A SEASONAL VARITIONS OF PHYTOPLANKTON IN VALVAN LAKE (MS), INDIA

S.S. Pokale
Department of zoology, Dr.B.N. Purandare Arts, Smt. S.G. GuptaCommerce and Science College, Lonavala -410.403.Maharashtra, India
(Affiliated to Savitribai Phule Pune University)

Received: June 24, 2018 Accepted: August 16, 2018

ABSTRACT *Among the biotic communities in an aquatic system phytoplankton from a majority by virtue of their capacity to transfer the solar radiant energy into thebiological energy by the process of photosynthesis.A study was carried out in Valvan Lakeon phytoplankton diversity in different seasons during 2015-2016. The Valvan Lake is predominantly a fresh water body located within MavalTahsil,Pune, Maharashtra. The four major groups of phytoplankton studied are Chlorophyceae, Cyanophyceae, Bacillariophyceae and Euglenophyceae.During this investigation, phytoplankton showed abundant growth in winter and sparse in monsoon.*

Keywords: *Seasonal, Phytoplankton, Valvan Lake*

INTRODUCTION

Phytoplanktons are the autotrophic component in an aquatic system. They are the primary producers of an aquatic ecosystem and form the principal level of the aquatic food chain. Phytoplankton form food for zooplankton, fishes and other aquatic animals. They also play in important role by regulating the level of dissolved oxygen which is a necessary gas for aquatic life (Sudhakara, 2012). In a fresh water body,phytoplanktons consist of macroscopic and microscopic suspended or free floating non- motile or weekly motile unicellular, colonial or filamentous algae. Algae are used to assess the ecological health of aquatic habitats.Ryder, *et.al.,* (1974) observed majority of members belong to Chloropyceae, Cyanophyceae, Bacillariophyceae and Euglenopyceae.

Phytoplanktonsfrom the base of most of the foot web chain in Lakes and fish productions is linked to phytoplanktons production. The number and species of phytoplankton are helpful in determining the quality of the water body. Phytoplankton are very sensitive to eutrophication and are therefore useful for detection of eutrophication of water and it`s adverse impact on the aquatic ecosystem and play in important role in regulating the dynamics of the aquatic food web and become a driving force in shaping the community structure of zooplanktons (Xie, *et.al.,* 1998). Phytoplanktons, diversity, biomass, density, seasonal variation and species distribution have been largely affected by a number of abiotic properties of water, water body morphology, sewage discharge and human activities.

MATERIAL AND METHOD

The water samples were collected from the four sites of Lake such as site A, site B, site C and site D. The samples were collected in the morning hours between 8.30 a.m. to 10.30 a.m. 50 ltr. of water sample was filtrated through the plankton net made of bolting silk number 25 with mesh size 64 lime. The collected samples were allowed to settle down by adding Lugol's iodine. Sedimentation requires 24 hrs after which supernatant was removed and concentrate was reduced to 50 ml depending the number of plankton and preserved in 5% formalin for further studies. For the quantitative study, the concentrated sample was shaken and one drop of sample was taken on a clear micro slide with the help of a standard dropper, the whole drop was carefully covered with the cover glass and observed. Plankton identification up to genera and whenever possible up to species level was classified according to keys given by Edmonson (1959), Adoni (1985) and APHA (1985) and standard analysis was undertaken as per Zar (2005).

Quantitative study of plankton was done by Sedgwick – Rafter Cell method.

The Sedgwick Rafter Cell is a special kind of slide similar to the Hemocytometer. The cell has a 50mm x 20 mm x 10 mm rectangular cavity that holds 1 ml sample. The cell is moved in horizontal directions on the stage of an inverted microscope and planktonic species encountered in the field are enumerated. A number of replicate samples are enumerated to calculate plankton / ltr.

Plankton (Units /ltr.) = n x c /v

Where, n= number of planktons in 1 ml.
c = volume of concentrate.
v = volume of sample in liters.

DISCUSSION AND RESULT: -

During the present investigation, maximum phytoplankton density was recorded in site A and minimum in site C and site D followed by site B. The present study also exhibited phytoplankton's showring a maximum growth in winter and minimum in monsoon in all four sites A, B, C and D of the lake. Maximum density of phytoplankton during winter season have also been observed by Chakraborty, *et.al.,* (1959) and Pahwa and Mehrotra (1966) in the rivers Ganga and Yamuna.

