# Periodicity and Distribution of Diatoms in Bhadra Reservoir, Karnataka

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***Abstract-*** *This paper deals with the diversity of diatoms in back water of Bhadra reservoir (Station-I) and its down stream stretch of the river Bhadra (Station-II). Diatoms were higher during summer and lower in winter. Anomoenies sphaerophora, A. brachysira, Achnanthes lanceolata, Achnanthes subsessils, Cymbella ventricosa and Tabellaria species occurred as rare forms. In total, 21 genera and 51 species of diatoms were recorded during the period of investigation. The physico-chemical factors that regulated the distribution pattern have been discussed in detail.*

***Keywords***- Bhadra reservoir, Diatoms, Periodicity, Seasonal variation.

## I. INTRODUCTION

Phytoplankton are the primary producers and form the basic bulk of food material for aquatic organisms and also play a important role in the food chain of fishes and other aquatic organisms. The water quality in relation to physico-chemical parameters plays a major role in ascertaining the distributional pattern and quantitative abundance of organisms inhabiting a particular ecosystem (Singh et al., 2009), It is the need of today to conserve these ecosystems. Several investigators have studied the physico-chemical dynamics of varied lentic water bodies with the intent to assess the water quality (Islam, 2011; Venkateshwarlu et al., 2003, Sayaswara et al., 2010; Sachinkumar Patil et. al.,2013). Hence periodic monitoring of water quality of wetlands like lakes, ponds, reservoirs, ditches and pools is necessary.

Although the volume of literature on the limnological studies on Indian reservoirs and rivers is gradually increasing (Kaul, 1977; Yadava *et al*., 1987; Mishra and Trivedy, 1993 ), a detailed study on Bhadra reservoir, one of the multipurpose project of Western ghat region is lacking. It is with this background, in the present study, an attempt has been made to study the occurrence and distribution of Diatoms.

## II. MATERIALS AND METHODS

### Study Area

The Bhadra dam is constructed across the Bhadra river near Lakkavali village, Chikmagalore district of Karnataka State at an elevation of 601 above mean sea level. The Bhadra reservoir is located at a latitude of 13°-45′-00″ N and longitude 75°-30′-14″ E. The Bhadra river rises from Varaha hills at a place called “Ganga moola” in the western ghats about 24kms west of Kalasa in Chikmagalore district. The catchment area at site is about 1968 sq. km. The storage capacity of the reservoir is about 61.70 TMC. It is a multipurpose project meant for fishing, irrigation and power generation

The investigation was conducted for two years. Two sampling stations were selected such as S-I (Backwater of Bhadra reservoir) and S-II (Downstream stretch of Bhadra river). The water samples were collected once in a month.

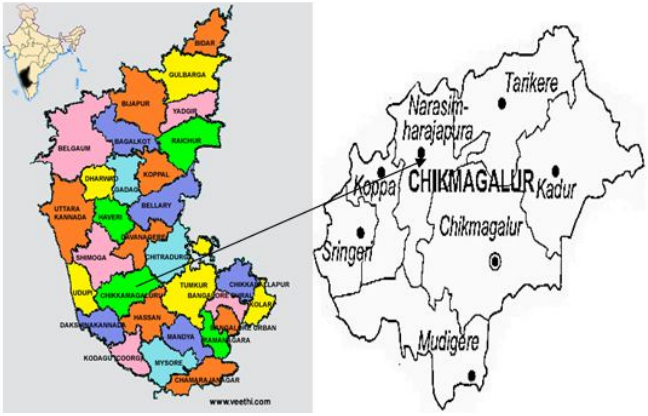


Figure 1: Study area map (Source: www.veethi.com; www.onefivenine.com)

### Estimation of Diatoms

Planktonic forms were collected by using a plankton net made of bolting silk cloth of meshes of 25µm fixing a

glass bottle of 100ml at a narrow end. For taking the samples of qualitative analysis, the net was towed for 5 minutes just below the surface of water (Green and Holden, 1960). Tows were restricted to a small area around each sampling point. The samples were immediately transferred to other bottles and preserved by adding 4% formaldehyde as per the practice of Welch (1948). The qualitative estimation was done by taking one ml of sample from the stock samples at each time and repeated 5 to 10 times. Identification of planktonic forms up to genera as well as species level was made with the help of standard literature (Fritsch, 1961; Hegde and Bharathi, 1985; Adoni *et al*., 1985; Prasad and Srivastava, 1985).

