

A Case Study of Physico-Chemical and Biological Parameters of Plankton Biodiversity and Fish Abundance in a Fresh Water Lake of Karimnagar District, Telangana State, India

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ABSTRACT

The quality of water is an important criterion for evaluating its suitability for drinking, irrigation and plankton diversity and fish culture. The influence of monthly and seasonal changes on the physico-chemical parameters of water body. Therefore a study has been conducted on the Mankondur fresh water lake in Karimnagar District, Telangana State, India. The study was conducted during June 2020 to May 2021. The water quality parameters considered in the present study water temperature, Transparency, Total Dissolved Solids, pH, Dissolved Oxygen, Carbon di Oxide, Total Hardness, Total Alkalinity, Chloride, Phosphate, Nitrate and Biological Oxygen Demand. The present observations revealed that Chlorophyceae species were dominant followed by Cyanophyceae, followed by Euglenophyceae and Bacillariophyceae were observed during the study period. There were percentage of Chlorophyceae (45%), Cyanophyceae (25%), Euglenophyceae (17%) and Bacillariophyceae (13%). The study helps in better understanding for the management of the manakondur fresh water lake for intensive fish culture.

Key words - Physico-Chemical Parameters, Zooplankton, Phytoplankton, Fish Fauna of Manakondur Fresh Water Lake.

INTRODUCTION

Water is one of the most valuable resources on planet earth and is the lifeline of almost all living creatures on earth. Water resources are of critical importance to both natural ecosystem and human development. It is vital factor of life and it is considered as precious compound on the earth. Water occupied 71% of our earth's surface, in this 97% of water available as in the form saline water in oceans and 3% fresh water in form of polar ice caps, surface and ground water resources. The natural aquatic resources like rivers, ponds, streams and lakes are causing heavy and varied pollution in environment leading to changes in water quality and depletion of aquatic biota. Due to increased pollution, urbanization rapid growth of industrialization and disposal of sewage, domestic waste, industrial effluents and other human being activities. The quality of water effects the species composition, abundance, productivity and physiological conditions especially, the indigenous population of aquatic organisms. (Wetzel R.G, 2001). The alteration in physico-chemical parameters leading to eutrophication

has become widely recognized problem of water quality deterioration. Several studies workers achieved studies on water first-class parameters of water impoundments in India like Yadav (2002), Fokmore and Musaddiq (2005), and Patil and Dongare (2006). Phytoplankton is the pioneer of an aquatic food chain. The productivity of an aquatic environment is directly correlated, with the density of phytoplankton. The physico-chemical factors are directly related with their productions. The phytoplankton is the base of most of the lake food webs and fish production is linked to phytoplankton (Ryder, 1974).

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Moreover, number and species of phytoplankton serves to determine the quality of water body. It was then the subsequent works were aimed at finding out the causative factors responsible for the growth and sustenance of groups of phytoplankton or zooplankton (Edmondson, 1946; Nygaard, 1949 and 1955; Gossler, 1950; Smith, 1950 and Gerloff *et al.*, 1952). Zooplankton is an integral component of aquatic ecosystem and comprises of microscopic animal life that passively float or swim freely. The principle components of zooplankton in lentic environment are represented by taxonomic group of Rotifera, Cladocera, Copepod and Ostracoda. The study of fresh water faunaspecially zooplankton even in a particular area is extensive and complicated phenomenon due to environmental, physical, geographical and chemical variation involving ecological extrinsic and intrinsic factor. Distribution of zooplankton and their variation at different zones of water body is Known to be influence by physico-chemical parameters of water. Pisces are the major group of vertebrates which shows an enormous diversity in shape, size, biology and habitat (Bobdey, 2014).

The aquatic ecosystem is important and it has large number of economically fish which is an important source of food. Fishes are the important vertebrate group of animal's world contributing to the biodiversity of animals. Primarily fishes are used as a food source. Many vital vitamins and fatty acids are found in fishes so sometimes it is referred by doctors as a food source. Freshwater resources are used for various purposes, like agricultural, industrial, household, recreational, environmental activities etc. Reservoirs and the main resources exploited for inland fisheries and understanding the fish faunal diversity is a major aspect for its development and the sustainability management. Lakes in India support rich variety of fish species, which intern support the commercial exploitation of the fisheries potential (Krishna and Piska, 2006). Many reports were published on reservoir, canal and tank fisheries. Pawar *et al.* (2006) studied fish fauna of Pethwadaj dam, Nanded.

MATERIAL AND METHODS

Study Area

To evaluate the water quality an effort was made to investigate the water Manakondur freshwater lake is located in Manakondur village, Karimnagar district, Telangana State. Lake is located in longitude 79°13'30"E and latitude 18°23'53"N. Physico- chemical and biological parameters had been expected within the laboratory by means of preferred techniques prescribed by using APHA (1985), Trivedy & Goel (1984). During the study period of one year from June 2020 to May 2021. Water Temperature, Transparency, Total Dissolved Solids, PH, Dissolved Solids, Carbon Di Oxide, Total Hardness, Total Alkalinity, Chlorides, Phosphates and Nitrates were determined.