The four major groups of phytoplankton studied are Chlorophyceae, Cyanophyceae, Bacillariophyceae and Euglenophyceae. Among these four groups Chlorophyceae was dominant in site A and site B, site C and site D of ValvanLake. During the present investigation phytoplankton showed abundant growth in winter and minimum in monsoon in all four sites A, B, Cand D of the Lake. Palmer (1969) has noted that the genera like Euglena, Oscillatoria, Scenedesmus, Microcystis, Navicula and Chlorella were found in organically polluted water, and agreed with the investigation conducted by Goel, *et.al.,* (1985) and similar genera were recorded during the present study.

AT SITE A:

Of the four Phytoplankton studied ,20 species of Chlorophyceaewere recorded, among which *Ankistrodesmus* sp. (398 no./ltr) was dominant followed by *Cladophora* sp. (376 no./ltr.),*Pleurodiscus* sp. (103 no./ltr.), *Netriumdigitus* (96 no./ltr.), *Pediastrum tetras* (89 no./ltr.), *Staurastrum* sp. (86 no./ltr.), *Nitella* (82 no./ltr.), *Trochisciapachyderma* (79 no./ltr.), *Chlorella* sp. (345 no./ltr.), *Chara* sp. (176 no./ltr.), *Cosmariumgranatum* (179 no./ltr.), *Coelastrumchodati* (184 no./ltr.), *Chlamydomonas* sp. (176 no./ltr.), *Spirogyra* sp. (165 no./ltr.), *Hydrodictyon* sp. (99 no./ltr.),*Cylindrospermum* sp. (64 no./ltr.), ,*Micrasteriaspinnatifida* (23 no./ltr.). *Micrasteriaspinnatifida* (43 no./ltr.), *Closteridiumlinula* (28 no./ltr.), *Goniochloris* sp. (49 no./ltr.),

10 species of Bacillariophyceae, were recorded among which Synedra ulna (587 no./ltr.) was dominant followed by *Pinnularia* sp. (244 no./ltr.),*Navicularadiosa* (164 no./ltr.), *Bacillariaparadoxa* (98 no./ltr.),*Anomoeoneissphaerophora* (74 no./ltr.), *Pinnularia* sp. (35 no./ltr.),Nitzschia*sigmoidea* (67 no./ltr.), *Cocconeisplacentula* (69 no./ltr.), *Diotoma* sp. (34 no./ltr.) and *Gyrosigmakutzingii* (64 no./ltr.),

3 species ofEuglenophyceae, were recorded among which *Phacus* sp. (763 no./ltr.) which was dominant followed by *Euglena acus* (432 no./ltr.) and *Peranematrichophorum* (108 no./ltr.).

7 speciesof Cynophyceae, were recorded among which *Microcystis* sp. (218 no./ltr.) was dominant followed by *Oscillatoria* sp. (143 no./ltr.), *Agmenellumquadruplicatum* (89 no./ltr.), *Anabaena* sp. (64 no./ltr.),*Gleotrichiaechinulata* (136 no./ltr.), *Nostoc* sp. (103 no./ltr.), and Anacys*tiscyanea* (78 no./ltr.)

SITE B:

14 species of Chlorophyceae,were recorded among which *Ankistrodesmus* sp. (284 no./ltr.) were dominant followed by *Chlorella* sp. (178 no./ltr.), *Cosmariumgranatum* (148 no./ltr.), *Chara* sp. (85 no./ltr.), *Nitella* sp. (66 no./ltr.), *Goniochloris* sp. (49 no./ltr.), *Goniochloris* sp. (33 no./ltr.), *Micrasteriaspinnatifida* (32 no./ltr.), *Chlamydomonas* sp. (68 no./ltr.), *Pediastrum tetras* (69 no./ltr.), *Coelastrumchodati* (27 no./ltr.), *Netriumdigitus* (76 no./ltr.), *Euastropsisrichteri* (64 no./ltr.), and *Pleurodiscus* sp. (73 no./ltr.)

