WORLD JOURNAL OF PHARMACY AND PHARMACEUTICAL SCIENCES
SJIF Impact Factor 7.421
Volume 8, Issue 2, 702-714 Research Article ISSN 2278 – 4357

PHYTOPLANKTON DIVERSITY OF PARDESWADI LAKE WALUJ M. I. D. C. AURANGABAD (M. S.) INDIA

V. T. Kamble*[1] and C. A. Jawale[2]

[1]Dept of Zoology, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad.

[2]Shri Madhavrao Patil Mahavidyalaya, Murum, Tq. Omerga, Dist.Osmanabad.

Article Received on
11 Dec. 2018,

Revised on 31 Dec. 2018,
Accepted on 21 Jan. 2019

DOI: 10.20959/wjpps20192-13050

***Corresponding Author**
V. T. Kamble
Dept of Zoology, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad.

ABSTRACT

The present study was carried out during Feb. 2014 - 2015, for the period of 24 month to observed the percentage of phytoplankton in Pardeswadi lake, Waluj MIDC, Aurangabad(MS) India. Phytoplankton is the pioneer of an aquatic food chain. The phytoplankton has great significance in the ecology as they provide the food for the organisms, especially for zooplankton. The phytoplankton samplings on monthly basis were carried out. Standard keys and other literature were used for identification of different species. Four major groups of phytoplankton (Chlorophyceae, Bacillariophyceae, Cynophyceae and Euglenophyceae.) were studied for diversity and seasonal abundance. Among the groups of phytoplanktons, the population density showed variations due to their adaptability to seasonal changes in water quality. Some plankton population disappeared at a specified period and reappeared during other period. This disappearance maybe due to the fact that some species occur in spores. Under favorable conditions spore germinate and appear as plankton. The percentage of Cyanophyceae is 54%, Chlorophyceae is 16.9%, while Bacillariophyceae is 24%, and Euglenophyceae is 10%, of pardeswadi Lake in the year 2014-15.Where as Cyanophyceae is 50.2%,Chlorophyceae is 19.50%,while Bacillariophyceae is 23.5%,and Euglenophyceae is 9.9%.in the year 2015-16. This study indicates Cyanophyceae was the most dominating group in the present lake. The diversity indices of the phytoplankton were found using “PAST” software.

KEYWORDS: Phytoplankton diversity; Diversity indices; Pardeswadi lake.

INTRODUCTION

The planktonic study is a very useful tool for the assessment of water quality in any type of water body. Plankton occurs in all natural water as well as in artificial impoundments like ponds, tanks, reservoirs, irrigation cannels, etc. Phytoplankton being the primary producer from the lowest tropic level in the food chain of fresh water ecosystem and plays a key role in fish culture.

The number of species of phytoplankton serves to determine the quality of water body. The structure of aquatic community is important in monitoring the water quality.[1-3] The influence of man on the water bodies caused by disposal of sewage and industrial waters, use for defecation, cultural activities, and agriculture chemicals greatly increased the quantity of nutrients and organic input into a water body.[31,32] Some important studies on phytoplankton diversity have been made by.[4-7] Considering ecological, economical and recreational promise of the water body, present work was undertaken to assess water quality in terms of seasonal diversity and population density of Phytoplankton. In the present study attempt was made to study eco-sustainability of Pardeswadi lake in waluj midc, aurangabad maharashtra, india, by studying phytoplankton quantification and their seasonal abundance and diversity to indicate the sustainability of water from drinking point of view.

MATERIALS AND METHODS

Study Site

The Pardeswadi lake is 0.5km from RAMRAI (PARDESWADI)village toWest, 0.5 km from JOGESWARI to North, 1.0 km from KAMLAPUR to East, and 1.5 km from WALUJ(Aurangbad-Pune highway) to South and about 22 km from Aurangabad city.

The present study was done for the lake) which is situated in WALUJ MIDC, AURANGABAD area and its geographical coordinates are 19°54' 0" North, and 79°29' 0" East.

Sampling

The water samples for phytoplankton analysis were collected from the lake from four sampling stations(A, B, C, and D) were selected after survey such as NORTH, SOUTH, EAST and WEST respectively, of the lake area. the phytoplankton sampling on monthly basis was carried out for a period of two year from FEB. 2014 to JAN. 2016 from the lake water. The samples were collected monthly in the morning between 9.00 a.m. to 11.30 a.m.

