

# A Study on Planktonic Status of Bansagar Dam, Deolond Shahdol (M.P.) India

**Santosh Kumar Kushwaha\* Ashok Kumar Mishra and Shilpi Mishra**

Department of Zoology

Government Vivekanand Post Graduate College, Maihar, Satna, M.P., India\*

Government Model Science College, Rewa, M.P., India

**Abstract:** *Phytoplanktons are floating microscopic autotrophs and consisting mainly members of Chlorophyceae, Cyanophyceae and Bacillariophyceae and algae like green flagellates. While the zooplanktons. The studies on phytoplankton are the subject of great interest because of their role as primary producers in an aquatic ecosystem. The qualitative and quantitative studies of those species may provide the knowledge of water quality and capacity of water to sustain heterotrophic communities. The present study was carried out in the Bansagar Dam, Shahdol (M.P.) during the period of November 2014 to October 2015. The objective of this study was to identify the group or species of phytoplanktons and zooplanktons to know the biological status and productivity potential of the dam. The higher density of Chlorophyceae group showed the good biological status of the dam. The Cyanophyceae 2234org/l, 41.51% Chlorophyceae 1906org/l, 35.42%, Bacillariophyceae 1156org/l, 21.48% and Euglenophyceae 85org/l, 1.57% annual densities and their composition of percentage were recorded respectively during study period. The average annual density and of composition of zooplanktonic group are as Rotifera 1044 org/l, 47.78% Copepoda 1587 org/l, 20.62%, Protozoa 1044org/l, 13.56%, Cladocera 932org/l, 12.11% and Ostracoda 455org/l, 5.91% during the study period.*

**Keywords:** Autotroph, flagellates, indices and heterotrophic

## I. INTRODUCTION

Planktons exhibit a unity and are characterized by some extreme order lines in the variations of physico-chemical characteristics. Therefore, evaluation of composition of planktonic populations and their diversity and succession are very important aspects in monitoring the productivity and status of a water body.

Zooplanktons are known as heterogeneous assemblage of minute and microscopic floating animals found in natural waters. These organisms usually play role as primary consumers and constitute an important relation between primary producers and higher consumers in aquatic food chains. The zooplanktons consist of a wide array of animal groups but the members of protozoa, rotifera, copepoda, cladocera and ostracoda are often found dominating. Gannon and Stemberger (1978) noted the occurrence of *rotifera* and *Cladocera* in highly eutrophic lakes.

## II. HISTORY

Recently, many workers have studied the hydrobiology of different aquatic resources of India, i.e. Nagamani *et al.* (2015) analysed the physico-chemical factors of water samples of urban and rural area of Bangalore. Sagar *et al.* (2015) reported the physico-chemical parameters for testing water. Shrivastava *et al.* (2015) reported the water quality management plan for Patalganga River for drinking purpose and human health safety, which is located 60 km from Mumbai and is a significant source of water supply for Panvel, Alibaug and Rasayani. Various technical research papers on the assessment of water quality of different areas have been presented Danha *et al.* (2015) worked on physico-chemical analysis and fish pond conservation in Kano State, Nigeria, Elegbede *et al.* (2015) reported the effect of water quality characteristics of fish population of the lake Volta, Ghana, Zafar *et al.* (2015) analysed water and soil quality parameters of shrimp and prawn farming in the southwest region of Bangladesh. Sandhya and Benarjee (2016) worked on physico-chemical properties of some selected fresh water fish ponds in relation to fish production in Warangal area, Telangana State, India. Reda (2016) studied the physico-chemical properties of drinking water quality of Arbamich Town, Ethiopia. Querijero and Mercurio (2016) worked on water quality in aquaculture and non-aquaculture sites in Taal lake, Batangas, Philippines. Kashyap (2016)

worked on physico-chemical analysis of various water samples of Rewa district (M.P.) India. Chakravarty *et al.* (2016) studied on spatial variation of water quality parameters of pond at East Godavari district, Anadhra Pradesh, India and Younas *et al.* (2017) worked on the physico-chemical parameters of water and soil of three dams of district Karak, KP, Pakistan.

