Phytoplankton Diversity of Tapi, Surat with Special References to Aquatic Nutrients

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ABSTRACT

The Present study has been carried out to estimate the Phytoplankton diversity of Tapi River. The chemical variables with special reference to nutrients (Silica, Phosphorus, Nitrate and Ammonical nitrogen) were estimated during Jan-2009 to Dec-2009.During monitoring three different sampling stations in Tapi were selected. The aim of the study was to observe the effect of nutrients on the quality of the phytoplankton. Phytoplankton assemblage was dominated by members of Bacillariophyceae, Cyanophyceae, Chlorophyceae and desmids.

Keywords: Tapi, phytoplankton communities, Nutrients

INTRODUCTION

Algae are natural inhabitants of water. It serves as the basic food within an aquatic ecosystem. Algae are involved in water pollution in different ways but the selective algae, in polluted water are also being used as indicators of pollution.

Phytoplankton community comprises of a heterogeneous group of tiny plants adapted to various aquatic environments. Their nature and distribution varies considerably with respect to seasons and water quality. Their dominance also leads to qualitative changes of aquatic systems. Quality of an aquatic ecosystem is dependent on the physical and chemical qualities of water as also on biological diversity of the system. **(Tripathi and Gupta, 2002).** The plankton is the indicator of ecological conditions and chemical nature show recent conditions. If the environmental conditions are altered then the change in the plankton population is inevitable which is replaced by species to species. The utility of plankton as direct or indirect food for fishes and their utility in assessing the water quality have now-been well established. **(Salodia, 1996).** Therefore, the investigation has been conducted to assess the impact of pollution through the evaluation of physico-chemical as well as biological parameters of Tapi river.

METHODOLOGY

To, fulfill the objectives and aims of the study, monthly collection was carried out from different stations at selected sites. The samples were collected monthly from Jan-2009 to Dec-2009.Three locations were selected on the Tapi on the basis of fresh water and sea water intrusion, anthropogenic and domestic sewage inlets.

Ashwani kumar (Freshwater Zone, Inlet of Domestic Sewage and Cremation ground drainage).

[1] Nanpura (Intermediate Zone, Anthropogenic pollution and Inlet of Sewage).

[2] Umara (Estuarine Zone, Anthropogenic pollution and Inlet of Sewage and cremation ground drainage).

Subsurface water samples for Physico-Chemical and Biological parameters were collected between 7:00 to 9:30 A.M, in 5 lit. container, which were previously cleaned with diluted HNO_3 and detergent followed by distilled water. Before sampling, they were again rinsed with sampling water. After collection they were brought to the laboratory.

Phytoplankton sample were collected from river by using silk bolting phytoplankton net.50 liter of water was filtered through the net and preserved immediately with 4% formalin and Lugol's iodine solution. Plankton were collected as described in APHA (2005). Phytoplankton identification was done by using Desikachary (1987) and Sarode and Kamat (1984).

RESULT AND DISCUSSION

Parameter	Minimum	Maximum
Silicate	10.01 mg/l Site 3 Feb 2009 *Amphora coffeaformis, Anabaena plactonica, Cosmarium portianum, Chlorella valgaris, Cyclotella comata, Cyclotella glomerata, Fragillaria intermedia, Fragillaria capucina, Gomphonema purvulum, Gomphonema quadripunctatum, Gyrosigma acuminatus, Tabellaria fenestrata, Melosira granulata, Microcystis aerugenosa,Navicula symmetrica, Navicula radiosa, Navicula confervacea, Nitzschia palea, Nitzschia closterium, Oscillatoria princeps, Spirogyra sp, Surirella elegans, Synedra ulna, Spirulina platensis, Nostoc sp, Pandorina moram, Pediastrum simplex, Pleurosigma elongatum,Closterium malmei* and *Mastagloea sp*	40.16 mg/l Site 3Oct 2009 *Anabaena sperica, Anabaena affinis, Anabaena flos-aquae, Ankistrodesmus falcatus, Cocconeis plcentula, Coscinodiscus radiatus, Cosmarium depressum, Chlorella vulgaris, Chlorella pyrenoidosa, Fragillaria intermedia, Gomphonema quadripunctatum, Melosira varins, Microcystis aerugenosa, Merismopodia sp, Microspora sp, Navicula radiosa, Nitzschia closterium, Oscillatoria princeps, Scenedesmus quadricauda, Scenedesmus obliqus, Spirogyra sp, Surirella elegans, Surirella capronii, Synedra ulna, Thallassionema sp, Nostoc sp, Pandorina morum, Pediastrum simplex, Pleurosigma elongatum, Mastagloea sp, Closterium attenutum* and *Closterium malmei*