For the quantitative estimation of deiatoms a drop of sedimented sample was taken on a clean slide and a known size of coverslip was put over it. Then the whole cover slip area was scanned under 10 different fields and then the organisms appeared were counted and tabulated as per the Rao's (1953) method.

**Water quality analysis**

Water samples were collected for chemical analysis from each station at an interval of 30 days. Samples were collected in polythene bottles of 5 litres capacity. For the estimation of certain factors like dissolved oxygen, water samples were taken in 300ml BOD bottle and fixed immediately using Winkler's reagent. Water temperature and pH were recorded at the time of collection. In general, sampling methods and analytical procedures as recommended by Welch (1948) and APHA (1998) were followed.

## III. RESULTS AND DISCUSSION

Table 2 depicts the yearly occurrence of Bacillariophyceae in both the sampling stations and Table 3 and 4 shows the seasonal variation and seasonal averages of different groups of Diatoms.

**Periodicity**

A total of 21 genera and 51 species of diatoms have been recorded during the present study. *Cocconies placentula* was observed at both the stations as a dominant form. This indicates that they adapt to both polluted and unpolluted waters. *Cyclotella meneghniana* is another diatom that occurred as a dominant species at two stations.

**Diatoms found at both the stations I and II**

*Cymbella tumida, C. affinis, C. ventricosa, Diatoma vulgare, Eunotia pectinalis, Fragillaria crotonensis, Gyrosigma attenuatum, Gomphonema abbreviatum, Melosira granulata, Navicula mutica, N. gracilis, N. rhomboides, N. palea, N. hustedtii, N. cuspida, Nitzschia palea, Pinnularia virdis, Synedra actinastroides, Surirella liuearis* have been recorded in station I and station II. Even though the water quality of two stations differed markedly indicating that the above diatoms adapted to both unpolluted and polluted waters.

**Diatoms recorded at station I**

This station is uncontaminated with clean water. The following are the forms that have been recorded at this station: *Amphora cofformis, Achnathes lanceolata, Anomoenies brachysira, Anomoenies sphaerophora, Cymbella affinis, Cymbella ventricosa, Cyclotella meneghniana, Cyclotella stelligera, Cocconies placentula, Calonies bacana, Diploneis subovalis, Diatoma vulgare, Eunotia pectinalis, Epithemia turgida, Fragillaria capucina, Fragillaria crotonensis, Gyrosigma attenuatum, Gomphonema subapicatum, G. tenellum, G. parvulum, G. abbreviatum, Melosira granumata, Navicula notha, N. mutica, N. gracilis, N. rhomboides, N. palea, N. hustedtii, N. cari, N. cryptocephala, N. cuspidata, N. protracta, N.radiosa, Nitzschia palea, Pinnularia gibba, P. abaujensis, P. virdis, Synedra ulna, S. actinastroides, S. acus and Surirella liuearis*, constitute forms favoured by clean and slightly polluted waters. This observation is in essential agreement with Prasad and Singh (1982).

The interesting point to be noted is that *Anomoenies brachysira, Anomoenies sphaeraphora, Cymbella ventricosa* and *Pinnularia abaujensis*, present in station I but absent at station II. The reason could be the pollution factor where station II receives lot of industrial effluents and sewage water. This indicates that the above diatoms are not at all favoured by contaminated waters. Therefore, they could be considered as the indicator organisms of clean water systems.

