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A STUDY ON THE MONTHLY VARIATION OF SOME HYDROGRAPHIC PARAMETERS IN THE AGNIAR ESTUARY, SOUTHEAST COAST OF INDIA

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ABSTRACT

The seasonal variations of physico-chemical parameters were studied during July 2014 to June 2015 in the Agniar estuary (Lat.10° 20' N Long.79° 23'E) Adirampattinam southeast coast of India. The atmospheric and water temperature ranged from 28.8ºC °C to 35.2°C and 26°C to 31.4°C respectively. The pH ranged between 7.3 and 8.6. The DO was ranged from 3.8 to 7.3 ml/l. Salinity fluctuated between 1.5‰ and 33.8‰. The DO was found to be low in summer and high during monsoon season. Similarly temperature, pH and salinity were low during monsoon and high during summer season.

INTRODUCTION

The estuaries are subjected to a wide range of fluctuating physic-chemical and biological parameters by short-term changes resulting from monsoonal cycles. The parameters in turn govern the occurrence of flora and fauna in aquatic bodies. Sharp *et al.*(1982) asserted that the first hand information about the fate and effect of different chemicals entering into estuaries can be obtained from the existing correlation between salinity and other physico-chemical parameters. Therefore, it is always considered worthwhile to acquire adequate knowledge on short and long term variations of different hydrographic events in the investigation of any water body; it becomes more necessary in tropical countries, where significant alterations are apparent as a consequence of the tidal and monsoonal fluctuations. Hydrographical studies of estuaries and coastal waters in India were initiated by Sewell (1913). On the West coast of India, the best studied estuarine system is the Cochin backwater. The physico-chemical features of Cochin backwater were studied by Ramamirtham and Jayaraman (1963), Qasim and Gopinathan (1969), Josanto (1975), Wellerrshans (1973), Saraladevi *et al.,* (1979) and Nair *et al*., (1983, 1984) similarly in Mondovi and Zuari estuaries of Goa, considerable works were done on the physic- chemical aspects by several works (Dehadrai, 1970; Dehadrai and Bhargava, 1972; Dwivedi *et al.,*1974; Cherian *et al*., 1975; De Souza, 1977; Qasim and Sengupta, 1981). The physico –chemical factors in relation to biological factors in the East coast were reported by Ganapathi and account on the hydrography of the Chilka lake was made by Banerjee and Roychoudhury (1966), Jhingaran and Nadarajan (1966,1969) and Mohanty (1975). Various aspects of hydrobiology of the lake Pulicate have also been studied (Chacko *et al*., 1953; Michael, 1970; Sreenivasan and Pillai, 1972; Raman *et al*., 1975; Kaliyamurthy, 1976 and Padma and Periakalai, 1999). In the velar estuary .the salinity changes in relation to mixing process (Dyer and Ramamoorthy, 1969) and seasonal and tital variations and tidal variations of hydrographical parameters were extensively studied (Vijayalakshmi and Venugopalan, 1973; Santhakumari and Krishnamurthy, 1975; Thangaraj *el al*., 1979; Sivakumar, 1982; Thangaraj, 1984; Chandran and Ramamoothy, 1984; Lyla, 1991). The present study was conducted to study the physico-chemcial parameters of water in the Agniar estuary, southeast coast of India.

MATERIALS AND METHODS

Agniar estuary is situated at Adirampattinam (Lat.10° 20' N Long.79° 23'E) of Bay of Bengal, southeast coast of India

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(Fig.1). In the present investigation, monthly samplings were made during forenoon in a plastic container from July 2014 to June 2015. The physico-chemical parameters were estimated by adopting standard procedures (Strickland and Parsons, 1972).

RESULTS AND DISCUSSION

The data of atmospheric temperature recorded in the study were illustrated in Fig.1. The minimum atmospheric temperature was (28.8ºC) in November 2014 and maximum (35.2 ºC) in March 2015. The moderate temperature was observed during premonsoon period while the minimum temperature was recorded in the monsoon period. Temperature is an universal factor of importance in the study of aquatic ecosystem.

