

ORIGINAL ARTICLE

Seasonal variations of diatoms in Shirgaon estuary of Ratnagiri, Maharashtra

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ABSTRACT

The present study was undertaken to study the composition of phyto-plankton in relation to physico-chemical water parameters of five sampling stations of Shirgaon estuary along the Ratnagiri coast from February 2013 to January 2014. Variation in atmospheric temperature 17.9-39.7 °C, water temperature 19.7 -35.1 °C, pH varied from 5.3-8.1, light penetration varied from 1-24 cm, salinity varied from 0-28.7 psu, dissolved oxygen varied from 0.4-4.8 mgL⁻¹, alkalinity varied from 3-80 mgL⁻¹, nitrate varied from 0.000323-0.00154 μMl⁻¹, nitrite varied from 0.000052-0.000208 μMl⁻¹, phosphate varied from 0.00253-0.000515 μMl⁻¹, silicate varied from 0.00129-0.000503 μMl⁻¹. A of total of 28 phytoplankton species were recorded comprising, 20 diatoms.

Keywords: Seasonal variations, diatoms

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INTRODUCTION

Estuarine environmental study has accelerated during the past two decades since estuaries support a rich pelagic, benthic communities and serves as excellent nursery and feeding grounds for many commercially important fishes and shrimps [3-5]. They also form the centres for natural seed collection of most of the commercially important fin fishes and shell fishes suitable for aquaculture. Estuaries may be specially enriched by nutrients from river water, organic pollution and by the entrainment of coastal waters in a subsurface counter-current, transporting nutrients into the estuary. The phytoplankton composition is affected by various environmental factors such as pH, light, temperature, salinity, turbidity and nutrients. Besides, their importance as the primary producers in food webs and ensuring ecological balance, species of phytoplankton are useful indicators of water quality [7, 8, 10, 16]. The relative availability of nutrients plays a major role in inducing the community structure of phytoplankton. No paper has been published on the physico-chemical characteristics in relation to the phytoplankton in Shirgaon estuary (Map 1) Ratnagiri. Hence the present study was conducted to study the seasonal variation of phytoplankton and physico-chemical parameters of water in the Shirgaon estuary, southwest coast of India.

MATERIALS AND METHODS

The distributions of diatoms were investigated in five stations from upper to lower reaches along the Shirgaon estuary at Ratnagiri, south west coast of India. The study was conducted from February 2013 to January 2014. Phytoplankton samples were collected at monthly intervals at highest high tide from the surface waters of the study area. In all the five stations, samples were collected by using the 60μ standard plankton net. These samples were preserved in 5% formalin and used for qualitative and quantitative analysis [1, 2, 9]. The major taxonomic groups of phytoplankton were determined under the light microscope with a magnification of 10x10. The species evenness, richness, diversity and index were calculated by using computer statistical software. Physico-chemical parameters such as atmospheric and surface water temperatures, light penetration in the water column, salinity, dissolved oxygen and pH were recorded during the sampling. Nutrients like inorganic phosphate, nitrate, nitrite and silicate were analysed by adopting the standard methods [15].



Map.1.0 Sampling locations at Shirgaon estuary, Ratnagiri

RESULTS AND DISCUSSION

Physico-chemical parameters

Atmospheric temperature is important factor in the ecosystem, which may influence the distribution and abundance of flora and fauna, it is varied from 17.9 to 39.7°C, Mumbai (15) was similarly observed water temperature variation between 19.7 to 35.1 °C, southwest coast of India which might be influenced by the seasonal variations in intensity of solar radiation, evaporation, cooling with ebb and flow from adjoining neritic waters, pH of water depends on many factors like photosynthetic activity, rainfall, nature of dissolved materials and discharge effluents it is varied from 5.3 to 8.1, light penetration 1-24 cm was , salinity acts as a limiting factor in the distribution of living organisms and its variation caused by dilution and evaporation which influence the fauna in the coastal ecosystem its range from 0 to 28.7 psu, dissolved oxygen concentration varies according to many factors : wind , photosynthesis and respiration by plant and animals in water and its 0.4-4.8 mg^l⁻¹, alkalinity the maximum alkalinity was recorded during post-monsoon season in the month of January 80 mg^l⁻¹ while minimum during monsoon season in the month of September 3 mg^l⁻¹, nitrate is an intermediate form of nitrate-nitrogen, both the oxidation of ammonia to nitrate and reduction process takes place in an environment like estuary changes from 0.000323 to 0.00154 μM l⁻¹, nitrite 0.000052-0.000208 μMl⁻¹ similar results observed in Goa (16), variations in inorganic phosphate concentration could be attributed to their utilization by phytoplankton its ranges between 0.00253-0.00515 μMl⁻¹, silicate varied between 0.00129 (post-monsoon)-0.000503 μMl⁻¹ (monsoon).