Figure-1. Satilite image of Pedda Cheruvu (Manakondur)

Sample Collection and Analysis:

In order to determine the water quality, samples of water collected from the Manakondur fresh water lake during June, 2020 to May, 2021 in different seasons. The seasons defined as Rainy Season (June to September), Winter Season (October to January) and Summer Season (February to May). The main aim of present study is to investigate the physicochemical and biological characteristics of water. Sampling stations were selected at suitable points of the lake and samples were collected from stations at 8.00 am to 10.00 am in the morning hours. Prior to sample collection, all the sampling bottles were thoroughly washed, sun-dried and rinsed with the same water to be collected in the lake. The sampling bottles were labeled with dates and collection sites. Until analysis, the collected water samples were kept in a cool container maintaining the temperature below 25°C till the analysis completed.

For the analysis of physico- chemical parameters the water samples were collected in plastic cans and brought to the laboratory, physico-chemical parameters were analyzed as the procedure given in APHA (1985), Trivedy & Goel (1984). For the collection of zooplankton and phytoplanktons were made by silk bolting cloth silk no.25 (Mesh size 56 µm). Water sample (50 liter) was filtered through the net from littoral and open water zones and carefully transferred to 50 ml bottle and preserved in 4% formalin. Preserved samples were examined under a binocular microscope with different magnification. Quantitative analysis was done on a Sedgwick Rafter Counter cell by taking 1 ml sample. Taxonomic identification was carried out with the help of standard literature by Needham and Needham (1962); Pennak (1978); Patil & Gouder (1982); Edmondson (1992); and Altaff (2004); Pingale and Deshmukh (2005); Deshmukh and Gunale (2007); Hosmani (2008).

RESULTS AND DISCUSSION

Present studies on Manakondur fresh water lake of Karimnagar district has been investigated to know the physico-chemical and biological parameters which

Table-1. The Physico-Chemical Parameters of Manakondur Fresh Water Lake during Year from June, 2020 to May, 2021

S.No	Parameters	Year	Seasons		
			Rainy	Winter	Summer
			Mean \pm SD	Mean \pm SD	Mean \pm SD
1.	Temperature(TEM)	2020 to 2021	26.12 \pm 0.85	23.75 \pm 3.79	28.50 \pm 2.08
2.	Transparency(TRS)	2020 to 2021	19.85 \pm 1.27	36.35 \pm 8.01	29.90 \pm 1.86
3.	Total Dissolved Solids (TDS)	2020 to 2021	258.00 \pm 16.41	221.25 \pm 15.47	327.50 \pm 22.17
4.	PH	2020 to 2021	8.00 \pm 0.35	7.85 \pm 0.31	7.62 \pm 0.09
5.	Dissolved Oxygen (Do)	2020 to 2021	10.22 \pm 1.75	7.60 \pm 0.14	6.10 \pm 0.73
6.	Carbon di Oxide (Co ₂)	2020 to 2021	4.87 \pm 2.42	7.95 \pm 0.88	4.95 \pm 1.33
7.	Total Hardness(TH)	2020 to 2021	160.50 \pm 33.28	125.25 \pm 12.78	183.75 \pm 11.08
8.	Total Alkalinity(TA)	2020 to 2021	190.00 \pm 15.81	266.75 \pm 31.23	183.75 \pm 14.93
9.	Chloride(CL)	2020 to 2021	33.27 \pm 2.53	36.55 \pm 0.26	43.57 \pm 6.69
10.	Phosphate(Po ₄)	2020 to 2021	0.050 \pm 0.18	0.035 \pm 0.012	0.097 \pm 0.06
11.	Nitrate(NO ₃)	2020 to 2021	0.042 \pm 0.017	0.027 \pm 0.009	0.10 \pm 0.042
12.	Biological Oxygen Demand(BOD)	2020 to 2021	2.67 \pm 0.69	3.37 \pm 0.47	5.37 \pm 1.37