For qualitative analysis a compound microscope was used. Standard key and other literature was used for identification of different species.[20,30] The analysis of samples was carried out in the research laboratory in Dept. of Zoology, Dr. Babasaheb Ambedkar Marathwada University Aurangabad(M.S). The Collection of phytoplankton samples was made by sieving 25 litres of habitat water from approximately 10 - 12 cm below the surface level passed through a 25 µm mesh net and the collected samples were transferred to 1litre capacity plastic bottles. Then the samples which were collected, was allowed to centrifuge to concentrate and made up to 100ml after removing the surface water in the centrifuging tube. The population of plankton accumulated in the container were then transferred to other bottle and immediately preserved in Lugol's Iodine solution, labeled and then transferred to laboratory for further experimentation. Each sample was stirred smoothly just before microscope examination. One ml from agitated sample was transfer to a Sedge-wick Rafter counting cell with a wide mouth graduated pipette. The abundance of plankton was estimated by counting their presence per focus of the microscopic field. Plankton were identified by using the keys.[9-11]

RESULTS AND DISCUSSION

In the present study among the group of phytoplankton's the Cynophyceae were recorded maximum followed by Bacillariophyceae, Chlorophyceae and Euglenophyceae (Table-1). In summer, monsoon and winter at all stations the Cynophyceae was maximum followed by Bacillariophyceae, Chlorophyceaeand Euglenophyceae is minimum. Some plankton population disappeared at a specified period and reappeared during other period. This disappearance may be due to the fact that some species occur in spores, under favorable conditions spore germinate and appear as plankton.[23] In the present study it is observed that 12genera of Cynophyceae, 6 genera of Bacillariophyceae,7 genera of Chlorophyceae and 2 genera of Euglenophyceae were found. Anabaena, Nostoc, Oscillatoria and Aphanizomenon species were dominant from Cynophyceae probably due to favourable environmental conditions.[27,38,33] Low phytoplankton's especially Euglenophyceae was observed to be less in quantity in almost all the stations during all the seasons.[36] The Cynophyceae was maximum in summer54% (Site-B)and minimum in monsoon 40.30% (Site-A). The Bacillariophyceae was maximum in summer 24% (Site-C) and minimum in monsoon20.2% (Site-A). The Chlorophyceae was maximum in winter 19.90% (Site-A) and minimum in monsoon 15.30% (Site A&B). The Euglenophyceae was maximum in summer 10% (Site-B) and minimum in monsoon 7.9% (Site-C).

The production of phytoplankton is directly correlated with phosphate, as well as nitrogen[22] Cynophyceae are found generally on rocks or soil forming a blackish crust when dried out. It contains Chlorophyll a Phycobicyanin and other pigments help the algae to synthesize their own food from carbon dioxide and water in presence of sunlight.[21]

In the present study, Euglenophyceae was found to be maximum in summer and minimum in winter water in almost all stations due to sufficient amount of nutrients.[34] The temperature ranged 28-35^{0}C, low pH are also favorable factors for the growth of Euglenophyceae[21,22,34] This study will help in understanding the amount of toxic compounds being received in lake and its biological magnification in animals particularly those at the lower level of food chain. This study will also help to make aware the local peoples for proper management of waste disposal and also to minimize the waste land and its biological magnification of toxic materials due to toxic compounds in food chain, which is a challenge to scientists, policy makers, administrators and all those involved in the conservation of the environment. Thus there is need to stop these ecologically destructive developments in the lake and its environment.

Conservation of the fresh water bodies must be considered as prime duty of the State and the citizens of the Country. The lake and river must be conserved at any cost for the benefit of the present and future generations. Nature and its contributions to a good quality of life are often perceived and valued by people in different and often conflicting ways.

Phytoplankton are at the base of aquatic food webs and of global importance for ecosystem functioning and services. The dynamics of these photosynthetic organisms are linked to annual fluctuations of temperature, water column mixing, resource availability and consumption.

Studies on the ecology of lake, phytoplankton have provideda wealth of insight into the interactions between abiotic factors and biotic ones such as competition and predation. Some workers have published there work on aquatic environment and ecology of phytoplankton in frsh water.[24,26,28,29,34,39] The Present plankton study is useful tool for the assessment of biotic potential and contributes to overall estimation of basic nature and general economic potentials of the water body[8]

Graph 1 to 8 shows the percentage composition of phytoplankton species in Pardeswadi lake during the study period of 24 month from Feb.2014 to Jan. 2016.