**Diatoms found at station II**

This station consists of *Amphora ovalis, Amphora cofformis, Achnanthes lanceolata, Achnanthes subsessilis, Anomoenies sphaerophora, Anomoenies brachysira, Cymbela tumida, C. affinis, C. ventricosa, Cyclotella meneghniana, Cyclotella stelligera, Cocconies placentula, Caloneis pulchra, Caloneis bacana, Diatoma vulgare, Eunotia pectinalis, Fragillaria capucina, Fragillaria crotonensis, Gyrosigma elongatum, Gyrosigma attenuatum, Gomphonema subapicatum, G. tenellum, G. parvulum G. abbreviatum, Melosira granulata, Navicula mutica, N. gracilis, N. rhomboides, N. palea, N. hustedtii, N. cari, N. cryptocephala, N. cuspidata, N. krasskei, N. radiosa, Nitzschia palea, N. tryblionella, N. amphibia, Pinnularia gibba, P. subcapita, P.*

*virdis, Synedra ulna, Synedra actinastroides, S. acus, Surirella liueraris and Tabellaria sp.* Seasonally, the diatoms were found to be high during summer at station I and station II (28610 o/l and 17042 o/l) and low during rainy season (10787 o/l) at station II (Table 3).

Marshall (1988) opined that phosphate at lower concentration regulate the diatomic population. In the present study, phosphate concentration was low (0.01mg/l) at station I with good number of diatomic population. Singh and Swarup (1979) reported that higher concentration of calcium promotes the abundance of diatoms. When the factor calcium is considered in the present study, it ranged between 5 .93mg/l at station I to 18.61mg/l at station II with diatomic population of 3096.45 o/l respectively. This observation clearly indicates that the diatoms behave rather irregularly towards calcium. Prasad and Singh (1982) and Somashekar (1987) have also made similar observation.

Patrick (1948) opines that pH above neutral favours the abundance of diatoms. In the present study, pH value ranged between 7.46 at station I to 7.29 at station II where the highest density of diatom was recorded at station I as compared to station II. Hence, the observation made in the present study is in agreement with that of Patrick (1948).

In the present study, the concentration of phosphates ranged from 0.001mg/l at station I, to 0.96mg/l at station II. Apparently phosphate at lower concentration is congenial for the growth of diatoms. Therefore, it may be said that higher concentration of phosphates does not support the abundance of diatoms.

Prasad and Singh (1982) are of the opinion that water temperature ranging from 30º to 35º C enhance the multiplication of diatoms. However, in the present study temperature ranged from 23º to 30.5º C at Station I and 24º to 30º C Station II and nevertheless, diatomic population was higher at Station I as compared Station II. This observation clearly indicates that the temperature less than 30.5ºC but, above 23ºC is highly congenial for diatoms growth and multiplication. This observation however, differs from that of Singh and Swarup (1979), Prasad and Singh (1982) and Venkateswarlu (1986).

It was evident from the data obtained that the concentration of free carbon dioxide is very high at station II (17.66mg/l) which supported a meager density of diatoms. While station I, showed lower amounts of free carbon dioxide but lodged good number of diatoms. Therefore, lower amounts of free carbon dioxide supported the luxuriant growth of diatoms.

In nutshell, highest phytoplankton diversity was recorded in summer season followed by Winter. It may be concluded from this study that the wastes discharged from the industries caused adverse impact on plankton diversity and the dominance of certain pollution tolerant plankton at the downstream stretch of the Bhadra river indicated degradation of the riverine habitat. The current study also revealed the abundance and seasonal variation of different phytoplanktonic forms in the Bhadra reservoir and its stretch.

## IV. CONCLUSION

Alkaline $p^H$, relatively higher amounts of dissolved oxygen above 4.83 mg/l, low free carbon dioxide and temperature between 23ºC to 30.5º C are highly congenial for the growth of Diatoms. The behaviour of Diatoms towards calcium is rather irregular. Season wise, diatoms were higher during summer and lower in winter. *Cymbella tumida, C. affinis, C. ventricosa, Diatoma vulgare, Eunotia pectinalis, Fragillaria crotonensis, Gyrosigma attenuatum, Gomphonema abbreviatum, Melosira granulata, Navicula mutica, N. gracilis, N. rhomboides, N. palea, N. hustedtii, N. cuspidata, Nitzschia palea, Pinnularia virdis, Synedra actinastroides, Surirella liuearis* are the common Diatoms occurred in both the stations. A total of 21 genera and 51 species of Diatoms were recorded during the period of investigation. The data generated clearly revels that the reservoir is basically productive and uncontaminated as compared to the downstream stretch of the Bhadra river course. Therefore, it is suggested that the status of the reservoir should be maintained by enforcing the environmental protection acts. The catchment area of the reservoir should be protected from the adverse effects of human activities.