### **III. MATERIALS AND METHODS:**

The work has been carried out from November 2014 to October 2015. Bansagar Dam is located on Latitude 24-11-30 N and Longitude 81-17-15E. near the village Deolond in Shahdol district on the Rewa – Shahdol road, at a distance of 51.4 KM away from Rewa. The project has been started with the name ‘Bansagar’ after Bana Bhatt, the renowned Sanskrit Scholar of 7<sup>th</sup> Century, who is believed to have hailed from this region in India.

#### **3.1 Analysis of Planktons**

Planktons were collected by filtering of 20 liter of water sample from each station and preserved in 4% formaline in plankton tube for further study.

#### **3.2 Collection of Planktons and Analysis**

The collected water samples were concentrated by centrifugation technique at 2500 rpm using ultra centrifuge. The supernatant was removed carefully by dropper and 3 drops of glycerin were added. Only 5 ml was kept as volume. Phytoplanktons and Zooplanktons were counted with the help of Sedjwick-Rafter counting cell and drop count method under the microscope. Counts were made in triplicate and results were represented in organisms per liter.

#### **3.3 Qualitative Analysis**

Phytoplanktons and zooplanktons were identified upto generic level with the help of standard literatures, books and research papers (Fritsch, 1935 and 1945; Edmondson, *et al.*, 1959; Ward and Whipple, 1966; Needham *et al.*, 1974; Tonapi, 1980; Adoni, 1985; APHA, 1985, 2008; Prajapati, 2018; Rawat and Trivedi, 2018. etc.)

#### **3.4 Quantitative Analysis**

Planktons were enumerated in the laboratory of Govt. Model Science College, Rewa (M.P.) using microscope by drop counting method (APHA, 1985) In this method one drop of the water sample is pipette out from a calibrated pipette on a glass slide and the planktonic organisms were counted in strips. The total area under the cover slip represents the number of organisms present per given volume of the sample. This volume expanded to an appropriate yield the organisms per liter of water for the Bansagar Dam. The results were presented as number of organisms per liter of original collected water sample. The counting of zooplanktons was also done with the help of Sedgwick-Rafter cell method (APHA, 1985). Since, the number of zooplanktons counted by Sedgwick-Rafter cell were related with 1 ml of concentrated sample, therefore, the observed number of zooplanktons were multiplied accordingly to get the results in number of organisms as per in original sample.

### **IV. RESULTS AND DISCUSSION**

#### **4.1 Annual Density of Phytoplankton**

The mean annual density of four taxonomic groups of phytoplankton recorded during study period is represented in Table 1a, 1b, 2, 3 and Graph 1. Cynophyceae showed their dominance over the other groups of phytoplankton. The average annual density of *Cyanohycee* was recorded as 2234 org/l with percentage contribution of 41.51% followed by *Chlorophyceae* with annual density of 1906 org/l and percentage contribution of 35.42%, *Bacillariophyceae* with annual density of 1156 org/l and percentage contribution of 21.48% and *Euglenophyceae* with annual density of 85 org/l and percentage contribution of 1.57 org/l during study period.

In the present study, a total of 27 phytoplankton species belonging to 27 genera representing 4 major classes were documented which indicate diverse nature of phytoplankton in general as well as of Bansagar Dam (Table 2 and 3). Among 27 species of phytoplankton, 08 belonged to *Chlorophyceae*, 10 to *Cynophyceae*, 07 to *Bacillariophyceae* and 02 to *Euglenophyceae*. The order of dominance was the *Bacillariophyceae* > *Chlorophyceae* > *Cynophyceae* > *Euglenophyceae*. Singh (1990) and Pillai *et al.*, (2011) were studied the variation and distribution of phytoplanktons in different water bodies, Pailwan *et al.*, (2008) and Baba and Pandit (2014) described the bimodal growth curve in their studies.