Phosphorus	0.066 mg/l Site 1May 2009 *Achnanthes minutissima, Amphora acutiuscula, Amphora coffeaformis, Anabaena sperica, Anabaena planctonica, Ankistrodesmus falcatus, Cosmarium depressum, Chlorella vulgaris, Cyclotella meneghiniana, Cymbella minuta, Fragillaria intermedia, Melosira granulata, Microcystis aerugenosa, Navicula radiosa, Navicula symmetrica, Nitzschia closterium, Nitzschia sigma, Oscillatoria princeps, Scenedesmus quadricauda, Spirogyra sp, Synedra ulna,Thallassionema sp, Nostoc sp, Pandorina moram, Pediastrum duplex, Pleurosigma elongatum* and *Mastagloea sp*	3.63 mg/l Site 3 Aug 2009 *Anabaena sperica, Anabaena planctonica, Ankistrodesmus falcatus, Euglena sp, Cocconeis placentula, Cosmarium depressum, Chlorella vulgaris, Chlorella pyrenoidosa, Cyclotella meneghiniana, Cyclotella comata, Cymbella tumida, Fragillaria biceps, Gomphonema purvulam, Melosira granulata, Microcystis aeruginosa, Merismopodia sp, Navicula radiosa, Navicula confervacea, Navicula forcipata, Nitzschia palea, Nitzschia tubicolla, Oscillatoria princeps, Odentella sp, Scenedesmus quadricauda, Surella elegans, Synedra ulna, Nostoc sp, Pediastrum duplex, Pleurosigma directum, Mastagloea sp* and *Closterium malmei.*
Nitrate	0.014 mg/l Site 1 March 2009 *Achnanthes lanceolata, Achnanthes holsatica, Amphora coffeaformis, Anabaena planctonica, Cocconeis placentula, Coscinodiscus radiosa, Cosmarium portianum, Chlorella vulgaris, Cyclotella meneghiniana, Cymbella minuta, Fragillaria intermedia, Gomphonema purvulum, Gomphonema quadripunctatum, Gyrosigma acuminatus, Hydrodictyon sp, Lyngbya sp, Microcystis aerugenosa, Navicula radiosa, Navicula forcipata, Nitzschia palea, Nitzschia Closterium, Scenedesmus obliqus, Scenedesmus quadricauda, Synedra ulna, Spirulina platensis, Nostoc sp, Pleurosigma elongatum* and *Mastagloea sp*	4.73 mg/l Site 1 Dec 2009 *Achnanthes minutissima, Achnanthes salvadoriana, Anabaena flos-aquae, Anabaena plactonica, Ankistrodesmus falcatus, Cocconeis placentula, Cosmarium portianum, Chlorella vulgaris, Fragillaria intermedia, Gomphonema purvulum, Oedogonium sp, Hydrodictyon sp, Lyngbya sp, Microcystis aerugenosa, Melosira granulate, Navicula confervacea, Navicula radiosa, Nitzschia closterium, Scenedesmus quadricauda, Spirogyra sp, Surirella capronii, Oscillatoria princes, Spirogyra sp, Synedra ulna, Spirulina sp, Volvox globerator, Volvox aureus, Pediastrum duplex, Ulothrix zonata, Nostoc sp* and *Closterium malmei*

Most of the surface water in India, including both rivers and lakes are getting increasingly polluted due to on sought of human activities of diverse nature. Phytoplankton respond rapidly to the changes in the aquatic environment particularly in relation to nutrients like nitrate, phosphate and silicate. Most of the phytoplankton in the marine and estuarine ecosystems is nutrient limited, meaning that their production is held below maximum levels by low concentration of one or more essential nutrients of which silicate is the most important nutrient for diatoms **(Eggs and Aksnes, 1992).** The results obtained from the study showed that some regional and seasonal variations depend upon the pollutants dumping into aquatic ecosystems.