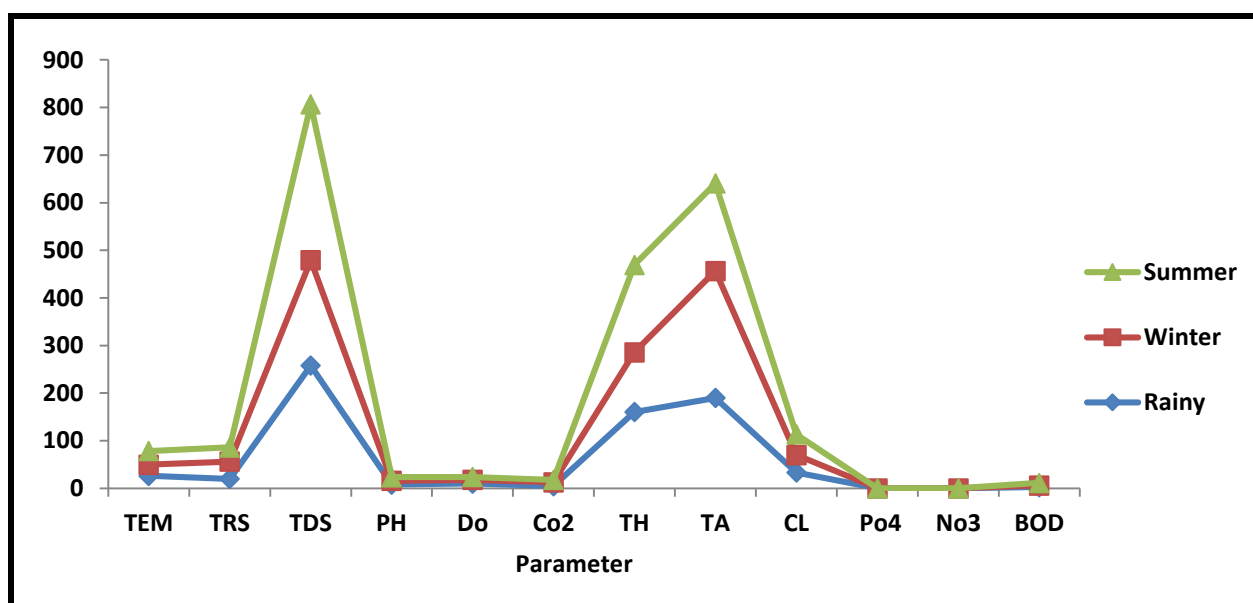


Figure-2. Seasonal variation in physico-chemical parameters of Manakondur Fresh Water Lake during the year from June, 2020 to May, 2021

includes diversity and distribution of phytoplankton, zooplankton and fish fauna, period of one year from June, 2020 to May, 2021 and the lake is discussed with an emphasis on their significance and interrelationship with fish diversity and also their adverse effect on the enhancement of fish production. The parameters studied were Water Temperature, Transparency, Total Dissolved Solids, PH, Dissolved Oxygen, Carbon di Oxide, Total Hardness, Total Alkalinity, Chloride, Phosphate, Nitrate and Biological Oxygen Demand. The biological parameters studied were Phytoplankton, Zooplankton and fishes. The seasonal variation in physico-chemical parameters was presented in Table -1. There are some variations in different physico-chemical parameters have

been observed during the study period. The physical and chemical properties of fresh water bodies are characterized by the climatic, geochemical, geomorphologic and pollution conditions. The quality of aquatic life depends on the water quality. In order to utilize fresh bodies successfully for fish production, it is very important to study the physico-chemical factors which influence the biological productivity of the water bodies.

The temperature performs an vital position for controlling the physico-chemical and organic parameters of water and considered as one of the essential thing surroundings particularly for freshwater (Mathur & Singh 2005). In the present study temperature ranges from 19.0°C to

Table-2. Monthly variation of individual zooplankton species in Manakondur Fresh water lake from 2020-2021

S.No	Group	Species	Season			Total
			Monsoon	Winter	Summer	
I	Rotifera	<i>Brachionus angularis</i>	22	18	18	58
		<i>Brachionus caudatus</i>	10	22	16	48
		<i>Brachionus diversicornis</i>	7	16	12	35
		<i>Cephalodella sp</i>	7	10	7	24
		<i>Edilatata</i>	4	1	6	11
		<i>keratellacochlerias</i>	33	40	98	171
		<i>Keratella tropica</i>	27	47	106	180
		<i>Lechane lunaris</i>	12	21	23	56
		<i>Filinalongisepta</i>	7	10	16	33
		<i>P.rsoeola</i>	1	6	1	8
			Total	130	191	303
II	Cladocera	Species	Monsoon	Winter	Summer	Total
		<i>Alona rectangular</i>	5	9	18	32
		<i>Bosminalongirostris</i>	3	16	11	30
		<i>Daphniacorunata</i>	18	36	47	101
		<i>Daphnia pulex</i>	19	18	24	61
		<i>Moinabrachiata</i>	9	25	24	58
			Total	54	104	124
III	Copepoda	Species	Monsoon	Winter	Summer	Total
		<i>Diaptomus sp</i>	5	9	14	28
		<i>Mesocyclops hyalimus</i>	14	15	18	47
		<i>Mesocyclops leukarti</i>	9	20	31	60
			Total	28	44	63
IV	Ostracoda	Species	Monsoon	Winter	Summer	Total
		<i>Cypris sp</i>	4	12	3	19
		<i>Hemicypris fossulata</i>	1	9	5	15
			Total	5	21	8

Table-3: Group wise percentage of zooplankton Population in Manakondur Fresh Water Lake during the year from June, 2020 to May, 2021

Seasons	Monsoon	Winter	Summer	Total	Percentage
Rotifera	130	191	303	624	58%
Cladocera	54	104	124	282	26%
Copepoda	28	44	63	135	13%
Ostracoda	5	21	8	34	3%
Total	217	360	498	1075	100%

31.0°C. Mean value of the temperature in Rainy season 26.12°C, Winter season 23.75°C and Summer season 28.50°C were recorded. The maximum temperature value recorded during summer season minimum temperature value recorded during winter season. Similar observations are according to David and David (2012); Rajani.V and G.Benarjee 2018. Transparency suggests the effective nature of this water on the idea of readability values as proposed by way of Sharma and Durve (1991). In the present study transparency ranges from 18.50cm to 44.30 cm. Mean value of the transparency in Rainy season 19.85 cm, Winter season 36.35cm and Summer season 29.90cm were recorded. The maximum transparency value

recorded during winter season minimum during rainy season. According to Rajani et al (2020) maximum transparency values were recorded in the winter season while the lowest transparency values were recorded in the monsoon season. In the present study TDS ranges from 200(mg/l) to 350(mg/l). Mean value of the TDS in Rainy season 258.00mg/l Winter season 221.25 mg/l and Summer season 327.50mg/l were recorded.