The minimum and maximum values of phytoplanktons fluctuated between 61 to 323org/l. The minimum values of phytoplanktons were recorded in the month of August and maximum in the month of April during study period. The mean  $\pm$ SD values of phytoplanktons were recorded  $149 \pm 85.875$ org/l during study period. The maximum values of phytoplanktons were recorded in summer season (225org/l), moderate in rainy season (122org/l) and minimum in winter season (101org/l) during study period

#### 4.2 Annual Density of Zooplankton

The mean annual density of five taxonomic groups of zooplankton recorded during study period is represented in Table 4a, 4b, 5, 6 and Graph 2. *Rotifera* group showed their dominance over the other groups of zooplankton. The average annual density of *Rotifera* was recorded as 1044org/l with percentage contribution of 47.78% followed by *Copepoda* with annual density of 1587org/l and percentage contribution of 20.62%, *Protozoa* with annual density of 1044org/l and percentage contribution of 13.56%, *Cladocera* with annual density 932org/l and percentage contribution 12.11% and *Ostracoda* with annual density of 455org/l and percentage contribution of 5.91%. The mean  $\pm$ SD values of zooplanktons were recorded as  $238 \pm 174.207$ org/l at station A,  $165 \pm 110.967$ org/l at station B and  $218 \pm 146.540$ org/l at station C with a mean value of  $207 \pm 115.388$ org/l during study period Table 4a. The maximum values of zooplanktons were recorded in summer season (328org/l), moderate in rainy season (181org/l) and minimum in winter season (103org/l) during study period (Table 4a, 4b, 5, 6 Graph 2).

Manjare *et al.* (2010) Sunkad and Patil (2004) Khaire (2012) reported four groups of zooplankton viz. *Rotifera* (7 species), *Cladocera* (5 species), *Copepoda* (1 species) and *Ostracoda* (1 species), zooplankton richness (52.38%) followed by *Copepods* (26.5%), *Cladocerans* (16.45%) and *Ostracodans* (4.67%), 19 genera of zooplanktons belonging to four major groups viz. *Rotifera*, *Cladocera*, *Copepoda* and *Ostracoda* respectively.

**Table 1a:** Mean values of monthly and seasonal variations of Phytoplanktons (org./l) in three sampling stations of Bansagar Dam from November 2014 to October 2015

| Months              | A      | B     | C     | Avg.  |
|---------------------|--------|-------|-------|-------|
| Nov.                | 127    | 74    | 126   | 109   |
| Dec.                | 131    | 53    | 72    | 85    |
| Jan.                | 107    | 44    | 61    | 71    |
| Feb.                | 217    | 75    | 126   | 139   |
| Mar.                | 424    | 210   | 261   | 298   |
| Apr.                | 442    | 195   | 317   | 318   |
| May                 | 214    | 96    | 134   | 148   |
| Jun.                | 172    | 72    | 167   | 137   |
| Jul.                | 167    | 69    | 134   | 123   |
| Aug.                | 111    | 31    | 44    | 62    |
| Sep.                | 145    | 37    | 58    | 80    |
| Oct.                | 316    | 110   | 241   | 222   |
| Min.                | 107    | 31    | 44    | 61    |
| Max.                | 442    | 210   | 317   | 323   |
| Mean                | 214    | 89    | 145   | 118   |
| SD $\pm$            | 117.45 | 57.89 | 87.31 | 87.55 |
| Seasonal variations |        |       |       |       |
| Winter              | 146    | 62    | 96    | 101   |
| Summer              | 313    | 143   | 220   | 225   |
| Rainy               | 185    | 62    | 119   | 122   |