Qualitative distribution of diatoms

The study has revealed clear cut monthly variation in phytoplankton. In general, the phytoplankton peak was observed in pre-monsoon and low in the post-monsoon season. The present investigation recorded 20 species of diatoms, they are: Table 1, Graph 1

Navicula sp. I (Plate 1) and *Navicula sp. II* (Plate 2) was recorded maximum in the pre-monsoon monsoon while minimum in the mid lower reaches in the monsoon season, *Nitzschia sp.* (Plate 3) was dominantly recorded during pre-monsoon at upper reaches and minimum in monsoon at lower reaches of the estuary similarly along Goa (3) coast, *Pleurosigma sp. I* (Plate 4) and *Pleurosigma sp. II* (Plate 5) was sporadically recorded during all the three seasons and in Mumbai (23) similar results were found, *Melosira sp.* (Plate 6) was observed in early pre-monsoon and post-monsoon seasons, *Bacillaria sp.* (Plate 7) was

sporadically present in all the three seasons similarly along Odisha (10) coast of India, *Coscinodiscus sp.* (Plate 8) was observed in the pre-monsoon and late post-monsoon seasons similar results observed in Mahanadi estuary (12), *Amphora sp.* was observed during late post-monsoon in the months of December and January, similarly in Goa (12), *Rhizosolenia sp.* (Plate 9) was observed only twice in the pre-monsoon and post-monsoon seasons, *Fragilaria sp.* (Plate 10) was recorded sporadically in the post-monsoon season, *Leptocylindricus sp.* (Plate 11) was sporadically recorded in all the three season, *Thalassionema sp.* (Plate 12) was observed only once in the month of January similar results found along southwest coast of India [10, 11], *Thalassiosira sp.* was recorded only in months of February and August similar results observed along Goa (12) coast, *Chaetoceros sp.* was recorded only once in post-monsoon and sporadically in pre-monsoon season, *Skeletonema sp.* (Plate 14) sporadically recorded in all the three seasons similar result in Goa (12) state, *Thalassiothrix sp.*, was similarly dominant in Andhra Pradesh (12) and Goa (12), *Cocconeis sp.* (Plate 13) was observed only once in both pre-monsoon and post-monsoon seasons also similar in Ranpar, Ratnagiri (9), *Paralia sp.* (Plate 15) was observed only in the month of November, *Ditylum sp.* was observed in the post-monsoon season, Diatoms abundance during pre-monsoon season could be attributed to the increased salinity, high temperature during the season [6] while lowest was observed during monsoon season, when the water column was remarkably stratified to a large extent because of heavy rainfall, reduced salinity, decreased temperature. Among diatoms *Bacillaria sp.* was dominated in all the three seasons.

The range of species diversity, richness and evenness were 0.51594 - 3.8176, 2 - 22, 1.02843 - 0.51595 respectively. The least values of biodiversity indices were recorded during monsoon season, but were higher during other periods Graph 2.

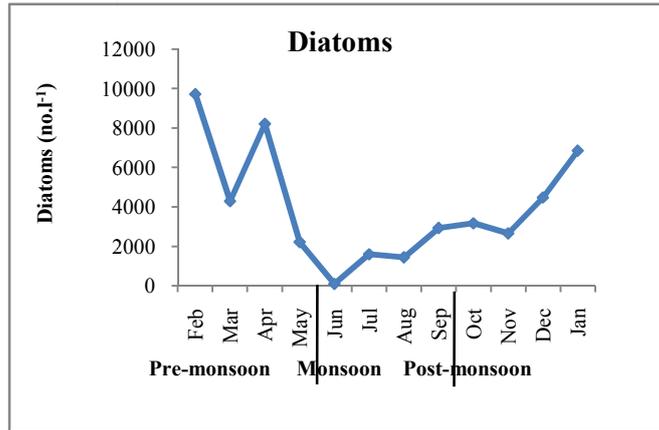
The maximum richness values were recorded during the post-monsoon season. The low richness was recorded during the monsoon season [12, 13, 14].

