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PHYTOPLANKTON BIODIVERSITY WITH REFERENCE TO PHYSICO-CHEMICAL CHARACTERISTICS OF TAPI IN SURAT DISTRICT, GUJARAT

MAHESHWARI SOLANKI AND KAPILA MANOJ

Department of Aquatic Biology,Veer Narmad South Gujarat University,Surat-395007

ABSTRACT

The present investigation was conducted on Tapi to study physico-chemical characteristics and algal diversity of Tapi. Due to increased population and indiscriminate discharge of wastes the river is polluted considerably. The algae and water samples are collected at monthly intervals from April 2008- April 2009. During the study period Diatoms, blue green algae, green algae and Desmids were reported.

Key Words:- Phytoplankton, Diversity, Nutrients, Tapi.

I. INTRODUCTION

Water is a vital resource used for various activities such as drinking, irrigation, fish production, power generation etc. The water resources situated near human habitats are getting polluted gradually. This results in change of physico-chemical and biological level of water. Several workers have studied the physico-chemical characteristics of rivers to assess the impact of sewage and effluents on water quality (Shukla *et al;* 1989). Senegar *et al;* 1985 reported that sewage water with a large amount of organic matter creates innumerable problems for the environment and aquatic life. Abundant growth of plankton in such polluted habitats resulted in bad tastes and odour problems, besides death of aquatic fauna and deterioration in the quality of water. The quality and quantity of phytoplankton along with their seasonal pattern are determined by a complex of chemical, physical and biotic factors in polluted and clean waters (Nasar; 1977).

II. MATERIALS AND METHODS

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 April 2008 to April 2009. Three locations were selected on the Tapi on the basis of fresh water and sea water intrusion, anthropogenic and domestic sewage inlets. (i) Ashwani kumar (Freshwater Zone, Inlet of Domestic Sewage and Cremation ground drainage),(ii) Nanpura (Intermediate Zone, Anthropogenic pollution and Inlet of Sewage) and (iii)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 HNO3 and detergent followed by distilled water. Before sampling, they were again rinsed with sampling water. After collection they were brought to the laboratory.

III. RESULTS AND DISCUSSION

Table 1 :Palmer's algal genus index.

Parameter	08Apr	May	June	July	August	Sept.	Sept.	Oct.	Nov.	Dec.	09Jan.	Feb.	March	April
Ashwani kumar	17	13	14	17	22	18	20	18	15	17	15	14	18	16
Nanpura	18	20	20	21	26	22	26	20	21	18	20	19	20	23
Umara	17	20	18	26	26	23	26	26	25	19	26	19	18	22

Table 2 : physico-chemical characteristics of Water

Parameter	Minimum	Maximum
pH	7.02 Site 2 April 2009 *Ankistrodesmus falcatus, Cocconeis placentula, Coscinodiscus oculus, Chlorella vulgaris, Cyclotella comata, Cymbella minuta, Fragillaria intermedia, Gomphonema purvulam, Gyrosigma acuminatus, Ulothrix zonata, Melosira granulata, Microcystis aerugenosa, Merismopodia sp, Navicula symmetrica, Nitzschia palea, Oscillatoria princes, Scenedesmus quadricauda, Skeletonema costatum, Synedra ulna, Spirulina pletansis, Pandorina moram, Pediastrum simplex, Pleurosigma elongatum* and *Mastagloea sp*	8.03 Site 1 February 2009 *Achnanthes minutissima, Amphora acutiuscula, Anabaenaffinis, Coscinodiscus oculas, Cosmarium depressum, Chlorella vulgaris, Cymbella minuta, Cymbella aspera, Fragillaria pinnuta, Fragillaria intermedia, Gomphonema clevei, Melosira granulata, Hydrodictyon sp, Lyngbya sp, Microcystis aerugenosa, Merismopodia sp, Navicula symmetrica, Navicula confervacea, Nitzschia sigma, Oscillatoria brevis, Spirogyra sp, Synedra ulna, Pleurosigma elongatum* and *Mastagloea sp.*
Silicate	9.4 mg/l Site 2 June 2008 *Achnanthes lanceolata, Achnanthes minutissima, Amphora coffeaformis, Anabaena plactonica, Coscinodiscus radiatus, Coscinodiscus granii, Coscinodiscus oculus, Cosmarium portianum, Chlorella valgaris, Cyclotella comata, Cyclotella glomerata, Cymbella minuta, Cymbella cistula, Cymbella tumida, Fragillaria intermedia, Fragillaria capucina, Gomphonema purvulum, Gomphonema quadripunctatum, Gyrosigma acuminatus, Tabellaria fenestrata, Melosira granulata, Microcystis aerugenosa,Navicula symmetrica, Navicula radiosa, Navicula confervacea,*	34.19 mg/l Site 1 May 2008 *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,*