**Table 1b:** Analysis of variance for Planktons.

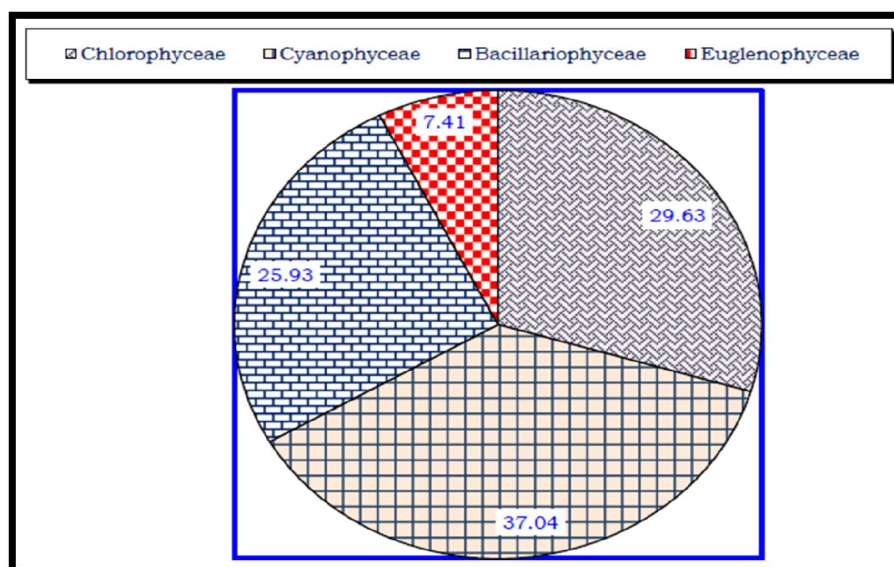
| Source of variation | Degree of freedom d.f. | Calculated F | Tabulated F | Probability level | Significance level |
|---------------------|------------------------|--------------|-------------|-------------------|--------------------|
| Between stations    | 2&4                    | 25.67        | 6.94        | 0.05              | *                  |
| Between seasons     | 2&4                    | 28.72        | 6.94        | 0.05              | *                  |

**Table 2:** Species composition of different phytoplanktons classes in Bansagar Dam from November 2014 to October 2015.

| S. No. | Class             | Genera    | Species   | Composition Percentage |
|--------|-------------------|-----------|-----------|------------------------|
| 1      | Chlorophyceae     | 8         | 8         | 29.63                  |
| 2      | Cyanophyceae      | 10        | 10        | 37.04                  |
| 3      | Bacillariophyceae | 7         | 7         | 25.93                  |
| 4      | Euglenophyceae    | 2         | 2         | 7.41                   |
|        | <b>Total</b>      | <b>27</b> | <b>27</b> | <b>100.00</b>          |

**Table 3:** Annual density of phytoplankton in Bansagar dam from November 2014 to October 2015:

| S.N. | Taxonomic group   | Mean annual density (org/l) |             |             |             |                           |
|------|-------------------|-----------------------------|-------------|-------------|-------------|---------------------------|
|      |                   | Nov. 2014 to Oct. 2015      |             |             |             |                           |
|      |                   | Winter                      | Summer      | Rainy       | Average     | Annual density percentage |
| 1    | Cyanophyceae      | 470                         | 1164        | 600         | 745         | 41.55                     |
| 2    | Chlorophyceae     | 438                         | 953         | 514         | 635         | 35.42                     |
| 3    | Bacillariophyceae | 283                         | 544         | 329         | 385         | 21.48                     |
| 4    | Euglenophyceae    | 22                          | 43          | 20          | 28          | 1.57                      |
|      | <b>Total</b>      | <b>1213</b>                 | <b>2704</b> | <b>1463</b> | <b>1793</b> | <b>100</b>                |



**Graph 1:** Species composition of different phytoplanktons' group in Bansagar Dam from November 2014 to October 2015.

**Table 4a:** Mean values of monthly and seasonal variations of Zooplanktons (org./l) in three sampling stations of Bansagar Dam from November 2014 to October 2015.

| Months              | A             | B             | C             | Avg.          |
|---------------------|---------------|---------------|---------------|---------------|
| Nov.                | 134           | 122           | 152           | 136           |
| Dec.                | 112           | 122           | 97            | 110           |
| Jan.                | 51            | 53            | 67            | 57            |
| Feb.                | 144           | 66            | 235           | 148           |
| Mar.                | 286           | 158           | 282           | 242           |
| Apr.                | 463           | 186           | 385           | 345           |
| May                 | 427           | 350           | 158           | 312           |
| Jun.                | 563           | 198           | 478           | 413           |
| Jul.                | 155           | 401           | 126           | 227           |
| Aug.                | 71            | 183           | 135           | 130           |
| Sep.                | 97            | 60            | 60            | 72            |
| Oct.                | 358           | 84            | 443           | 295           |
| <b>Min.</b>         | <b>51</b>     | <b>355</b>    | <b>60</b>     | <b>155</b>    |
| <b>Max.</b>         | <b>563</b>    | <b>401</b>    | <b>478</b>    | <b>481</b>    |
| <b>Mean</b>         | <b>238</b>    | <b>165</b>    | <b>218</b>    | <b>207</b>    |
| <b>SD±</b>          | <b>174.20</b> | <b>110.96</b> | <b>146.54</b> | <b>143.90</b> |
| Seasonal variations |               |               |               |               |
| Winter              | 110.00        | 60.00         | 138.00        | 103.00        |
| Summer              | 444.00        | 223.00        | 326.00        | 328.00        |
| Rainy               | 170.00        | 182.00        | 191.00        | 181.00        |