9 species of Bacillariophyceae, were recorded among which *Synedra ulna* (390 no./ltr.) was dominant followed by *Navicularadiosa*(150 no./ltr.), *Rhopalodiagibba*(132 no./ltr.), *Anomoeoneissphaerophora* (57 no./ltr.),*Gyrosigmakutzingi* (63 no./ltr.), Nitzschia*sigmoidea* (53 no./ltr.), *Diatoma* sp. (29 no./ltr.),*Bacillariaparadoxa* (79 no./ltr.) and *Cocconeisplacentula* (66 no./ltr.)

3 species of Euglenophyceae, were recorded*Phacus* sp. (563 no./ltr.) among which was dominant followed by *Peranematrichophorum* (247 no./ltr.) and *Euglena acus* (210 no./ltr.).

4species of Cynophyceae, were recorded among which *Microcystis* sp. (302 no./ltr.) was dominant followed byNostoc sp. (230 no./ltr.), *Oscillatoria* sp. (143 no./ltr.), and *Agmenellumquadruplicatum* (65 no./ltr.)

AT SITE C:

17 species of Chlorophyceae, were recorded among which Cladophora (296 no./ltr.) was dominant followed by *Ankistrodesmus* sp. (282 no./ltr.), *Chorella* sp. (246 no./ltr.), *Coelastrumchodati* (129 no./ltr.), *Goniochloris* sp. (63 no./ltr.), *Gloeocystisgigas* (51 no./ltr.), *Spirogyra* sp. (74 no./ltr..), *Nitella* sp. (70 no./ltr..), *Troschisciapachyderma* (62 no./ltr.), *Chlamydomonas* sp. (78 no./ltr.), *Closteridiumlinula* (73 no./ltr.), *Chlorococcumhumicola* (84 no./ltr.), *Chara* sp. (69 no./ltr.), *Pleurodiscus* sp. (66

no./ltr.),*Hydrodictyon* sp. (53 no./ltr.), *Pediastrum tetras* (50 no./ltr.), and *Microsteriaspinnatifida* (31 no./ltr.).

8 species of Bacillariophyceae, were recorded among which *Synedra ulna* (507 no./ltr.) was dominant followed by *Rhopaldiagibba* (263 no /ltr.), *Navicula* (98 no./ltr.), *Bacillariaparadoxa* (78 no./ltr.),*Nitzschiasigmoidea* (64 no./ltr.) Cyclotella sp. (35 no./ltr.)*Anomoeoneissphaerophora (*49 no./ltr.) and*Gyrosigmakutzingii* (37 no./ltr.).

7 species of Cynophyceae, were recorded among which *Microcystis* sp. (230 no./ltr.) was followed by *Oscillatoria* (186 no./ltr.), *Nostoc* sp. (140 no./ltr.), *Anabaena* sp. (68 no./ltr.), *Gleotrichiaechinulata* (154 no./ltr.), *Coelastrumpolychordum* (63 no./ltr.) and Spirulina sp. (45 no./ltr.).

2 species of Euglenophyceae were, recorded among which *Phacus*sp.(390 no./ltr.)was followed by *Euglena acus* (251 no./ltr.).

AT SITE D:

16 species of Chlorophyceae, were recorded among which Cladophora (301 no./ltr.) was dominant followed by *Ankistrodesmus* sp. (291 no./ltr.), *Chorella* sp. (254 no./ltr.), *Microsteriaspinnatifida* (33 no./ltr.), *Chara* sp. (59 no./ltr.), *Pleurodiscus* sp. (53 no./ltr.),*Hydrodictyon* sp. (47 no./ltr.),*Coelastrumchodati* (120 no./ltr.), *Goniochloris* sp. (61 no./ltr.), *Gloeocystisgigas* (51 no./ltr.), *Spirogyra* sp. (67 no./ltr..), *Nitella* sp. (65 no./ltr..), *Troschisciapachyderma* (61 no./ltr.), *Chlamydomonas* sp. (75 no./ltr.), *Chlorococcumhumicola* (80 no./ltr.), and *Closteridiumlinula* (76 no./ltr.).

8 species of Bacillariophyceae, were recorded among which *Synedra ulna* (511 no./ltr.) was dominant followed by*Rhopaldiagibba* (269 no /ltr.),*Navicula* (261no./ltr.), *Bacillariaparadoxa* (75 no./ltr.),*Nitzschiasigmoidea* (61 no./ltr.) Cyclotella sp. (39 no./ltr.) ,*Gyrosigmakutzingii* (34 no./ltr.) and *Anomoeoneissphaerophora (*42 no./ltr.).