The above data were subjected to a software program "PAST" which generates nine diversity indices namely Dominance D, Shannon H, Simpson, Evenness, Menhinick, Margalef, Equitability J, Fisher alpha and Berger-Parker. As diversity increases index value gets smaller [Dominance index is a simple measure of the numerical importance of the most abundant species. The Dominance index in the present study indicates that Pardeswadi lake at site B (0.3654) has the highest dominance and at site A (0.3386) has the least dominance of planktonic species during year 2014-15.Where as at site D (0.3502) has the highest dominance and at site A (0.3098) has the least dominance of planktonic species during year 2015-16.

Shannon and Weiner index represents entropy. It is a diversity index into account the number of individuals as well as the number of taxa.[14] This index can also determine the pollution status of a water body. Normal values range from 0 to 4. Wilham and Dorris concluded that the values of the index greater than 3 indicate clean water, values in the range of 1 to 3 are characterized by moderate pollution and values less than 1 characterized as heavily polluted.[15] According to this index, Pardeswadi lake (1.229) moderately polluted.

The Simpson's index is often used to quantify the biodiversity of the habitats. According to Simpson's index species are not evenly distributed. The values range from a minimum of 0.6346 at site B and maximum 0.6902 at site A during year 2014-16.

The Pielou's evenness index states that species evenness is diversity index, a measure of diversity that quantifies how the distribution of the community is equally.[16] The Evenness in Pardeswadi Lake was (0.8464) during the study year.

Menhinick's and C indices measure richness of species in an ecosystem. During study period, Menhinick's index is low at site B (0.126) and reaches a high value of 0.1331 at site A, where as Margalef's index is low (0.433) at site D and reaches a high value of 0.4408 at site A in Pardeswadi Lake.

The Equitability index is a measure of the evenness with which individuals are divided among the texa present. Equitability takes the values between 0 and 1, with 1 being complete

evenness. The index when applied to the present study indicates that Pardeswadi Lake has 0.9166.

Fisher's alpha index is a mathematical calculation for determining diversity within a population.[17] It represented the first attempt to describe mathematically the relationship between the number of species and the number of individuals of those species. The index is very low in Pardeswadi Lake (0.5286) at site D and is highest 0.5387 at site A during the study period. This indicates the abundance of species in the lake.

Berger-Parker dominance index is the number of individuals in the dominant texon divided by number of individuals (n).[18,19] The values are high in Pardeswadi lake (0.5357) at site B and is least (0.4463) at site A during study year 2014-16.

Table 1.Seasonal variation of phytoplankton (organism/lit.) during Feb 2014- Jan 2016.

year		2014-2015						2015-2016					
Site	**Order/season**	**Summer**	**Monsoon**	**Winter**	**Total**	**Average**	**%**	**Summer**	**Monsoon**	**Winter**	**Total**	**Average**	**%**
	Cynophyceae	286	76	91	453	151	45.3	250	47	106	403	134..33	40.3
	Chlorophyceae	56	30	72	153	51	15.3	95	37	67	199	66.33	19.9
A	Bacill.phyceae	104	26	93	223	74.33	22.3	79	48	75	202	67.33	20.2
	Eugle.phyceae	55	6	30	91	30.33	9.1	45	29	25	99	33	9.9
	Average	125.25											
	Cynophyceae	332	103	105	540	180	54	316	44	111	471	157	47.1
	Chlorophyceae	55	28	70	153	51	15.3	90	33	72	195	65	19.5
B	Bacill.phyceae	107	27	81	215	71.66	21.5	81	43	90	214	71.33	21.4
	Eugle.phyceae	58	10	32	100	33.33	10	61	09	21	91	30.33	9.1
	Average												
	Cynophyceae	331	85	97	513	171	51.3	295	39	127	461	153.66	46.1
	Chlorophyceae	66	24	79	169	56.33	16.9	73	38	74	185	61.66	18.5
C	Bacill.phyceae	108	28	104	240	68	24	76	38	92	206	68.66	20.6
	Eugle.phyceae	55	6	35	96	32	9.6	44	10	25	79	26.33	7.9
	Average												
	Cynophyceae	344	89	102	535	178.33	53.5	330	43	129	502	167.33	50.2
	Chlorophyceae	60	29	71	160	53.333	16	56	33	85	174	58	17.4
D	Bacill.phyceae	105	30	101	236	78.66	23.6	84	49	102	235	78.33	23.5
	Eugle.phyceae	53	3	34	90	30	9	45	08	27	80	26.66	8
	Average												

Table no. 2: Total Number and Percentage of Phytoplankton(Organism/ litter) of Pardeswadi lake.