**Table 4b:** Analysis of variance for Zooplanktons.

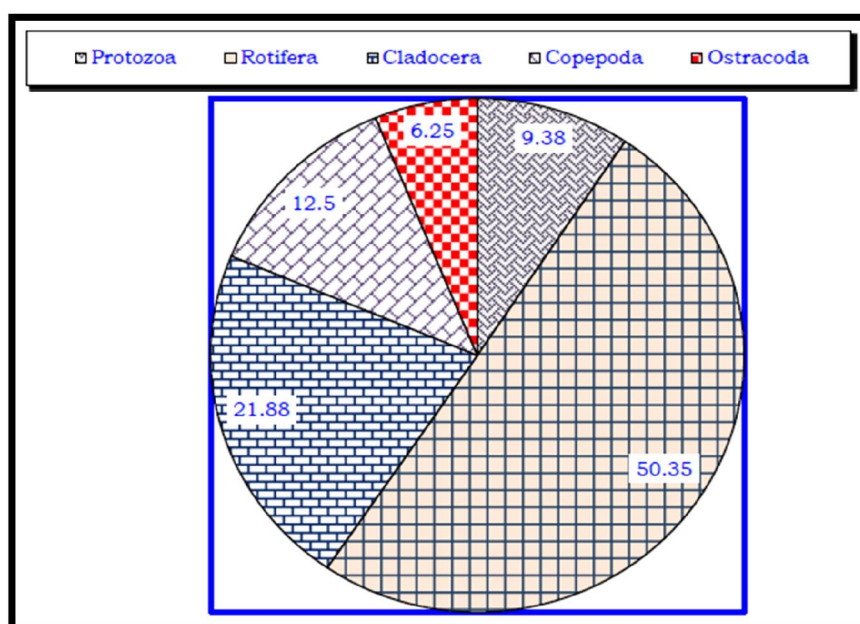
| Source of variation | Degree of freedom d.f. | Calculated F | Tabulated F | Probability level | Significance level |
|---------------------|------------------------|--------------|-------------|-------------------|--------------------|
| Between stations    | 2&4                    | 1.13         | 6.94        | 0.05              | NS                 |
| Between seasons     | 2&4                    | 9.53         | 6.94        | 0.05              | *                  |

**Table 5:** Genera and species percentage composition of different zooplankton classes in Bansagar Dam.

| S.No. | Group        | Genera    | Species   | Percentage    |
|-------|--------------|-----------|-----------|---------------|
| 1     | Protozoa     | 3         | 3         | 9.38          |
| 2     | Rotifera     | 17        | 17        | 50.35         |
| 3     | Cladocera    | 7         | 7         | 21.88         |
| 4     | Copepoda     | 4         | 4         | 12.50         |
| 5     | Ostracoda    | 2         | 2         | 6.25          |
|       | <b>Total</b> | <b>33</b> | <b>23</b> | <b>100.00</b> |

**Table 6:** Annual density of zooplanktons in Bansagar dam from November 2014 to October 2015:

| S. No. | Taxonomic group | Mean annual density (org/l) |        |       |      |                           |
|--------|-----------------|-----------------------------|--------|-------|------|---------------------------|
|        |                 | Nov. 2014 to Oct. 2015      |        |       |      | Annual density percentage |
|        |                 | Winter                      | Summer | Rainy | Ave. |                           |
| 1.     | Protozoa        | 148                         | 739    | 157   | 348  | 13.36                     |
| 2.     | Rotifera        | 665                         | 2017   | 995   | 1226 | 47.05                     |
| 3.     | Cladocera       | 194                         | 416    | 322   | 311  | 11.92                     |
| 4.     | Copepoda        | 284                         | 794    | 509   | 529  | 20.30                     |
| 5.     | Ostracoda       | 121                         | 257    | 196   | 191  | 7.34                      |
|        | Total           | 1412                        | 4223   | 2179  | 2605 | 100                       |