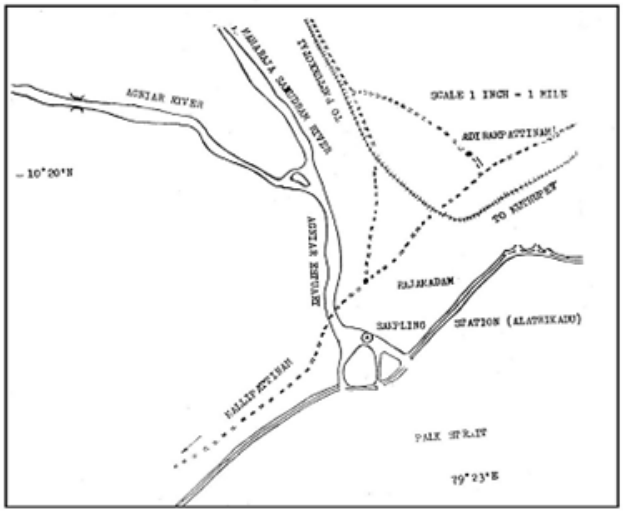

Fig.1. Study Area Agniar Estuary

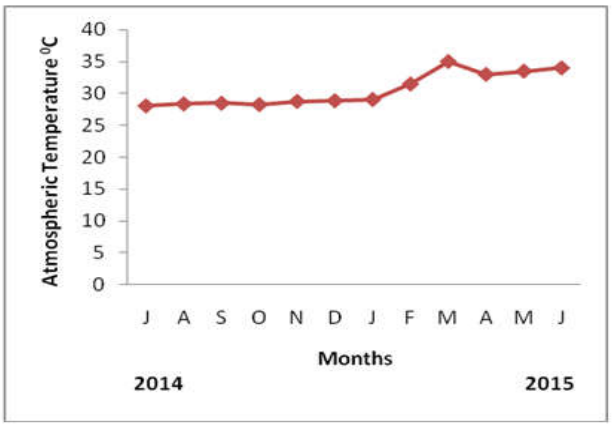

Fig. 2. Monthly changes in atmospheric temperature during 2014 to 2015 in Agniar estuary

There are documents that measure the effect of temperature on the growth of phytoplankton in laboratory (Huburt and Guillard, 1968). But only a few evidences to show the importance of the effects of temperature on the production, abundance and distribution of organism in the shallow ecosystems. Veliela (1984) suggested that temperature may be more important as a covariate with other factors than as an independent factor. In the present study, the variation in atmospheric temperature was found to be associated with the time of collection of water samples and the rainfall during the study period. The variation in the atmospheric and water temperature were very narrow and sometimes no significant variation was observed. Day (1951) also suggested that in shallow estuaries with wide intertidal flats, solar radiation and water temperature changes. The higher atmospheric and water temperature was observed during summer and postmonsoon and lower temperature during monsoon and premonsoon periods throughout the study period.

The surface water temperature closely followed the atmospheric temperature. The mean monthly values of surface temperature are depicted in Fig.2. In the Agniar estuary the water temperature varied from 26°C in November 2014 to 31.4°C in March 2015. During the study period higher temperature was noticed in the summer and post monsoon periods where as minimum temperature was recorded in the mosoon period. Water temperature of the Agniar estuary showed a position correlation with salinity (r=0.7386), pH (r = 0.8584) and a negative correlation with dissolved oxygen (r = -0.8353). The seasonal variation in the water temperature may be associated with the wind force, fresh water discharge influx of the inshore water and atmospheric temperature. The reduction in the water temperature mainly depends upon the intensity of rainfall during monsoon and the low air temperature that time. Similar results were reported by other researchers. Banerjee and Roychoudhury (1966) and Mohanty (1975) recorded higher water temperature during summer season in Chilka lake. Sreenivasan and pillai (1972) and Raman *et al*., (1975) reported maximum water temperature during the summer in Pulicate lake. The high values of atmospheric temperature during summer and low values during monsoon period from the Vellar estuary were recorded by Thangaraj (1984) and Lyla (1991). Kalidasan (1992) also recorded higher water temperature during summer season and low water temperature during premonsoon and lower temperature during monsoon period in Muthupet estuary. The present findings favour the earlier reports on the fluctuations of water temperature on the estuaries. The salinity of the water showed a wide range of fluctuation and seasonal variation. The salinity values of the estuaries water showed a variation ranging from 1.5‰ in November 2014 to 33.8‰ in March 2001 (Fig.3).