6 species of Cynophyceae, were recorded among which *Microcystis* sp. (246 no./ltr.) was followed by *Nostoc* sp. (191 no./ltr.),*Oscillatoria* (176 no./ltr.), *Anabaena* sp. (71 no./ltr.), *Coelastrumpolychordum* (68 no./ltr.) and *Gleotrichiaechinulata* (54 no./ltr.).

2 species of Euglenophyceae were, recorded among which *Phacus*sp.(388 no./ltr.)was followed by *Euglena acus* (231 no./ltr.).

The presence of pollution indicator species of chlorophyceae like *Ankistrodesmus* sp., *Spirogyra*sp shows that the site A is eutrophic and site B is moving towards eutrophication. A.B. Sarwade and N.A. Kamble (2013) observed major species as *Chlorella* sp., *Ankistrodesmus* sp., *Spirogyra* sp., in BharatnagarLake Miraj,Tahsil, Sangli Maharashtra. M.R. Abdar (2013) reported presence of organic pollution indicator algal species like *Ankistrodesmusfalcatus*, *Chlorella vulgaris* in MornaLake Shirala (M.S.).

In the present investigation, Chlorophyceae was found maximum during the winter season and minimum during the monsoon season. Jayabhaye, *et.al.,* (2007) observed maximum Chlorophyceae population during the summer and minimum during the rainy season in Parola dam Hingoli, Maharashtra. D.S. Malik and Umesh Bharti (2012) revealed that Chlorophyceae was maximum during the winter season and minimum during the monsoon season in Sahastradhara stream at Uttarakhand.

In the present investigation, Chlorophyceae was found maximum during the winter season due to high amount of dissolved oxygen and minimum during the monsoon season may be due to lower temperature and dilution due to rain water. Dissolved oxygen shows positive correlation with Chlorophyceae species.Banaker, *et.al.,* (2005) observed several pollution indicator species of Bacillariophyceae from Chandravalli tank inChitradurga, Karnataka. Aarti Devi and Neha Antal (2013) also recorded presence of water pollution indicator species as *Nitzchia* sp., *Synedra* sp., *Diatoma*sp. in a Temple pond in Birpur (Jammu and Kashmir). Jindal and Gussain (2007) observed *Naviculla* sp. and *Nitzschia*sp. as a pollution indicator species inBichollipond, Rajasthan.

In the present investigation the maximum density of Bacillariophyceae was recorded during the summer season due to high temperature as high temperature favoursa luxuriant growth of Bacillariophyceae and may be due to the site a which is rich in organic matter and minimum density of Bacillariophyceae in rainy season at site B due to sudden fall of temperature, more human activities and dilution of water by rain.

The present investigation also showsthe dominance of *Microcystis* sp. and *Oscillotoria* sp. in site A site Bsite, C site and site D shows the polluted nature of the four sites which concludes that the Lake are highly polluted.

In the present investigation, maximum Cyanophyceae were observed during the winter season and minimum during the monsoon season. Pendse, *et.al.,* (2000) recorded the maximum population of blue-green algae during winter. The present investigation also exhibitsthe maximum amount of Cyanophyceae

during the winter is due to favorablesunlight, increase in domestic sewage, human generated pollution, while minimum quantity during the monsoon is probably due to increase in water quantity.

Alam and Khan (1996) stated that the occurrence of *Euglena* sp. and *Phacus* sp. are a direct indication of beginning of pollution load because both these species are generally, considered to bedominant and tolerant genera of a polluted pond. Palmer (1969) has reported that the Euglenophyta are the biological indicators of organic pollution. In the present investigation, Euglenophyceae are greater in number in organically polluted water and water contaminated with organically rich effluents. In the present investigation the maximum Euglenophyceae during the winter season may be due favorable water temperature and minimum in rainy season due to dilution of water by rain water.

Presence of the pollution tolerant phytoplankton species shows that the Valvan Lake is highly polluted.