**Graph 2:** Species composition of different zooplanktons' group in Bansagar Dam from November 2014 to October 2015.

#### REFERENCES

- [1]. Adoni, A.D. and Saran, (1985). Limnological studies on seasonal variation in Phytoplanktonic Pr. productivity in Sagar lake. Proc. nat. Symp. Pure and Applied Limnology (ed.) Bull. Bot. Soc. Sagar, 32: pp. 7-76.
- [2]. APHA, AWWA and WPCF. (1985). Standard Methods for the examination of water and waste water. 16th edition APHA, 1015 fifteenth Street NW. Washington DC. pp 1266.
- [3]. Baba, A.I. and Pandit, A.K. (2014). Species Composition, Diversity and Population Dynamics of Phytoplankton at Saderkot in Wular Lake, Kashmir. Journal Ecosystem and Ecography, 4(1): 1-9.
- [4]. Chakravarty, M.S., Ganesh, P.R.C., Amarnath, D., Shanthi Sudha, D. and Srinu Babu, T. (2016). Spatial variation of water quality parameters of shrimp (*Litopenaeus vannamei*) culture ponds at Narsapurapupeta, Kajuluru and Kaikavolu villages of East Godavari district, Andhra Pradesh. International Journal of Fisheries and Aquatic Studies, 4(4): 390-395.
- [5]. Danha, E.P., David, D.L., Wahedi, J.A., Buba, U.N., Usman, D., Bingari, M.S. and Tukur, K.U. (2015). Physico-chemical analysis and fish pond conservation in Kano State, Nigeria. Archives of Applied Science Research.7(6): 28-34.
- [6]. Edmondson, W.T., Ward, H.B. and Whipple, G.C. (1959). Fresh water biology. 2nd Ed. – John Willey and Sons. New York and London. pp. 1248.