The maximum TDS value is recorded during summer season minimum during winter season. Similar observations are according to Verma et al., 2012. In the present study PH ranges from 7.5 to 8.3. Mean value of the

Table-4. Phytoplankton Recorded from Manakondur Fresh water Lake during June-2020 to May-2021

Chlorophyceae	Cyanophyceae	Euglenophyceae	Bacillariophyceae
1).Ankistrodesmus falcatus	1).Anabena tyengarii	1).Lepocinclis fusiformis	1).Amphora spp
2).Chara spp	2).Anabenopsis spp	2).Menoidium spp	2).Cymbella affinis
3).Chlorella vulgaris	3).Gloeotrichia spp	3).Phacus spp	3).Fragillaria brevistriata Grum
4).Cladophora glomarata	4).Hydrococcus spp	4).Euglena caudata	4).Navicula cuspidate
5).Cladophora ariculata	5).Microcystis aeruginosa		5).Pinnularia clasterium
6).Cosmarium borytis	6).Nostoc splaerium		6).Pinnularia gibba
7).Mageotia spp	7).Oscillatoria formosa		7).Synedra ulna
8).Microspora spp	8).Oscillatoria rubescens		
9).Nitella spp	9).Trichodesmium spp		
10).Oedeogonium borisianum			
11).Spyrogyra acanthophora			
12).Spyrogyra discoidea			
13).Ulothrix spp			
14).Volvox			
15).Zygnema spp			

Table-5: Group wise Percentage of Phytoplankton population in Manakondur Fresh Water Lake during the year from June, 2020 to May, 2021

S.No	Group	Seasons			Total	Percentage
		Monsoon	Winter	Summer		
1.	Chlorophyceae	290	410	351	1051	45%
2.	Cyanophyceae	192	160	232	584	25%
3.	Euglenophyceae	75	201	125	401	17%
4.	Bacillariophyceae	82	130	100	312	13%
	Total	639	901	808	2348	100%

PH in Rainy season 8.00, winter season 7.85 and summer season 7.62 were recorded. The maximum PH value was recorded during Rainy season minimum during summer season. Christy (2002) PH value is very important for plankton growth. Similar observations are according to Hina kouser and Mokappa Naik (2012). In the present study DO ranges from 5.2 (mg/l) to 12.0 (mg/l). Mean value of the DO in Rainy season 10.22mg/l, Winter season 7.60mg/l and Summer season 6.10mg/l were recorded. The maximum Dissolved Oxygen values were recorded during rainy season minimum during summer season. Similar observations are according to Srikanth 2009; Saloom and Duncan 2005 and V.Rajani (2020). In the present study CO_2 ranges from 3.0(mg/l) to 9.2(mg/l). Mean value of the CO_2 in Rainy season 4.87, Winter season 7.95 mg/l and Summer season 4.95mg/l were recorded. The maximum CO_2 values were recorded during winter season minimum CO_2 during rainy season. Similar observations are according to Hina kouser and

Mokappa Naik(2012) and V.Rajani (2020). Hardness is the assets of water, which prevents the lather formation with cleaning soap and will increase the boiling points of water (Patil and Patil, 2010). In the present study Total Hardness ranges from 110(mg/l) to 210(mg/l). Mean value of the Total Hardness in Rainy season 160.50mg/l, Winter season 125.25mg/l and Summer season 183.75mg/l were recorded. The maximum Total Hardness values were recorded during summer season minimum during winter season. Similar observations are according to Kataria et al., (1996), Hujare (2008) and Rumysa Kaliq *et al.*, (2013).

Alkalinity of lake water depend upon many elements among them the provision of carbonate and bicarbonate is one of the essential thing alkalinity affords idea of herbal salts present in water Gawas et.al (2006). In the present study Total Alkalinity ranges from 165(mg/l) to 300(mg/l). Mean value of the Total Alkalinity in Rainy season 190.00mg/l, Winter season 266.75mg/l and

Table-6. Phytoplankton Recorded from Manakondur Fresh water Lake during June-2020 to May-2021