Table No. 1: Seasonal variation of phytoplankton in Valvan Lake at Site-A during year 2015-2016

Sr.No	Parameters	Monsoon	Winter	Summer	Total
1	Cynophyceae	103.75 ± 11.98	108.74 ± 27.29	46.35 ± 17.11	86.28 ± 8.55
2	Chlorophyceae	366.15 ± 27.11	261.15 ± 59.78	143.60 ± 11.87	256.96 ± 19.98
3	Bacillariophyceae	102.80 ± 10.07	148.65 ± 17.45	120.85 ± 29.45	124.01 ± 5.54
4	Euglenophyceae	146.08 ± 23.14	139.80 ± 31.12	74.36 ± 17.12	120.08 ± 8.22

Table No. 2: Seasonal variation of phytoplankton in Valvan Lake at Site-B during year 2015-2016

Sr.No	Parameters	Monsoon	Winter	Summer	Total
1	Cynophyceae	94.25 ± 23.06	57.59 ± 46.54	42.65 ± 16.01	64.83 ± 4.96
2	Chlorophyceae	198.21 ± 34.03	105.85 ± 37.34	38.35 ± 17.66	114.13 ± 8.60
3	Bacillariophyceae	124.45 ± 16.16	129.27 ± 25.36	19.56 ± 15.82	91.09 ± 4.41
4	Euglenophyceae	87.73 ± 23.13	109.27 ± 23.46	39.86 ± 13.12	78.90 ± 4.79

Table No. 3: Seasonal variation of phytoplankton in Valvan Lake at Site-C during year 2015-2016

Sr.No	Parameters	Monsoon	Winter	Summer	Total
1	Cynophyceae	128.68 ± 18.07	87.30 ± 68.02	41.65 ± 30.56	85.87 ± 21.22
2	Chlorophyceae	240.32 ± 49.14	134.67 ± 64.36	61.15 ± 35.77	145.38 ± 11.67
3	Bacillariophyceae	131.60 ± 21.62	118.23 ± 35.46	69.63 ± 49.21	106.48 ± 11.45
4	Euglenophyceae	59.45 ± 36.24	97.35 ± 28.89	20.27 ± 2.46	59.02 ± 5.62

Table No. 4: Seasonal variation of phytoplankton in Valvan Lake at Site-D during year 2015-2016

Sr.No	Parameters	Monsoon	Winter	Summer	Total
1	Cynophyceae	112.32 ± 11.03	110.30 ± 25.89	46.35 ± 17.12	89.65± 6.09
2	Chlorophyceae	354.35 ± 28.15	254.87 ± 56.34	159.54 ± 13.47	256.25 ± 17.78
3	Bacillariophyceae	101.21 ± 10.91	165.75 ± 16.98	120.65 ± 28.88	129.20 ± 7.44
4	Euglenophyceae	128.89 ± 25.23	158.30 ± 30.78	75.65 ± 14.56	120.94 ± 4.95

Graphical representation of Seasonal variation of parameter Cynophyceae of Phytoplankton in Valvan lake at various sites is presented below.

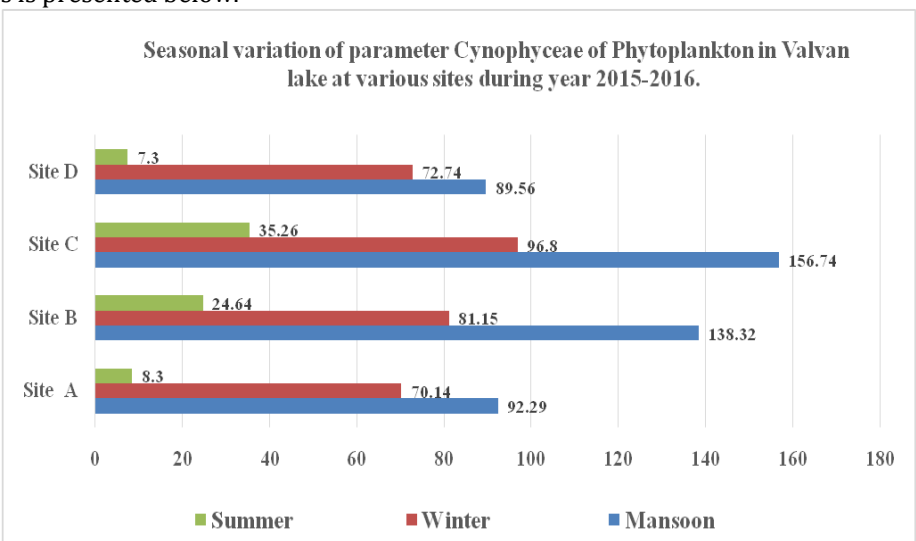

Figure 1

Graphical representation of Seasonal variation of parameter Chlorophyceae of Phytoplankton in Valvan lake at various sites is presented below.

