridis	Diaptamus spp.	Eudiaptomusgracilis Sars
Mesocyclopsps	Megacyclops sp.	Paracyclopsfimbriatus	Mesocyclopsleuckarti
Nauplius larvae		Heliodiaptomus contortus	

Table. 6 List of Cladocera observed in the sample collected from Kurnur Dam in 2013

Alona	Alonaguttataa Sars	Macrothrixgoeldii (Richard)	Biaperturaaffinis (Leydig)
Bosmina	Bosminalongirostris	Ceriodaphniapulchella Sars	Grimaldinabrazzai (Richard)
Daphnia sp	Trophocyclops	Macrothrixspinosa (King)	Daphnia cucullataSars
Cypris	Flurcularia sp	Ilyocryptussordidus(Lievin)	Scapholeberis kingiSars
Diaphanura	Moina mircura		

Table.7 List of Ostracoda observed in the sample collected from Kurnur Dam in 2013

Candocypris spp.	Candona	Centrocypris	Cyprides
Cyprinotus	Cypris spp.	Darwinula	Ilyocypris
Limnocythere	Metacypris	Potamocypris	Stenocypris spp.

VI. CONCLUSION

The quantity of rainfall and the quality of inlet water through agriculture runoff along with temperature are the important factors that directly or indirectly govern all other abiotic factors considered here like total dissolved solids, pH of water and mineral concentration. During summer season especially in the month of April and May the reservoir water volume decreases by evaporation loss as well as dam discharge, which enhance the pollution effects of domestic sewage from the nearby village. The rainfall distributed in less number of rainy days lead to dilution of water rapidly. In 2014 summer season that is from May to June the quantity of water in the reservoir was sufficient in comparison to previous years because of good rainfall in the month of February and March by premonsoonrainfallf (Awakalis). In summer season Rotifera, Copepoda, Cladocera and Ostracoda predominate in terms of quantity and diversity than other seasons. In summer season zooplankton community is dominated by Rotifera followed by Ostracoda and then Copepoda and least is Cladocera. Growth rate of population may be highest in summer season especially in the month of June which follow high temperature and count is lowest in winter season during November and December. In winter season also Rotifera dominates the community followed by Ostracodaand Copepoda as same in summer. Cladocera found to be least in count in both seasons. Thus temperature is the important physical factors that govern the community either directly by influencing the population growth rate or indirectly that is by influencing other dependant physicochemical parameters. Besides, rainfall and quality of runoff influx influence the zooplankton community structure.

PRINCIPAL
Govt. College of Arts & Science
Aurangabad

140

ACKNOWLEDGEMENT

Peoples have keen interest in studies related nature, I found one of the interesting team which helped me to collect sample and analyse it. Prof. PatilSubhasachendra helped to collect sample from the site therefore I must say special thanks to him. I grateful to Dr.Sawant, Prof. Rokade A.U, Prof. Dr.Bharate.S.R.andProf.Dr. Bagale M.B. who guided me and assisted me to complete this project.

VII. REFERENCES

[1] Huisman, J., and F. J. WeissingBiodiversity of plankton by species oscillations and chaos.Nature 402:407–410, 1999.

[2] APHA, AWWA and WPCFStandardmethodsfor the examination of Water and WastewaterEds.A.D. Eaton, L.S. Cleseri and A.I. Greenberg, 20th ed., American 1998.

[3] Avinash B. GholapSpecies diversity indices of zooplankton from Sadatpur reservoir, Ahmednagar, Maharashtra Annals of Biological Research, 2014, 5 (4):58-61, 2014

[4] AzmaHanimIsmail andAnisAmalinaMohd Adnan. Zooplankton Composition and Abundance as Indicators of Eutrophication in Two Small Man-made Lakes Trop Life Sci Res. 2016 Nov; 27(supp1): 31–38,2016

[5] Beuro of Indianstandard methods of Sampling and Test (Physical and Chemical) for water and waste water (IS-3025)

[6] D.K. Verma, JajatiMandal, Rajeev Padbhushan, Sunil Kumar and Manohar Lal Water quality index for the assessment of groundwater quality in the Sabour block of Bhagalpur district, Bihar DOI Number: 10.5958/2230-732X.2016.00061.9IJAEB: 9(4): 467-472 August 2016

[7] Huisman, J., and F. J. Weissing Biodiversity of plankton by species oscillations and chaos. Nature 402:407–410.1999.

[8] Hutchinson, G. E. The paradox of the plankton. American Naturalist 95:137–145.1961.

[9] Neves I F, Rocha O, Roche KF, Pinto AAZooplankton community structure of two marginal lakes of the River Cuiabá (MatoGrosso, Brazil) with analysis of Rotifera and Cladocera diversity. Braz J Biol. 2003 May;63(2):329-43. Epub 2003 Aug 15,2003.

[10] Odum E.P., Fundamentals of Ecology W.B. Saunders Company, Philadelphia., 1971

[11] Ryder R.A., Kerr S.R., Loftus K.H. and Register H.A.et.al,The morphoedaphic index, a fish yields estimator review and evaluation., Journal of Fisheries Research Board of Canada., 31, 663 – 668. 1974.

[12] Swati Jadhav, SunitaBorde, DilipJadhav and AtulHumbe Seasonal variations of zooplankton community in SinaKolegoan Dam Osmanabad District, Maharashtra, India. Journal of Experimental Sciences 2012, 3(5): 19-22, ISSN: 2218-1768, 2012.

[13] Vanjare – Pai, Ecology Of Freshwater Rotifera In A Seasonal Pond Of The University Of Pune (Maharashtra, India), Published inApplied Ecology And Environmental Research 11(4): 525-539. http://www.ecology.uni-corvinus.hu ISSN 1589 1623 (Print) ISSN 1785 0037 (Online)

[14]http://water.usgs.gov/owq/FieldManual/chapter4/html/Ch4_contents.html,https://doi.org/10.1139/f69-181

[19] http://www.epa.gov/region6/qa/qadevtools/mod5_sops/groundwater/sampling/r1_gw_sampling.pdf.