The high levels of silicate in almost all the sites can be attributed to the sources of industrial pollution. The concentration of silicate relative to other nutrients can determine the abundance of diatoms than the other groups as suggested by **(Officer and Ryther, 1980).**

Silicate is an important chemical nutrient required for the growth and development of Diatoms. Abundant in sand will enter the inland waters by land run off from the catchment areas during precipitation **(Kumar, 2002 and Quasim and Sengupta, 1980).**

Generally Phosphate, Nitrate and Nitrite are together referred as nutrients. They are most important for the growth and maintenance of aquatic life in ecosystem. The presence of phosphate in an estuary can be taken as an index of potential fertility of the ecosystem as a whole **(Gupta and Pankaj, 2006).**

Phosphate is one of the most important factors that control the algal production. Phosphate was found in high concentration, where a many sewage are dumping their domestic wastes. Sewage is considered as the principle source of phosphate and other nutrients. **(Edmondson, 1972)** gave the most detailed data on the study of effect of sewage effluents, on the aquatic habitat. He found that sewage effluents are good source of phosphorus. **(Himanshu and Kapila, 1999)** observed that over 80 % of phosphorus entered from sewage in Tapi.

The significant direct relationship emerged between phosphate and Bacillariophyceae and Chlorophyceae shows higher phosphate concentration favored their growth **(Kumar and Azis, 1999).** Nitrate the end product of nitrification is generally recorded in natural waters at levels higher than nitrite and ammonia. Nitrate is the main nutrient which limits the growth of plankton. Nitrate is the highest oxidized form of nitrogen. Domestic sewage, natural run off and agricultural wastes are the important sources of nitrates in the aquatic ecosystem **(Saxena, 1987).**

The minimum nitrate value observed in sites was probably due to the growth of phytoplankton which might have consumed it as reported by **(Gonzalves and Joshi, 1946 and Singh, 1965).**

As suggested **by Trivedy *et al.*, 1990** that nitrate can serve as useful indicator of organic pollution of aquatic environments. Low concentration in summer was due to utilization by plankton and aquatic plants. Similar results were observed by **(Kannan, 1978).**

Nitrite is the intermediate state of nitrogen. Oxidation of ammonia first produces nitrite and then nitrate. The nitrite concentration was relatively lower during the entire investigation period. The nitrite content showed distinct seasonal cycle with relatively higher values in winter and lower in summer and monsoon. The lower concentration of nitrite in summer and monsoon may be due to the utilized by Cyanophyceae. Highly negative correlation of nitrite was found with Cyanophyceae which indicated higher consumption of nitrite by members of Cyanophyceae. A positive correlation was obtained for Chlorophyceae and Bacillariophyceae. Similar results were observed by **(Bhatt *et al;* 1999).**

Ammonia in natural waters is generally absent or present at very low levels. Water pollution by sewage or industrial wastes containing nitrogenous organic water may contain high concentration of ammonia **(Goel, 1997). (Wetzel, 1983).** Stated that ammonia is generated by heterotrophic microbes as a primary end product of decomposition of organic matter either directly from protein or from the organic compounds. Correlation between ammonia and Cyanophyceae was found to be highly positive but it showed highly negative correlation with Chlorophyceae and Bacillariophyceae.

Among the Cyanophyceae *Microcystis sp, Anabaena sp, and Oscillatoria sp* were present throughout the year whereas *Spirulina sp* was found only during rainy season. **Vasisht and Sra (1979)** have recorded that dominant and regular presence of *Microcystis sp* as an indicator of pollution and eutrophication of water body. Among the Chlorophyceae *Chlorella sp, Ankistridesmus sp* and *Scenedesmus sp* were present throughout the year. Among the Bacillariophyceae *Fragillaria sp, Navicula sp, Gomphonema sp, Niztschia sp* and *Cyclotella sp* were observed throughout the year.

CONCLUSION

Results obtained suggest that Tapi is moderately polluted and showed a trend of increasing eutrophication. Richness in nitrogen and phosphate were favourable for the growth of phytoplankton. With reference to Qualitative changes it is observed that *Melosira sp, Nitzschia sp, Navicula sp, Oscillatoria sp, Spirulina sp, Fragillaria sp,*

Cyclotella sp, Skeletonema sp, Chlorella, Cymbella sp, Gomphonema sp, spirogyra sp, Pleurosigma sp, Gyrosigma sp, Coscinodiscus sp, Ankistrodesmus sp, Scenedesmus sp, Surirella sp, Turbellaria sp, Anabaena sp, Closterium sp. etc. were found.

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