Table. 1-Seasonal variations of phytoplankton species recorded in Shirgaon estuary

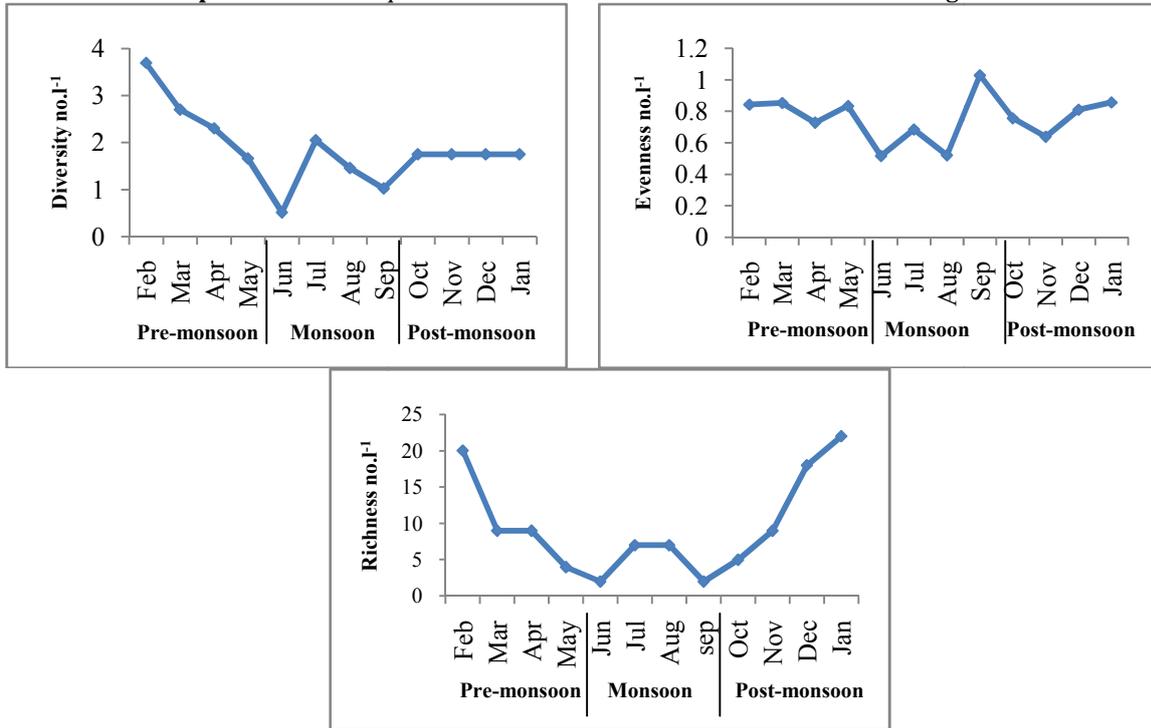
Months Species	Feb- 13	Mar- 13	Apr- 13	May- 13	Jun- 13	Jul- 13	Aug- 13	Sep- 13	Oct- 13	Nov- 13	Dec- 13	Jan- 14
Diatoms												
<i>Amphora sp.</i>	-	-	-	-	-	-	-	-	-	-	+	+
<i>Bacillaria sp.</i>	+	+	+	-	-	+	+	+	-	+	+	+
<i>Ditylum sp.</i>	-	-	-	-	-	-	-	-	-	-	+	-
<i>Chaetoceros sp.</i>	+	-	+	-	-	-	-	-	-	-	-	+
<i>Cocconeis sp.</i>	+	-	-	-	-	-	-	-	-	-	-	+
<i>Coscinodiscus sp.</i>	+	+	+	-	-	-	-	-	-	-	+	+
<i>Fragilaria sp.</i>	+	-	+	-	-	-	-	-	+	-	+	+
<i>Leptocylindricus sp.</i>	+	+	-	+	-	+	-	-	-	-	+	+
<i>Melosira sp.</i>	+	+	-	-	-	-	-	-	-	+	+	+
<i>Navicula sp. I</i>	+	+	+	-	-	+	-	-	-	-	+	+
<i>Navicula sp. II</i>	+	-	-	-	-	-	-	-	-	-	+	+
<i>Nitzschia sp.</i>	+	+	+	-	-	-	-	-	-	+	+	+
<i>Paralia sp.</i>	-	-	-	-	-	-	-	-	-	+	-	-
<i>Pleurosigma sp. I</i>	+	+	-	+	+	+	+	-	-	-	+	+
<i>Pleurosigma sp. II</i>	-	-	-	-	-	-	-	-	-	-	-	+
<i>Rhizosolenia sp.</i>	+	-	-	-	-	-	-	-	-	-	-	+
<i>Skeletonema sp.</i>	+	-	+	+	-	+	+	-	-	+	-	-
<i>Thalassionema sp.</i>	-	-	-	-	-	-	-	-	-	-	-	+
<i>Thalassiosira sp.</i>	+	-	-	-	-	-	+	-	-	-	-	-
<i>Thalassiothrix sp.</i>	-	-	-	-	-	-	-	-	+	+	-	-