Year site	Order	2014-15		2015-16	
		Total No.Of Individuals	Percentage %	Total No.Of Individuals	Percentage %
	Cynophyceae	920	45.3	903	40.3
A	Chlorophyceae		15.3		19.9
	Bacillariophyceae		22.3		20.2
	Euglenophyceae		9.1		9.9
	Cynophyceae	1008	54	971	47.1
B	Chlorophyceae		15.3		19.5
	Bacillariophyceae		21.5		21.4
	Euglenophyceae		10		9.1
	Cynophyceae	1018	51.3	931	46.1
C	Chlorophyceae		16.9		18.5
	Bacillariophyceae		24		20.6
	Euglenophyceae		9.6		7.9
	Cynophyceae	1021	53.5	991	50.2
D	Chlorophyceae		16		17.4
	Bacillariophyceae		23.6		23.5
	Euglenophyceae		9		8

Table no.3: Diversity Indises of Pardeswadi Lake.

Year	2014-15				2015-16			
Index/site	A	B	C	D	A	B	C	D
Texa-sp.	4	4	4	4	4	4	4	4
Individuals	920	1008	1018	1021	903	971	931	991
Dominance-d	0.3386	0.3654	0.346	0.3603	0.3098	0.333	0.3408	0.3502
Simpson-1-d	0.6614	0.6346	0.654	0.6397	0.6902	0.667	0.6592	0.6498
Shannon-h	1.22	1.179	1.207	1.182	1.271	1.229	1.212	1.194
Evenness-e^h	0.8464	0.813	0.8357	0.815	0.8908	0.854	0.8402	0.8254
Menhinick	0.1319	0.126	0.1254	0.1252	0.1331	0.1284	0.1311	0.1271
Margalef	0.4396	0.4338	0.4332	0.433	0.4408	0.4362	0.4388	0.4349
Equitability	0.8797	0.8507	0.8705	0.8524	0.9166	0.8862	0.8744	0.8616
Fisher_alpha	0.5372	0.5297	0.5289	0.5286	0.5387	0.5327	0.5362	0.531
Berger-parker	0.4924	0.5357	0.5039	0.524	0.4463	0.4851	0.4952	0.5056