- [7]. Elegbede, I.O., Kies, F., Omolara, L.A.A., Rashidat, S.D. and Hakeem, E.B. (2015). Effect of Water Quality Characteristics on Fish Population of the Lake Volta, Ghana. *J Environ Anal Toxicol*. 5: 317.
- [8]. Fritsch, F.A. (1935). The structure and reproduction of the algae (Volume I) Vikas Publishing House Pvt. Ltd., New Delhi, Bombay, Bangalore, Calcutta, Kanpur.
- [9]. Fritsch, F.A. (1945). The structure and reproduction of the algae (Vol. II), Vikas Publishing House Pvt. Ltd., New Delhi.
- [10]. Gannon, J.E. and Stermberger, R.S. (1978). Zooplankton especially crustaceans and Rotifers as indicators of water quality. *Trans. Amer. Microscop. Soc.*, 97(1): 16-35.
- [11]. Kashyap, V.R. (2016). Physico-chemical analysis of various water samples of Rewa district (M.P.) India. *International Journal of Applied Research*; 2(1): 311-313.
- [12]. Khaire, B.S. (2012). Studies on Zooplankton Population Correlated with Some Physico-Chemical Factors in Kambli Water Reservoir of Maharashtra (India). *Bionano Frontier Eco Revolution, Colombo – Srilanka* ISSN 0974-0678.
- [13]. Manjare, S.A., Vhanalkar, S.A. and Muley, D.V. (2010). Water quality assessment of Vadgaon tank of Kolhapur with special reference to zooplankton, *Int. J. Advance Biotech & Res.*, 1(2): 91-95.
- [14]. Nagamani, C., Saraswathi, Devi, C. and Shalini, A. (2015). Physico-chemical analysis of water samples. *International Journal of Scientific and Engineering Research*, 6(1): 2149-2155.
- [15]. Needham, J.G. and Needham, P.R. (1974). A guide to study of Freshwater biology. Hilden bay. San Francisco. U.S.A. pp. 107.
- [16]. Pailwan, I.F., Muley, D.V., Muske, S. (2008). Limnological features, plankton diversity and fishery status of three fresh water perennial tank of Kolhapur district (M.S.) India. *Proceeding of Taal: The 12th World Lake Conference*: 1643-1649.
- [17]. Pillai, M.M., Brintha, M. and Sukumaran, M. (2011), Studies on Phytoplankton Diversity in Response to Abiotic Factors in Pachiparai Dam, Kanyakumari District, Tamil Nadu, India, *Journal of Theoretical and Experimental Biology*, 8(1&2): 29-34.
- [18]. Querijero, B.L. and Mercurio, A.L. (2016). Water quality in aquaculture and non-aquaculture sites in Taal lake, Batangas, Philippines, *Journal of Experimental Biology and Agricultural Sciences*, 4(1): 109-115.
- [19]. Reda, A.H. (2016). Physico-chemical Analysis of Drinking water quality of Arbaminch Town. *Journal of Environmental and Analytical Toxicology*, 6(2): 1000356.
- [20]. Sagar, S.S., Chavan, R.P., Patil, C.L., Shinde, D.N. and Kekane, S.S. (2015). Physico-chemical parameters for testing of water- A review *International Journal of chemical studies*, 3(4): 24-28.
- [21]. Sandhya, K. and Benarjee, G. (2016). Physico-chemical Properties of Some Selected Fresh Water Fish Ponds in Relation to Fish Production in Warangal Area 6(4): 23-31.
- [22]. Shrivastava, Asheesh, Tandon, Shalini, A. and Rakesh Kumar (2015). Water Quality Management Plan for Patalganga River for Drinking Purpose and Human Health Safety. *International Journal of Scientific Research in Environmental Sciences*, 3(2): 0071-0087.
- [23]. Singh, R.K. (1990). On the seasonal abundance of phytoplankton in relation to Ecological conditions of Undasa Pond. *Comp. Physiol. Ecol.*, Vol 15, No. 3, pp. 91-95.
- [24]. Sunkad, B.N. and Patil, H.S. (2004). Water quality assessment of Fort lake of Belgaum (Karnataka) with special reference to zooplankton, *J. Environ. Biol*. 25(1): 99-102.
- [25]. Tonapi, G.T. (1980). Fresh water animals of India: An ecological approach. Oxford & IBH Publishing Co., New Delhi, Bombay, Calcutta.
- [26]. Ward, H.B. and Whipple, G.C. (1966). Fresh water biology (ed. W.T. Edmondson) 2nd ed. 4th printing, John Wiley & Sons, Inc. N.Y. p. 1248.
- [27]. Younas, S., Junaid, F., Gul, S., Rehman, H.U., Iqbal, N., Adan, K., Rauf, F., Ahmad, I., Najoom, S., Inayatullah, Sadia, H. and Usman, K. (2017). Physico-chemical parameters of water and soil of three Dams of district Karak, K.P., Pakistan. *Journal of Entomology and Zoology Studies*, 5(3): 317-322.
- [28]. Zafar, M.A., Haque, M.M., Aziz, M.S.B. and Alam, M.M. (2015). Study on water and soil quality parameters of shrimp and prawn farming in the south-west region of Bangladesh. *J. Bangladesh Agril. Univ*. 13(1): 153-160.

- [29]. APHA, (2008). Standard Methods for the examination of water and waste water. 23rd edition APHA, 1015 fifteenth Street NW. Washington DC.
- [30]. Prajapati, B. (2018). Studeis of water quality and soil condition of Borina pond, Chargavan, Tehsil – Rithi, Distt. Katni (M.P.) in relation to fish productivity. Ph.D. Thesis. pp. 58-63.
- [31]. Rawat R. and Trivedi S. (2018). Seasonal diversity of phytoplanktons in relation to seasonal changes in physico-chemical parameters of Khedi Kalan station of Dholawad Dam of Ratlam district M.P. Int. J. Pune. App. Biosci. 6(2): 448-454.