	Nitzschia palea, Nitzschia closterium, Oscillatoria princeps, Spirogyra sp, Surirella elegans, Synedra ulna, Spirulina platensis, Thallassionema sp, Nostoc sp, Pandorina moram, Pediastrum simplex, Pleurosigma elongatum and *Mastagloea sp*	*Nostoc sp, Pandorina morum, Pediastrum simplex, Pleurosigma elongatum, Mastagloea sp, Closterium attenutum* and *Closterium malmei*
Phosphorus	0.045 mg/l Site 1&3 November 2008 *Achnanthes lanceolata, Achnanthes holsatica, Achnanthes minutissima, Amphora acutiuscula, Amphora coffeaformis, Anabaena sperica, Anabaena planctonica, Ankistrodesmus falcatus, Coscinodiscus radiosa, Cosmarium depressum, Chlorella vulgaris, Cyclotella purvulum, 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, Spirulina platensis, Spirulina maxima, Thallassionema sp, Nostoc sp, Pandorina moram, Pediastrum duplex, Pleurosigma elongatum* and *Mastagloea sp*	3.013 mg/l Site 2 October 2008 *Anabaena sperica, Anabaena planctonica, Ankistrodesmus falcatus, 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, Surirella elegans, Oscillatoria princes, Euglena sp, Navicula confervacea, Navicula forcipata, Nitzschia palea, Nitzschia tubicolla, Odentella sp, Scenedesmus quadricauda, 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*	3.23 mg/l Site 3 September 2008 *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*
Nitrite	0.002 mg/l Site 3 March 2009	3.215 mg/l Site 3 January 2009

	Achnanthes lanceolata, Achnanthes holsatica, Amphora coffeaformis, Anabaena affinis, Anabaena plactonica, Anabaena flos-aquae, Ankistrodesmus falcatus, Cocconeis placentula, Caloneis sp, Cosmarium portianum, Chlorella vulgaris, Cyclotella meneghiniana, Cyclotella comata, Cymbella tumida, Cymbella minuta Fragillaria intermedia, Gomphonema clevei, Gomphonema quadripunctatum, Gyrosigma attenuatum, Tabellaria fenestrata, Melosira granulata, Microcystis aeruginosa, Merismopodia sp, Navicula forcipata, Navicula radiosa, Nitzschia closterium, Nitzschia sigma, Surirella elegans, Synedra ulna, Encyonema sp, Pleurosigma elongatum and *Mastagloea sp*	*Amphora acutiscula, Amphora coffeaformis, Ankistrodesmus falcatus, Asterionella japonica, Biddulphia sp, Cocconeis placentula, Cosmarium depressum, Chlorella vulgaris, Fragillaria intermedia, Gomphonema purvulam, Gyrosigma acuminatus, Melosira varians, Microcystis aerugenosa, Merismopodia sp, Microspora sp, Navicula symmetrica, Navicula confervacea, Nitzschia sigma, Nitzschia palea, Oscillatoria princes, Pediastrum duplex, Pandorina morum, Scenedesmus quadricauda, Synedra ulna, Spirulina platensis, Spirulina maxima, Skeletonema costatum, Pleurosigma elongatum, Mastagloea sp* and *Closterium mamei*
Ammonical nitrogen	0.018 mg/l Site 3 November 2008 *Amphora acutiuscula, Amphora coffeaformis, Anabaena sperica, Anabaena planctonica, Ankistrodesmus falcatus, Coscinodiscus radiosa, Cosmarium depressum, Chlorella vulgaris, Cyclotella purvulum, 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, Spirulina platensis, Spirulina maxima, Thallassionema sp, Nostoc sp, Pandorina moram, Pediastrum duplex, Pleurosigma elongatum* and *Mastagloea sp*	21.61 mg/l Site 3 September 2008 *Anabaena affinis, Anabaena flos-aquae, Ankestrodesmus falcatus, Asterionella japonica, Asterionella formosa, Cocconeis placentula, Cosmarium depressum, Chlorella vulgaris, Cyclotella glomerata, Cyclotella meneghiniana, Cymbella minuta, Fragillaria intermedia, Gomphonema quadripunctatum, Gomphonema purvulum, Gyrosigma attenuatum, Melosira granulata, Microcystis aerugenosa, Merismopodia sp, Navicula radiosa, Nitzschia sigma, Nitzschia Closterium, Oscillatoria princeps, Scenedesmus quadricauda, Spirogyra sp, Skeletonema costatum, Surirella gemma, Synedra ulna, Pandorina morum, Pediastrum duplex, Pleurosigma elongatum* and *Mastagloea sp*