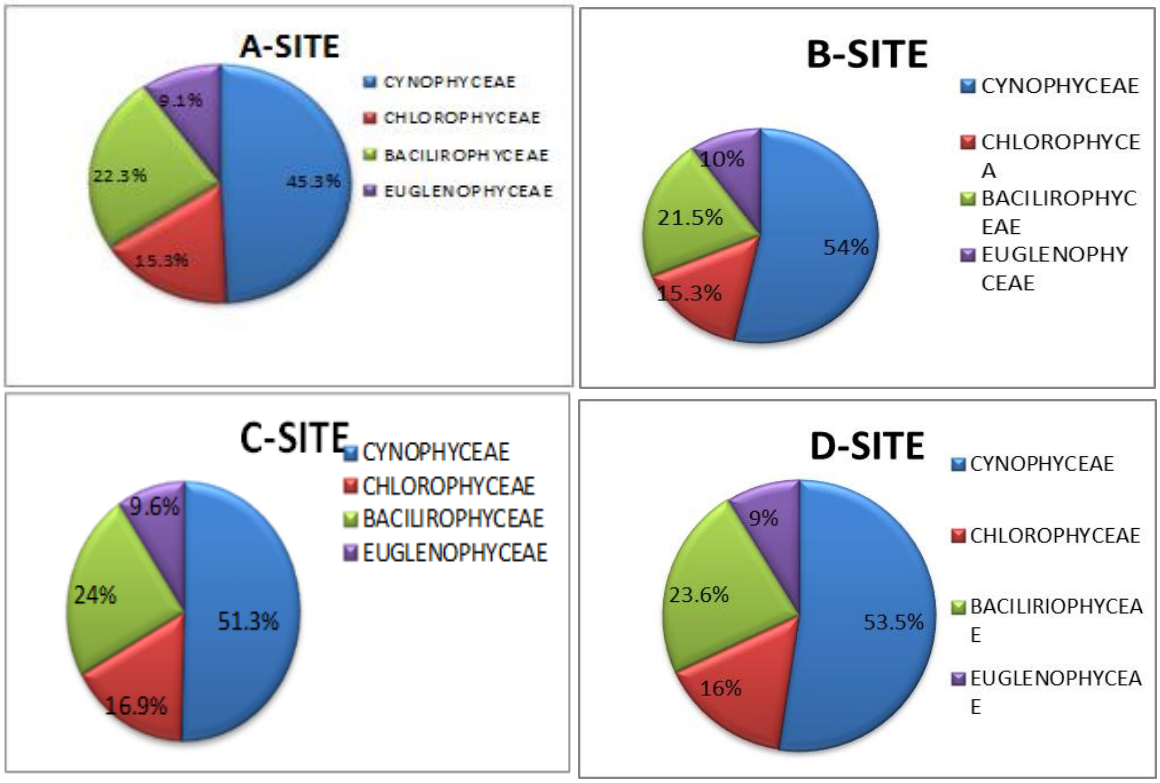

FIG.1 PI chart shows percentage of phytoplankton at pardeswadi lake during feb14-jan15.

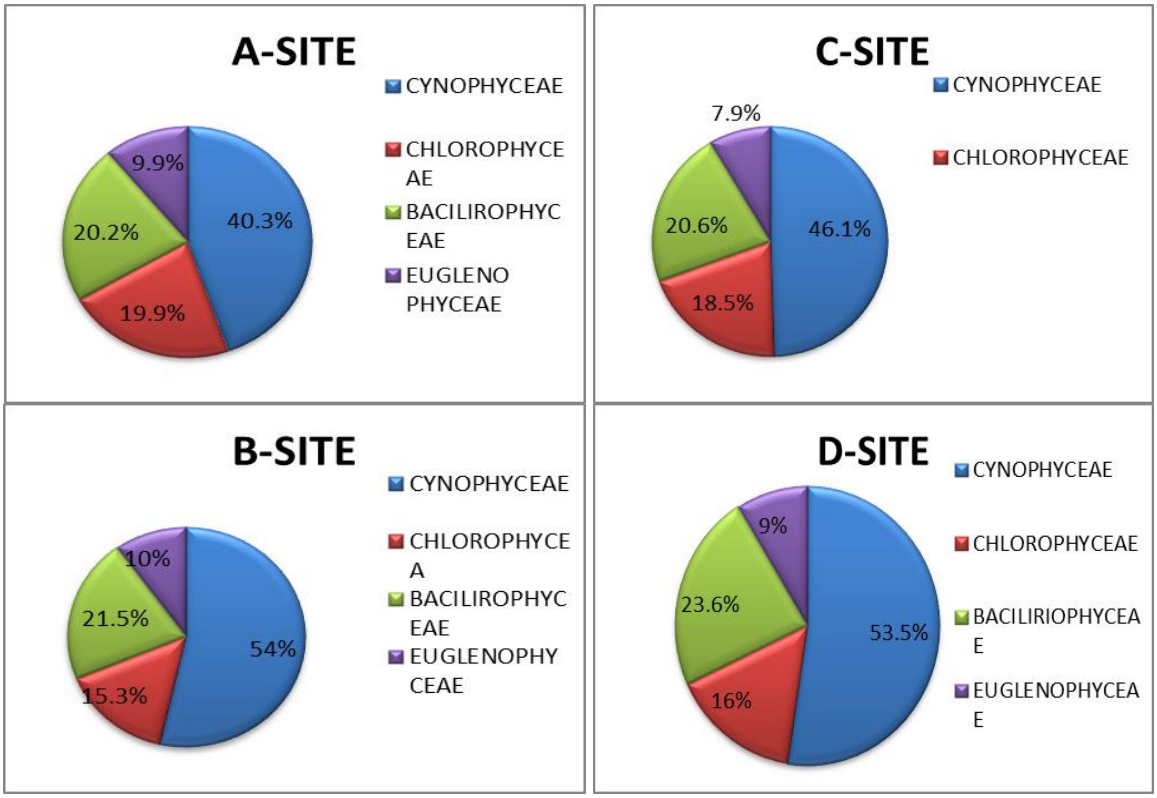

FIG.2 PI chart shows percentage of phytoplankton at pardeswadi lake during feb15-jan16.