ORDER	FAMILY	GENUS	SPECIES	LOCAL NAME	
Cypriniformes	Cyprinidae	<i>Catla</i>	1. <i>Catla Catla</i> (Hamilton-Buchanan,1822)	Botcha	
			2. <i>Cirrhinus mrigala</i> (HamiltonBuchanan,1822)	Merige	
				3. <i>Cirrhinus reba</i> (HamiltonBuchanan,1822)	Arju
				4. <i>Labeo calbasu</i> (HamiltonBuchanan,1822)	Kakibotcha
				5. <i>Labeo rohita</i> (Hamilton-Buchanan,1822)	Rohu
				6. <i>Labeo potail</i> (Sykes,1839)	Bocche
				7. <i>Labeo goni</i> (Hamilton,1822)	Kursi
				8. <i>Cyprinus carpio carpio</i> (1758)	Bangaruthiga
			<i>Punctius</i>	9. <i>Punctius chola</i> (HamiltonBuchanan,1822)	Parka
				10. <i>Punctius titius</i> (HamiltonBuchanan,1822)	Budda parka
				11. <i>Puctiussophore</i> (HamiltonBuchanan,1822)	Parka
				12. <i>Punctiussaranasarana</i> (HamiltonBuchanan,1822)	Gundu parka
				13. <i>Amplypharygodon microlepis</i> (Bleeker,1854)	Kodipe
		14. <i>Salmostoma bacaila</i> (Hamilton,1822)	Chandamama		
	Cobitidae	<i>Lepidocephalus</i>	15. <i>Lepidocephalus guntea</i> (Bleeker,1822)	Ulshe	
Siluriformes	Bagridae	<i>Mystus</i>	16. <i>Mystus bleeker</i> (Day,1877)	Jella	
			17. <i>Mystus cavasius</i> (Hamilton,1822)	Guddijella	
			18. <i>Mystus vittatus</i> (Bloch,1822)	Errajella	
		Siluridae	<i>Wallago</i>	19. <i>Wallago attu</i> (Schneider,1839)	Waaluga
				<i>Ompok</i>	20. <i>Ompok bimaculatus</i> (Bloch,1974)
				21. <i>Ompok pabda</i> (Hamilton,1822)	Buggadamma
		Clarridae	<i>Clarius</i>	22. <i>Clarius batracus</i> (Linnaeus,1758)	Marphoo
	Heteropneustidae	<i>Heteropneustes</i>	23. <i>Heteropneustes fossils</i> (Bloch,1794)	Inglikam	
Osteoglossiformes	Notopteridae	<i>Notopterus</i>	24. <i>Notopterus Notopterus</i> (Pallas,1769)	Vollenka	
			25. <i>Notopterus chitala</i> (Hamilton)	Vollenka	
Channiformes	Channidae	<i>Channa</i>	26. <i>Channapunctatus</i> (Bloch,Day-1878)	Mottapilla	
			27. <i>Channa striatus</i> (1793)	Korramatta/Murrel	
			28. <i>Channa orientalis</i> (Bloch&Schneider,1801)	Malapankidi	
Perciformes	Gobiidae	<i>Glosogobius</i>	29. <i>Glosobius giuris giuris</i> (Hamilton,1822)	Ushkedhanthi	
	Anabantidae	<i>Anabas</i>	30. <i>Anabas testudineus</i> (Bloch,1792)	Burka	
	Mastacembelidae	<i>Mastacembelus</i>	31. <i>Mastacembelus armatus</i> (Lecepede,1800)	Paapera	
			32. <i>Mastacembelus panclus</i> (Lecepede,1800)	Chinni paapera	
Anthriformes	Belonidae	<i>Xenontodon</i>	33. <i>Xenontodon cancella</i> (Hamilton,1822)	Nayanikuntha	

Summer season 183.75 mg/l were recorded. The maximum Total Alkalinity values were recorded during winter season minimum during summer season. Similar observations are according to Abdar 2013 and V.Rajani 2020. The salt flavor produced by using chlorides relies upon at the chemical composition of the water. High

chloride content material also has deleterious effect on steel pipes and systems in addition to in agriculture plant life (NEERI, 1988).

Higher concentration of chloride within the water may be due to discharge of home sewage and also extra of

Table-7. Number of families, genera and species under various orders

S.no	Order	Families	Percentage	Genera	Percentage	Species	Percentage
1.	Cypriniformes	2	17%	7	39%	15	46%
2.	Siluriformes	4	34%	5	28%	8	24%
3.	Osteoglosiformes	1	8%	1	5%	2	6%
4.	Channiformes	1	8%	1	5%	3	9%
5.	Perciformes	3	25%	3	17%	4	12%
6.	Antheriniformes	1	8%	1	6%	1	3%

chlorine in water, it serves as a trademark of water pollutants. In the present study Chlorides ranges from 35.00(mg/l) to 50.20(mg/l). Mean value of the Chlorides in Rainy season 35.42(mg/l), winter season 36.55 (mg/l) and summer season 44.07(mg/l) were recorded. The maximum Chloride values were recorded during summer season minimum during rainy season. Similar observations are according to Pejawar et al., 2004 and Sharma and Chouhan (2007). In the present study Phosphates ranges from 0.02 (mg/l) to 0.16 (mg/l). Mean value of the Phosphates in Rainy season 0.050 (mg/l), winter season 0.035 (mg/l) and summer season 0.097 (mg/l) were recorded. The maximum Phosphate values were recorded during summer season minimum during winter season. Similar observations are according to Patil et al., (2008) and Christy (2002). Nitrate content is most important parameter in studies of pollution. In the present study Nitrates ranges from 0.02(mg/l) to 0.14(mg/l). Mean value of the Nitrates in Rainy season 0.042mg/l, winter season 0.027(mg/l) and summer season 0.10(mg/l) were recorded. The maximum Nitrates values were recorded during summer season minimum during winter season.

and the main components of oxidizable be counted include carbonaceous count ,nitrogen compounds and chemically lowering compounds. In the present study BOD ranges from 2.5(mg/l) to 7.0(mg/l).Mean value of the BOD in Rainy season 2.67(mg/l), winter season 3.37(mg/l) and summer season 5.37(mg/l) were recorded. The maximum BOD values were recorded during summer season minimum during rainy season. Similar observations are according to Bhatt et al., 1999 (Table-1; Figure-2).