algae are simple plants inhabiting diverse kinds of habitats, but are prominently and almost invariably present in natural water bodies(Table 1). Algae are also known to indicate the level of pollution (Trivedi and Goel, 1986).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. Algae are potential pollution indicators because of their quick response to the toxicants and other chemicals. It has long been recognized that the algae are sensitive indicators of water quality. (Salodia; 1996).

The data presented in physico-chemical characteristics of Water (Table 2) viz., pH, Silicate, Phosphorus, Nitrate, Nitrite and Ammonical nitrogen.

pH is the important parameter which controls the aquatic environment. All physico-chemical and biological reactions are directly depending upon the hydrogen ion concentration of the system. (Sreenivasan, 1977) studied that changes in pH reflect up on the Alkalinity and growth of Phytoplankton. The higher value of pH can also be attributed to increased production in aquatic ecosystem which utilize carbon and nitrogen from nitrates, and phosphorous, converting them into hydroxyl ions which increase the pH (Zaffer, 1964). Similar results were observed by (Sumana and Saxena, 2004) according to them pH ranges from 7.2 to 8.2 is favorable for the growth of phytoplankton. A similar direct relationship between pH and phytoplankton had been reported by (Nandan and Patel, 1992). (Robert *et al;* 1974) suggested that pH 5 to 8.5 is ideal for phytoplankton growth and during study period this was found to be true. Diatom has a preference for high pH value which promotes the growth of algae and results in blooming (Davis and Anderson, 1983).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. Diatom requires silica in soluble forms for its wall silicification. It is generally considered that silicate formed the main nutrient in diatom metabolism. Abundance of silicate favour multiplication of diatoms. At times of maximum diatom growth natural waters show a decline in dissolved silica content (Boney, 1989). 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).(Pendse *et al;* 2000) studied phosphate concentration in the water which favors luxurious growth of diatoms population.Higher concentration of nitrate is an indication of organic pollution and eutrophication. Increase in the concentration of nitrates promotes the growth of phytoplankton (Nandan and Patel; 1992).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). Phytoplankton productivity is often the primary source of all the organic matter in an ecosystem. Being an index of trophic status phytoplankton reflects the overall environmental condition of the system and its potentiality. Their density has been reported to be affected by the quality of water. (Trivedy; 2000). Algae are common and normal inhabitants of the surface layers in water bodies exposed to sunlight. Myxophyceae and Bacillariophyceae were shown to be correlated with the intensity of pollution by (Palharya and Malviya; 1988). According to (Mahajan; 2005) *Spirogyra sp, Anabaena sp, Navicula sp, Synedra sp* and *Oscillatoria sp* can be considered as pollution tolerant forms. *Spirogyra* and *Oscillatoria* form abundant growth in the summer season. The pollution tolerant algae such as *Spirogyra sp*, *Oscillatoria sp, Scenedesmus sp, Pinnularia sp, Gomphonema sp* and *Euglena sp* were used as bio-indicator of pollution

IV. CONCLUSION

Algal community was used to monitor the water quality. Water pollution indices are based on the community, which is used commonly to detect and evaluation of water pollution.Phytoplankton

constitutes the very basis of nutritional cycle of an aquatic ecosystem. To evaluate the water quality of Tapi is the great advantages for showing the amount of pollutant present in the water and its impact on the physico-chemical and biological components of the water column and it can to used to assess what the organisms are likely to be exposed to as well as for calculation of the amount of pollutant transported in and out of the system.The diatoms were the dominant component of phytoplankton and the distribution was recorded in the decreasing order as follows Diatoms> Cyanophyceae >Chlorophyceae > Desmids.*Chlorella sp, Anabaena sp, Navicula sp, Nitzschia sp, Oscillatoria sp, Fragillaria sp, Pediastrum sp, Melosira sp, Pleurosigma sp* And *Mastagloea sp* were recorded in all the seasons. According to Palmer's Genus Index Ashwani kumar was less polluted and Nanpura and Umara were highly organically polluted May be because of Inlet of Domestic and industrial sewage and anthropogenic activities.

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