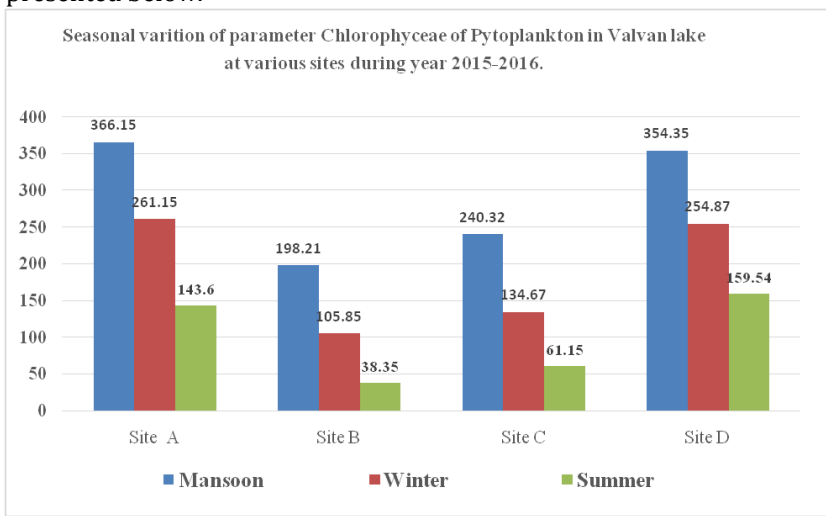

Figure 2

Graphical representation of Seasonal variation of parameter Bacillariophyceae of Phytoplankton in Valvan lake at various sites is presented below.

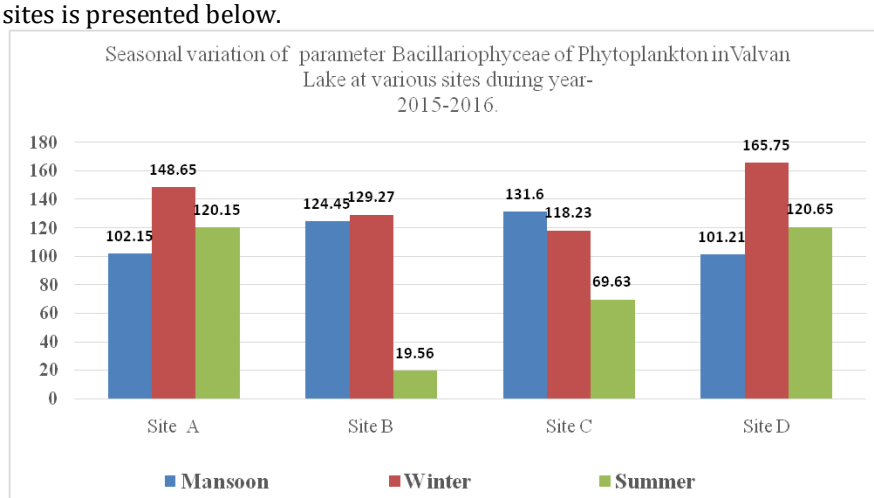

Figure 3

Graphical representation of Seasonal variation of parameter Bacillariophyceae of Phytoplankton in Valvan lake at various sites is presented below