CONCLUSION

Diversity measures are more useful in Lake Ecosystem, which harbor a large variety of algal species in general and species diversity within genera. Calculating the diversity indices during this period indicated that Pardeswadi lake had the richness of phytoplankton species. The role of phytoplankton species and their assemblage as bio-indicators reflected the pollution status of the study lake. The pollution indicator species are present in the Pardeswadi lake. Hence environmental monitoring makes use of the fact that polluted or stressed communities are characterized by a change in the species abundance.

ACKNOWLEDGEMENT

We are thankful to Dr. C. A. Jawale, Shri Madhavrao Patil Mahavidyalaya, Murum,Tq. Omerga, Dist. Osmanabad to guide us for our work and Head of the Dept. of Zoology, Dr.Babasaheb Ambedkar Marathwada University, Aurangabad(M.S.) India to give us laboratory facility.

REFERENCES

1. Ningule K.B, Ustad IR Study of some environmental factors and diversity of phytoplankton in Godavari river at, 2016.
2. Huisman J, Weissing FJ Competition for nutrients and light in a mixed water column: A theoretical analysis. Am Nat, 1995; 146(4): 536-564.
3. Klausmeier CA, Litchman E. Algal games: The vertical distribution of phytoplankton in poorly mixed water columns. Limnol Oceanogr, 2001; 46(8): 1998-2007.
4. Diehl S. Phytoplankton, light, and nutrients in a gradient of mixing depths: Theory. Ecology, 2002; 83(2): 386-398.
5. Ariyadej C, Tansakul R, Tansakul P, Angsupanich, Saowapa Phytoplankton Diversity and its Relationships to the Physico-Chemical Environment in the Banglang Reservoir, Yala Province, Song Klanakarin J Sci Technol, 2004; 26(5): 595-607.
6. Mishra BB, Chaturvedi GB, Tewari DD Phytoplankton Fluctuatuations under the Stress of Abiotic Factors at Kohargaddi Dam, Balrampur. J Exp Sci., 2010; 1(5): 22-24.
7. Joshep B, Yamakanamardi MS Monthly Changes in the Abundance and Biomass of Zooplankton and Water quality Parameter in Kukkarahalli Lake of Mysore, India. J Environ Biol., 2011; 32(5): 551-557.
8. Pawar SK, Pulle JS, Shendge KM The Study on Phytoplankton of Pethwadaj Dam. Tq. Kandhar, Dist. Nanded, Maharashtra. J Aqua Boil, 2006; 21(1): 1-6.

9. Lloyd M, Ghelardi RJ A table for calculating the "equitability'' component of species diversity. J Animal Ecol, 1964; 33(2): 217-225.
10. Needham JG, Needham PR A guide to the freshwater biology. 5th (Edn.), Holden day Inc. San. Fransisco, Calif, 1966; 108.
11. Bhouyain AM, Asmat SM Freshwater Zooplankton from Bangladesh, 1st (Edn.), Gazi Publishers, 37, Banglabazar, Dhaka, Bangladesh, 1992; 137.
12. Ali S and T Chakrabarty Bangladesher Mitha Panir Amerudandi Prani (A book of freshwater invertebrates of Bangladesh), 1st (Edn.), Bangla Academy, Dhaka Bangladesh, 1992; 207.
13. Hammer O, Harper DA, Rayan PD PAST: Palentological Statistics software package for Education and Data Analysis. Palaenotological Electronica, 2001; 4(1): 4-9.
14. Shannon CE, Weiner V. A mathematical Theory of Communication. University Press Illinois Urban, 1949; 101-107.
15. Wilham JL, Dorris TC Biological Parameters of water Quality Criteria. Bioscience, 1968; 18(6): 447-481.
16. Pielou EC Ecological Diversity. John Wiley and Sons newyork, 1975; 165.
17. Fisher RA, Corbert AS, Williams CB The relation between the numbers of species and the number of individuals in a random sample of an animal population. J Anim Ecol, 1943; 12(1): 42-58.
18. Berger WH, Parker FL Diversity of Planktonic Foraminifera in deep sea Sediments. Sci., 1970; 168(3937): 1345-1347.
19. Díaz S, Demissew S, Joly C, Lonsdale WM, Larigauderie A. A Rosetta Stone for Nature's Benefits to People. PLoS Biol., 2015; 13(1): e1002040.
20. 20.Auti, R.G.: Seasonal variations in the water characteristicks and micro faunal distribution in Salim Ali Lake near Delhigate, Aurangabad. Ph.D. Thesis. Dr. BAMUniv.A' bad. 2003; 1-239.
21. Bhadran, G.: The plankton population of Asramam Creek of Ashtamudi Lake in Kerla, south India. J. Aqua. Biol., 2001; 19(1): 13.
22. Borse S.K. and Bhave: Seasonal temperature variation and its influence on the level of dissolved oxygen and pH in Aner River, Jalgaon, Asia J. Micr. Birotech & Env. Sc., 2000; 2(3-4): 159-163.
23. Dahiwale B.J. Diversity of Benthic macro invertebrates with respect to hydrobiological Characteristics of Sukhana Dam near Aurangabad. Ph.D. Thesis, BAMUniversity, Aurangabad, 2008.