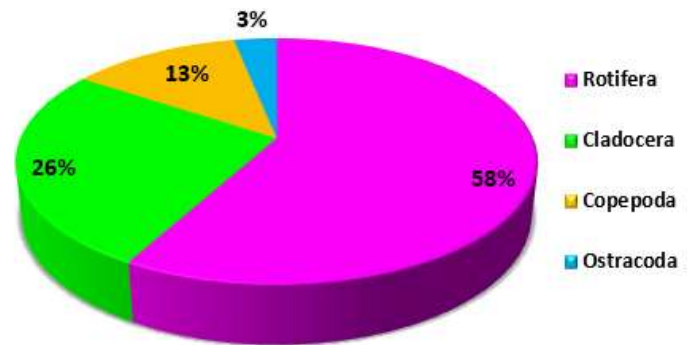


Figure-4. Percentage of different zooplankton groups in Manakondur Fresh Water Lake during the year from June, 2020 to May, 2021

The plankton is heterogeneous assemblage of minute organism which occurs in natural water and float about by wave action and movement of water Moss.B (1982). Zooplankton study provides a relevant and convenient point focus for research on the mechanism of eutrophication and its adverse impact on an aquatic ecosystem. Zooplankton are an important components in aquatic ecosystems, whose main function is to act as primary secondary links in the food chain Hutchinson (1967). Zooplankton diversity rapidly to changes in the aquatic environment. Several zooplankton species are served as bio indicators Ahmad et al (2011); Mola (2011). In the present investigation 20 species of zooplankton belonging to 4 groups were recorded manakondur fresh water lake. Out of 20 species 10 species of Rotifera,5 species of cladocera,3 species of copepod and 2 species of ostracoda (Table-2).

Rotifers are microscopic soft bodies’ fresh water invertebrates. Their distribution and ecology have

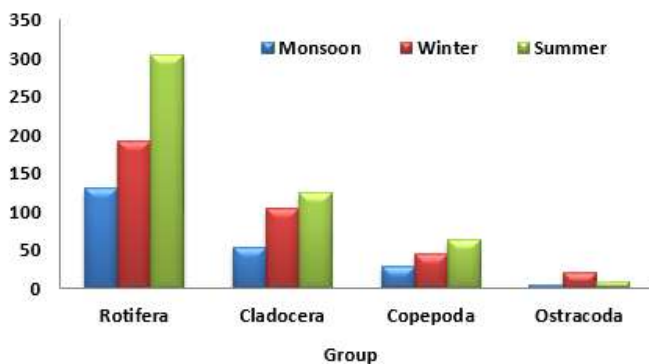


Figure-3: Seasonal Wise - Zooplankton composition during June, 2020 to May, 2021

BOD is dissolved oxygen required by micro-organism for cardio decomposition of natural rely found in water. BOD has been considered as an critical parameter in aquatic surroundings to establish the popularity of pollution (Azmi et al., 2015). BOD is important parameter that shows the value of water pollution through the oxidizable organic matter. The most important supply of answerable for organic enrichment of an aquatic environment are home savage, agricultural runoff and industrial effluents

interesting evolutionary implications Edmondson (1992). The rotiferans exhibit a very wide range of morphological variations and adaptations. Among the zooplankton rotifers respond more quickly to the environmental changes and used as a change in water quality Gannon (1978). The monthly variation of zooplankton density (nos/lit) at four stations found that rotifera population 130 no/individuals during monsoon season, 191 no/individuals during winter season and 303 no/individuals during summer season. Cladocera population during 54 no/individuals in monsoon season, 104 no/individuals in winter season and 124 no/individuals in summer season. The Cladocerans also prefer to live in clear waters. Copepods are considered as important food item for various kinds of fish, play a key role in the energy transformation at different trophic levels. As a nature of copepod they prefer Eutrophication environment. Copepod population 28 no/individuals during monsoon, 44 no/individuals during winter season and 63 no/individuals during summer season. Similar observation was made by Chauhan (1993). Ostracoda population 5 no/individuals during monsoon season, 21 no/individuals during winter season and 8 no/individuals during summer season. The composition of zooplankton rotifers was dominant (58%) followed by cladocera (26%), copepod (13%) and ostracoda (3%) (Table-3; Figure-4). The mean population of each zooplankton groups from all the seasons recorded was in the following order, Rotifers > Cladocerans > Copepods > Ostracods.

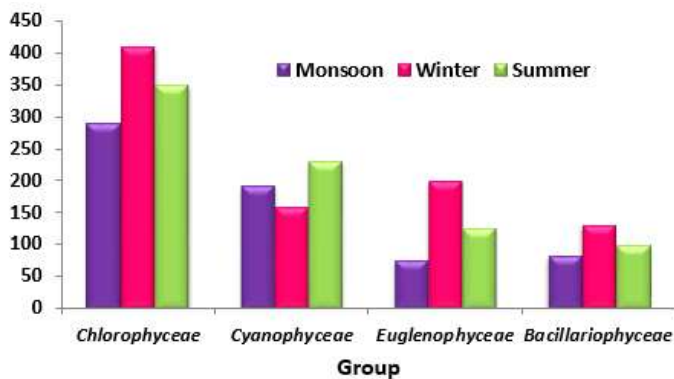


Figure-5. Seasonal Wise - Phytoplankton composition during June, 2020 to May, 2021