## V. ACKNOWLEDGEMENTS

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**Table 1: List of diatoms in Bhadra reservoir ,Karnataka**

| Sl. No. | Name of the organisms | Sl. No. | Name of the organisms |
|---|---|---|---|
| 1 | *Amphora ovalis* | 27 | *Melosira granulata* |
| 2 | *Amphora cofformis* | 28 | *Navicula notha* |
| 3 | *Achnanthes lanceolata* | 29 | *Navicula mutica* |
| 4 | *Achnanthes subsessilis* | 30 | *Navicula gracilis* |
| 5 | *Anomoenies sphaerophora* | 31 | *Navicula rhomboides* |
| 6 | *Anomoenies brachysira* | 32 | *Navicula palea* |
| 7 | *Cymbella tumida* | 33 | *Navicula hustedtii* |
| 8 | *Cymbella affinis* | 34 | *Navicula cari* |
| 9 | *Cymbella ventricosa* | 35 | *Navicula cryptocephala* |
| 10 | *Cyclotella meneghniana* | 36 | *Navicula cuspidata* |
| 11 | *Cyclotella stelligera* | 37 | *Navicula protracta* |
| 12 | *Cocconies placentula* | 38 | *Navicula krasskei* |
| 13 | *Caloneis pulchra* | 39 | *Navicula radiosa* |
| 14 | *Caloneis bacana* | 40 | *Nitzschiapalea* |
| 15 | *Diploneis subovalis* | 41 | *Nitzschia tryblionella* |
| 16 | *Diatoma vulgare* | 42 | *Nitzschia amphibia* |
| 17 | *Eunotia pectinalis* | 43 | *Pinnularia gibba* |
| 18 | *Epithemia turgida* | 44 | *Pinnularia subcapita* |
| 19 | *Fragillaria capucina* | 45 | *Pinnularia abaujensis* |
| 20 | *Fragillaria crotonensis* | 46 | *Pinnularia virdis* |
| 21 | *Gyrosigma elongatum* | 47 | *Synedra ulna* |
| 22 | *Gyrosigma attenuatum* | 48 | *Synedra actinastroides* |
| 23 | *Gomphonema subapicatum* | 49 | *Synedra acus* |
| 24 | *Gomphonema tenellum* | 50 | *Suritella liuearis* |
| 25 | *Gomphonema parvulum* | 51 | *Tabellaria sp.* |
| 26 | *Gomphonema abbreviatum* | | |

**Table 2 : Yearly and two yearly occurrence of Diatoms in Station I and Station II (o/l)**

| Stations | I year | II year | Average |
|---|---|---|---|
| SI | 35238.0 | 39077.0 | 74315.0 |
| SII | 19860.0 | 20425.0 | 40285.0 |

**Table 3: Seasonal occurrence of Diatoms(o/l) in Bhadra reservoir**

| Seasons | SI | SII |
|---|---|---|
| Rainy | 24559.0 | 10787.0 |
| Winter | 21146.0 | 12456.0 |
| Summer | 28610.0 | 17042.0 |
| **Total** | **74315.0** | **40285.0** |

**Table 4** : **Seasonal average of Diatoms (o/l)**

| Seasons | SI | | | SII | | |
|---|---|---|---|---|---|---|
| | I year | II year | Average | I year | II year | Average |
| Rainy | 2741.00 | 3398.75 | 3069.87 | 1448.25 | 1248.50 | 1348.37 |
| Winter | 2771.75 | 2514.75 | 2643.25 | 1455.25 | 1658.75 | 1557.00 |
| Summer | 3296.75 | 3855.75 | 3576.25 | 2061.50 | 2199.00 | 2130.25 |
| **Total** | **8809.50** | **9769.25** | **9289.37** | **4965.00** | **5106.25** | **5035.62** |