24. Dwivedi B. K. and G. C. Pandey. Physico-chemical factors and algal diversity of two ponds (Jinja Kund and Maqubara pond), Faizabad, India, Poll. Res., 2002; 21(3): 361-370.
25. Jadhawar, V.R, Ghorade, I.B and Patil, S.S: Assessment of Groundwater Quality in And Around Nagothane Region Dist. Raigad, Maharashtra. J.Aqua. Biol. Ref: B-07: water qurt, 2010; 25(2): 91-99.
26. Khan A. M. Physico-chemical characteristics of Vishnupuri dam water with special reference to plankton, Ph. D.thesis, Marathwada University, Aurangabad, 1992.
27. Kumawat, D.A. and Jawale, A.K.: Phytoplankters of a fish pond at Anjale, Maharashtra. Eco-Env. and Cons, 2003; 9(3): 411-415.
28. Mazher Sultana and Dawood Sharief Water pollution studies in the double lake (Frretaleri) with relation to phytoplankton. J. Aqua. Biol., 2004; 19(1): 15-18.
29. More Y. S. and S. N. Nandan Hydrobiological study of algae of Panzara dam (Maharashtra), Eco. Env. and Cons, 2003; 9(3): 367-369.
30. Patil, S.S., Auti, R.G. and Mokashe, S.S. Conservation and management of Slaim Ali Lake Aurangabad. Proc. Of Taal 2007: 12th World Lake Conf, 2008; 1614-1622.
31. Patil, S.S. & Ghorade, I.B: Management of Water & Eco-sustainability Assessment of Godavari River from Maharashtra State for Sustainable Utilization". Indian Journal of Applied Research. Ref., Nov. 2011; 1(2): 19-22.
32. Patil S.S. and Ghorade I.B.: Phytoplankton diversity from Godavari river water (Maharashtra). Indian Journal of Applied Research, 2012; I(4): 112-114
33. Pawar, B.A. and Mane, U.H.: Hydrography of sadatpur lake near Pravaranagar, Ahmednagar district, Maharashtra. J. Aqua. Biol. Vol, 2006; 21(1): 101-104.
34. Pendse D.C., Yogesh Shastry and Barhate): Hydrobiological study of percolation tank of village Dasane. Ecol. Env. And Cons, 2000; 6(1): 93-97.
35. Sirsat D. B., Ambore N. E. and Pulle J. S. Study of phytoplankton of fresh water pond at Dharmapuri in Beed District (Maharashtra), J. Aqua. Biol. Vol., 2004; 19(2): 7-10.
36. Somani V.U. and Pejaver M.K.: Dynamics of chlorophyceae in phytoplankton of lake Masunda, Thane (M.S.). J. Aqua. Biol., 2003; 18(2): 21-25.
37. Trivedi, R.K. andGoel, P.K. Chemical and biological methods for water pollution studies. Environmental Publications Karad, India, 1987.
38. Yeole S.M. and Patil G.P.: Physico-chemicalstatus of Yedshi lake in relation to water poll ution, J. Aqua. Biol. Vol., 2005; 20(1): 41-44.

39. Yogesh Shastri, Barhat V. P. and Bhogaonkar Hydrobiological studies of a percolation tank : II Algal Flora, J. Aqua. Biol., 1999; 14(1 and 2).