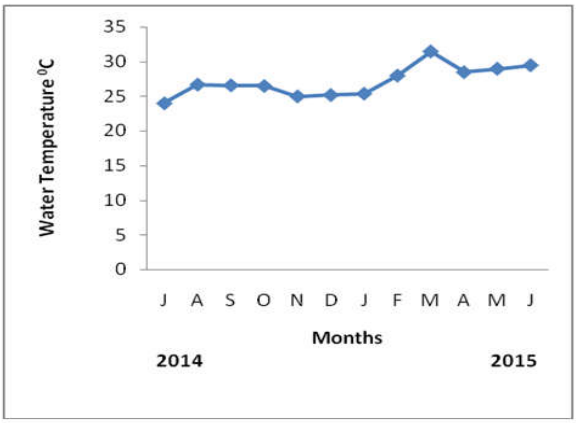

Fig. 3. Monthly changes in water temperature during 2014 to 2015 in Agniar estuary

A marked seasonal variation in salinity was observed throughout the study period .minimum salinity was recorded during monsoon and was maximum during post monsoon and summer. The salinity of the Agniar estuary showed a weak correlation (r = 0.7386) with water temperature, while it showed a strong correlation with pH (r= 0.8648). At the same time, it showed a negative correlation with dissolved oxygen (r= - 0.8124). The salinity variation in the estuaries brings the exchange of ions and nutrients because of the tidal flow and the freshwater discharge. A wide seasonal fluctuation in salinity was the found throughout the period of study. The salinity in this study area showed positive correlation with temperature and pH and negative correlation with dissolved oxygen. The seasonal average salinity registered high values during summer and postmonsoon and low values during monsoon period. The intrusion of neritic water and low river discharge may be responsible for high salinity and the monsoonal rain and continuous flow of fresh water from the river may be responsible for low salinity.