In the present study Phytoplanktons were represented by 4 groups. A total number of 35 species were recorded. Chlorophyceae was dominant with 15 species. Cyanophyceae 9 species, Euglenophyceae 4 species and Bacillariophyceae 7 species. The present observations revealed that Chlorophyceae species were dominant followed by Cyanophyceae, followed by Euglenophyceae and Bacillariophyceae were observed during the study period. The Chlorophyceae or green algae form greenish scum on the surface of quiet or stagnant water or grow firmly attached to the submerged rocks and other objects in water. There are about 6500 species of green algae

worldwide. The factors such as high temperature low nitrate and a bright sunlight are favorable for the high population of green algae (Rao, 1955). The total population density of Chlorophyceae of varied between 290no. Individuals per liter during Monsoon season, 410 number individuals per liter during winter season, 351 number individuals per liter during summer season.

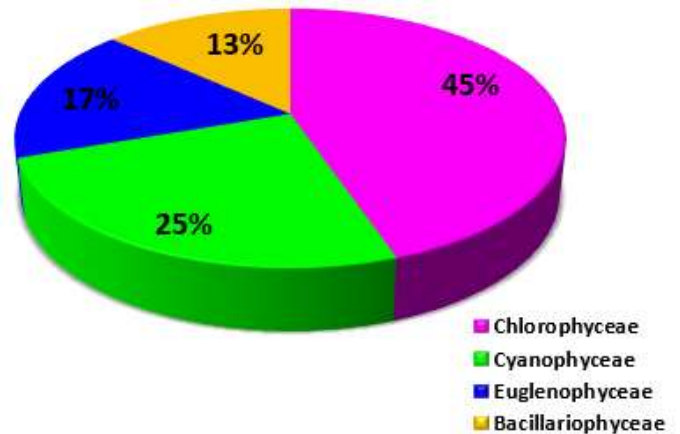


Figure-6. Percentage of different Phytoplankton groups in Manakondur Fresh Water Lake During the year from June, 2020 to May, 2021

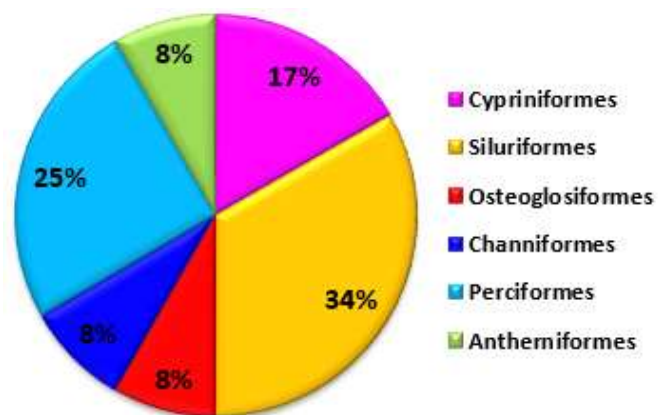


Figure-7: Showing percentage of families to the orders

The annual population density of Chlorophyceae of varied between 1051 no.individuals/lit. The results of present investigation are also similar with Sakhare and Joshi (2002) recorded 14 species of Chlorophyceae from Yeldari reservoir Maharashtra; Pawar *et al.*, (2006) recorded 23 species of Chlorophyceae from Pethwadaj dam Kandhar, Nanded; Desmukh and Gunale (2007); Tiwari and Chauhan (2007a), and (2007b). The composition of Cyanophyceae population showed different peaks in the Monsoon season, winter season and summer season during the present investigations. Total 9 species were found among the Cyanophyceae group. The total population density of Cyanophyceae of Manakondur Lake varied between 192 no. individuals/lit during Monsoon season, 160no.individuals/lit during winter season, 232no.individuals/lit during summer season. The annual population density of Cyanophyceae of

584no.individuals/lit. Euglenophyceae is commonly found in small water bodies having rich organic matter. Although the euglenoid algae (Euglenophyceae) are relatively large and adverse, few species are truly planktonic. Almost all euglenoids are unicellular, lack a distinct cell wall and possess one, two or three flagella. Total 4 species were found among the Euglenophyceae group. The total population density of Euglenophyceae varied between 75no. Individuals/lit during Monsoon season, 201no.individuals/lit during winter season, 125no.individuals/lit during summer season. The annual population density of Euglenophyceae of varied between 401no.individuals/lit.The Bacillariophyceae constitutes an important component of the fresh water or marine plankton. Total 7 species were found among the Bacillariophyceae group. The total population density of Bacillariophyceae of varied between 82no. Individuals/lit during Monsoon season, 130no.individuals/lit during winter season, 100no. Individuals/lit during summer season. The annual population density of Bacillariophyceae of varied between 312no.individuals/lit.Waghmare and Mali (2007) reported maximum density during winter season at Kalamnuri dam, Hingoli district, Maharashtra.The total percentage in phytoplankton population of Manakondur Lake during June 2020 to May 2021. Chlorophyceae (45%), Cyanophyceae (25%), Euglenophyceae (17%) and Bacillariophyceae (13%) respectively (Table-5; Figure-6).