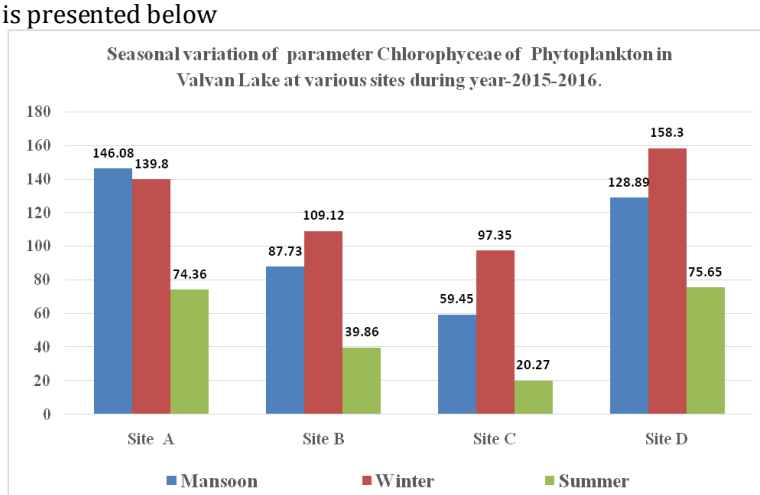

Figure 4

REFERANCES

1. Aarti Devi and Neha Antal (2013) Variation in phytoplankton diversity and its relationship with abiotic environment of a Temple pond in Birpur (JandK) India. Universal Journal of Environmental Research and Technology. Vol.3 (2): 181-189.
2. Abdar, M.R. (2013) Physico-chemical characteristics and phytoplankton of Morna lake, Shirala (M.S.), India. Biolife an international quarterly journal of biology and life science. Vol. 1 (2): 1-7.
3. Adoni, A.D. (1985) Work book on limnology, Dept. of Environment, Govt. of India, Bandana printing service, New Delhi. pp. 88.
4. Alam, A. and Khan, A.A. (1996) Dynamics of plankton communities in four freshwater lentic ecosystems in relation to varying dominant biota. Poll. Res., Vol. 15 (3): 287- 291.
5. APHA (1985) Standard Methods for the Examination of Water and Waste Water, American Public Health Association, New York. 16th Edition.
6. Banakar, A.B., Manjappa, S., Kiran, B.R., Puttaiyah, E.T. and Ravikumar, M. (2005) Phytoplankton diversity in relation to abiotic factors in Chandravalli tank at Chitradurga, Karnataka. J. Aqua. Biol. Vol. 20 (2): 25-30.
7. Chakraborty (1959) A qualitative study of plankton and physico-chemical condition of the river Yamuna at Allahabad. Ind.J. fish. Vol. 6 (1): 186-208.
8. Edmondson, W.T. (1959) Freshwater Biology, John Wiley and Sons Inc. N.Y. pp. 420-494.
9. Goel (1985) Studies on the limnology of few fresh water bodies in South Western Maharashtra. Indian J.Env.Prot. Vol. 5 (1): 19-25.
10. Jayabhaye, U.M., V.R. Madlapure and B.S. Salve (2007) Phytoplankton diversity of Parola Dam Hingoli, Maharashtra. J. Aqua. Biol. Vol. 22 (2): 27-32.
11. Malik, D.S. and Umesh Bharti (2012) Status of plankton diversity and biological productivity of Sahastradhara stream at Uttarakhand, India. Journal of Applied and Natural Science. Vol. 4 (1): 96-103.
12. Pahwa, D.V. and Mehrotra, S.N. (1966) Observations in the abundance of plankton in relation to certain hydro-biologicalconditions of river Ganges. Proc. Natl. Acad. Sci. Vol. 36 (2): 157-89.
13. Palmer, C.M. (1969) A composite rating of algae tolerating organic pollution. Journal of Phycology. Vol.5: 78-82.
14. Pendase, D.C., Shastri, Y. and Barhate, V.P. (2000) Hydrobiological study of percolation tank of village Dasane, Maharashtra, India. Eco. Env. And Con.Vol. 6 (1): 93-97.
15. Ryder, R.A., Kerr, S.R., Loftus, K.H. andRegister, H.A. (1974) The morphoedaphic index, a fish yield estimator review and evaluation. J. fisheries Res. Canada. Vol. 31: 663-668.
16. Sarwade, A.B. and N.A. Kamble (2013) Planktonic quantification in Bharatnagar lake of Miraj tahsil, District Sangli, Maharashtra. BionanoFrontier.Vol. 6 (1): 118-124.
17. Xie, P., Iwakum, T. and Fujii, K. (1998) Changes in the structure of a zooplankton community, during a certium (divoflagllate) bloom in a eutrophic fishless pond. J. Plankton Res. Vol. 20 (9): 1663–1678.