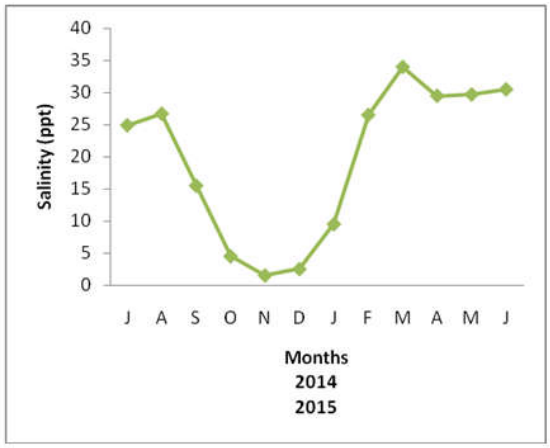

Fig. 4. Monthly changes in Salinity during 2014 to 2015 in Agniar estuary

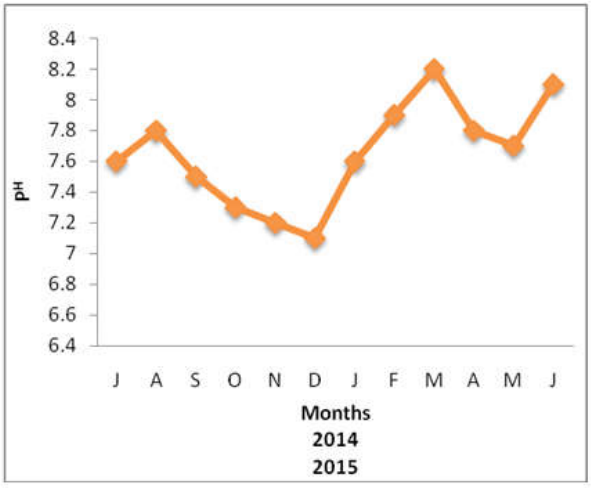

Fig. 5. Monthly changes in pH during 2014 to 2015 in Agniar estuary

The present observation of high salinity during summer and postmonsoon and low salinity during monsoon period is in conformity with the earlier reports from different estuaries of India (Ramamirtham and Jayaraman, 1963; Banerjee and Roychoudhury, 1966;Dyer and Ramamoorthi, 1969; Michael, 1970; Josanto,1975; sreenivasan and pillai, 1972; mohanty,1975; saraladevi *et al*.,1979; Thangaraj *et al*., 1979; siva kumar, 1982; Nair *et al*., 19893; Chandran and Ramamoorthy, 1984; Lyla, 1991; Murugan and Ayyakkannu, 1991; Kalidasan, 1992; Gouda and panigraphy,1993). The seasonal variation of pH in the Agniar estuary is represented in fig.4 through the pH of the water was observed to be alkaline in nature. The monthly average values of hydrogen ion concentration of estuarine water varied from 7.3 (December 2014) to 8.6 (May 2015). During the study period the hydrogen ion concentration was observed to be higher in summer and low values were recorded in the monsoon period (Fig.4). Statistical analysis showed that the pH had positive relationship with water temperature (r = 0.8584) and salinity (r = 08648) whereas it had an inverse relationship(r = - 0.9860) with dissolved oxygen.

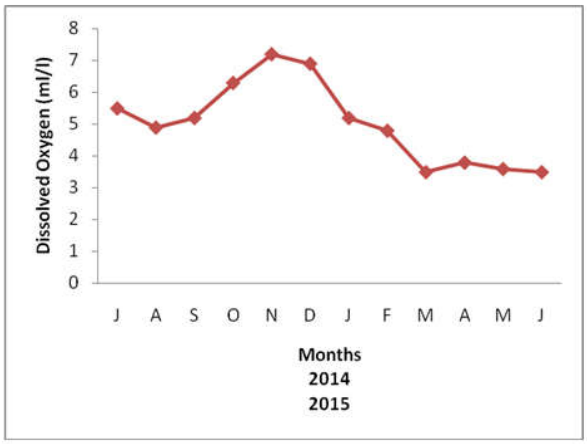

Fig. 6. Monthly changes in dissolved oxygen during 2014 to 2015 in Agniar estuary

Variations in the hydrogen ion concentration of the Ageniar estuary throughout the study period were less pronounced. Generally low pH values were recorded during the monsoon period and slightly higher values during summer and postmonsoon periods. Similarly, low pH values during monsoon period and it was influenced by the fresh water from river in Chilka lake (Mohandy, 1975) which supports the present investigation. High pH values observed in the present investigation during summer could be due to the removal of CO_2 during higher rate of photosynthesis. A positive correlation of pH was observed between the salinity and temperature. The changes in the pH of water during the course of study could be attributed to the discharge of freshwater, rainfall, temperature changes and biological activities. Dissolved oxygen (DO) in Agniar estuary was varied between 3.8 and7.3 ml/l. Minimum DO was recorded during the month of March 2015 and maximum in November, 2014 (Fig.5). Statistical analysis showed that dissolved oxygen had a negative correlation with water temperature (r=-0.8353), salinity (r=0.8124) and pH (r=0.9860). Dissolved oxygen is one of the important parameters which reflect the physical and biological processes prevailing in the water. It seemed to be controlled by various factors such as monsoon, temperature, salinity, phytoplankton and bacteria. The dissolved oxygen in the Agniar estuary showed a negative correlation with salinity.

The maximum dissolved oxygen content recorded during monsoon could be the influx of freshwater, higher solubility of oxygen in colder and less saline waters. Similar observations were also made Cochin backwater by Qasim and Gopinathan (1970); in the Mandovi (1973, 1976); in the Vellar estuaries by Vijayalakshmi and Venugopalan (1973); Chandran (1982) and Senthilnathan (1990); in Pappankanniar estuary by Chezhian and Habib Mohamed (1997); in Kerala estuaries by Saraladevi *et al.,* (1983); in the Uppanar backwaters by Murugan and Ayyakkannu (1991)and in the Bahuda estuary by Mishra *et al.,* (1993). In the present study observed that the low values of dissolved oxygen during summer. It is in agreement with the earlier observations of Chandran (1982); Chandran and Ramamoorthy (1984) and Mohandhas (1988) and the Vellar estuary; Upadhyay (988), Das *et al.,* (1977) in the Mahanadi estuary and Saisastry and Chandramohan (1990) in the Godavari estuary. A general decline in the level of oxygen recorded in summer months of the present study was attributable to the increase in salinity and temperature of the estuarine water.

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