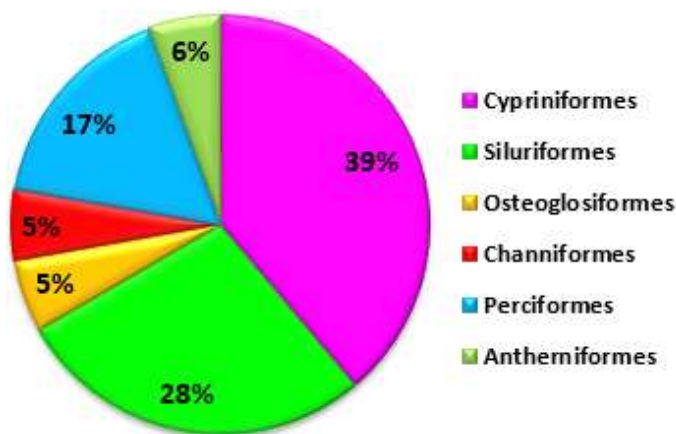


Figure-8. Showing percentage of Genera to the orders

Pisces are the major group of vertebrates which shows an enormous diversity in shape, size, biology and habitat (Bobdey, 2014).The aquatic ecosystem is important and it has large number of economically fish which is an important source of food. Fishes are the important vertebrate group of animal's world contributing to the biodiversity of animals. Primarily fishes are used as a food source.Many vital vitamins and fatty acids are found in fishes so sometimes it is referred by doctors as a food source.Freshwater resources are used for various purposes, like agricultural, industrial, household, recreational, environmental activities etc.Reservoirs and the main resources exploited for inland fisheries and understanding the fish faunal diversity is a major aspect

for its development and the sustainability management. Lakes in India support rich variety of fish species, which intern support the commercial exploitation of the fisheries potential (Krishna and Piska, 2006).India is one of the mega biodiversity countries in the world and occupies the ninth position in terms of freshwater mega biodiversity (Shinde et al., 2009).The present investigation was under taken to study the aquatic vertebrate animals with reference to fishes from Manakondur Lake.In the present study, 33 species of 18 different genera 12 families and 6 orders were recorded from Manakondur Lake (Table-6).

Cypriniformes 15 species, Siluriformes consists of 8 species, Osteoglossiformes consists of 2 Species, Channiformes consists of 3 species, Perciformes consists of 4 species, Anthrniformes consists of 1 species. Order wise percentage composition is Cypriniformes (17%), Siluroformes (34%),(Osteoglossiformes(8%), Perciformes (25%), Channiformes (8%), Anthrniformes (8%) (Table-7; Figure-7). Genera wise percentage composition is Cypriniformes (39%), Siluroformes (28%), (Osteoglossiformes (5%), Perciformes (5%), Channiformes (17%), Anthrniformes (6%) (Table-7; Figure-8).

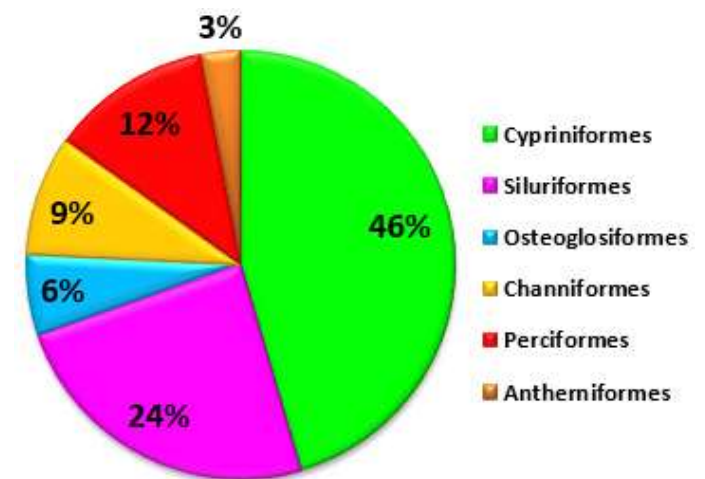


Figure-9: Showing percentage of species to the orders

Species wise percentage composition is Cypriniformes (46%), Siluroformes (24%), (Osteoglossiformes(6%), Perciformes (9%), Channiformes (12%), Anthrniformes (3%) (Table-7; Figure-9).

In these reported fishes, Cypriniformes was more dominant. Many researchers have reported the strong dominance of Cyprinidae family. Khedkar and Gynanth (2005) reported 37 species in Issapur Reservoir District Yeotmal, Maharashtra State India; Pawar et al. (2007) were recorded 26 fish species from Pethwadad dam Talukandhar in Nanded District, Maharashtra, India. Sharma (2008); Srikanth, K. (2009); Naik and Hina Kousar (2012); Ahirrao (2014); Laxmappa and Ravindar Rao (2015); Bhattacharya (2018); V.Rajani (2021); Kumar et al, (2020): Studies on the hydrobiology and fish fauna of some lakes and suitability for fish farming in Karimnagar

district, telangana, Thesis submitted to Kakatiya University, Warangal.

CONCLUSIONS

From the present study, it may be concluded that all the physico-chemical parameters are at nearly permissible limit at all 4 stations. The overall lake is not considered to be more polluted. The lake having rich diversity of flora and fauna. The lake is precious to all aquatic life. At present the lake water is suitable for fish culturing and irrigation purpose.

Conflicts of Interest

Authors declare that there is no conflict of interests regarding the publication of this paper.

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