(-) Absent

(+) Present



Graph 1 - Seasonal quantitative variations of diatoms recorded during 2013-14



Graph 2 – Seasonal variations of phytoplankton species diversity, richness and evenness recorded during 2013-14

Dominant phyto-plankton species of Shirgaon estuary, Ratnagiri

**Phytoplankton
Diatoms**

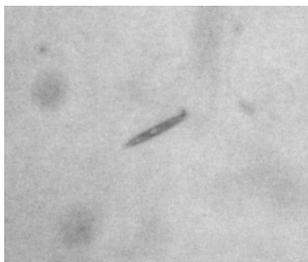


Plate -1 *Navicula* sp. I 10X × 10X



Plate -2 *Navicula* sp. II 10X × 10X



Plate -3 *Nitzschia* sp. 10X × 10X



Plate -4 *Pleurosigma sp. I* 40X × 10X



Plate -5 *Pleurosigma sp. II* 20X × 10X

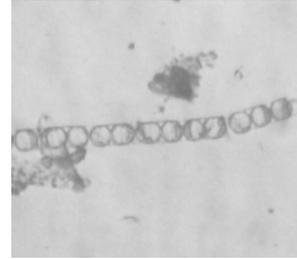


Plate -6 *Melosira sp.* 20X × 10X



Plate -7 *Bacillaria sp.* 10X × 10X

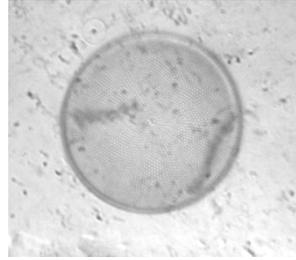


Plate -8 *Coscinodiscus sp.* 40X × 10X

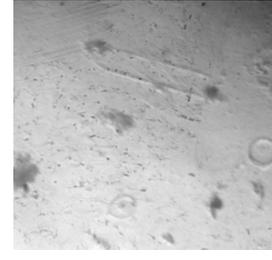


Plate -9 *Rhizosolenia sp.* 20X × 10X

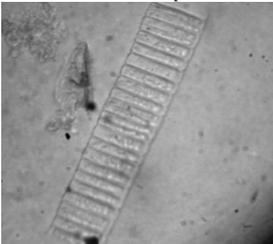


Plate -10 *Fragilaria sp.* 40X × 10X

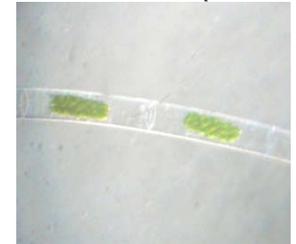


Plate -11 *Leptocylindricus sp.* 40X × 10X

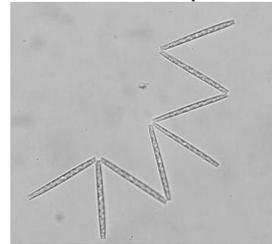


Plate -12 *Thalassionema sp.* 20X × 10X



Plate -13 *Cocconeis sp.* 10X × 10X

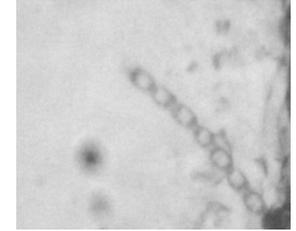


Plate -14 *Skeletonema sp.* 10X × 10X

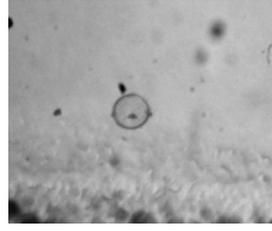


Plate -15 *Paralia sp.* 10X × 10X

CONCLUSION

The present investigation suggest that the baseline information on the phytoplankton is useful for preparing data sheet on fish production report of Shirgaon area. The present report on phytoplankton provides the baseline information for future ecological assessment and monitoring of the Shirgaon, Ratnagiri coastal area.

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