Studies on the Influence of Climatic Conditions on pH and Temperature of Southeast Coast, Chennai, Bay of Bengal

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Abstract—**pH and temperature are the two important physicochemical parameters of water quality analysis. Water samples were collected from sampling sites (Ennore, Royapuram, Marina and Foreshore) along the Southeast Coast, Chennai, Bay of Bengal and analyzed to observe the fluctuations in the pH and temperature during different climatic seasons for a period of one year. The values of pH and temperature were in the range of 7.5 – 8.5 and 25 – 38°C respectively and obtained data was confirmed by cluster analysis. This study clearly demonstrated that, the physicochemical parameters were critically influenced by geoclimatic factors and interference, interventions of humankind.**

Keywords— marine; pH; temperature; seasons; cluster analysis

I. INTRODUCTION

The coast is considered as the geographical interface between the land and ocean. It is a dynamic exchange or interchange, which influences significantly each other's physicochemical and biological nature. Another commendable impact on these environments is by the human activities in and around this system. Around the globe there is a tendency of migrating larger volumes of population towards the coastal regions [1]. The complexity of this highly vulnerable region, influenced by a various physical, chemical and biological processes exist with. Being primordial physicochemical parameters which influence the living system are pH and temperature. To assess the biological support in any system, these two factors provide direct correlation and play a vital role to determine the ecological viability. Thus it necessitates evaluation of the pH and temperature. There is a cyclic shift in these two parameters round the year with various seasons and climates in marine system. Temperature of water is also influenced by latitude. Conceiving the importance of these two parameters, conducted the detailed study on the influence on the marine waters of Southeast Coast, Chennai, Bay of Bengal.

Seasonal variations of physicochemical parameters in the Southeast Coast, Chennai, Bay of Bengal were studied by several researchers [2 - 9]. The significance of the assessment of physicochemical parameters has been well illustrated by the related research work carried out along the Southeast coast, Chennai which was highly polluted because of the discharge of the waste products/effluents into the water bodies, both by industries as well as by human beings [10]. This resulted in alarming deterioration in the quality of the

water [11-14]. Cooum and Adyar are major rivers in polluting the coastal regions in the Southeast coast of Bay of Bengal, Chennai. The coastal regions in the Southeast coast of India are examples for the uncontrolled disposal of water and high pollution [15]. Ennore, harbor, Cooum and Adyar estuaries are the critical areas affected by manmade pollution [16 - 18]. Ennore is well known for the TPP. For the cooling of turbines, gallons of water are being siphoned in and the resulting warm water from the power plant is discharged into the river [19]). This is becoming a threat to the marine life [20]. Also, Ennore is a place where a large number of industries are located which also disposed their waste products into the water. The number of published articles mentioned above was reviewed and arrived at the selection of four ecologically fragile and polluted areas such as Ennore, Royapuram, Marina and Foreshore (Plate 1).

Plate 1. Study area in Southeast Coast, Chennai, Bay of Bengal

II. MATERIALS AND METHODS

A. Sampling sites

1) Ennore

Ennore is located between 13°14'51"N latitude and 80°19'91"E longitude in the Coromandel Coast of Tamil Nadu. This location was selected because of the existence of a thermal power plant (TPP) and its waste disposal into the nearby aquatic bodies. This was facilitated by an outlet canal connecting the plant's disposal into the sea water.

2) Royapuram

Royapuram beach was chosen because this site lies near one of the major fishing centers of Chennai and site is containing the huge disposal of battery waste. This location

of sample collection is geographically located 13º06'16"N latitude and 80°17'31"E longitude.

3) Marina

Marina is one of the well known beaches in south India; it is located between 13º03'974"N latitude and 80º17'36"E longitude. It also recognized as the longest beach in India and second longest in the world. This beach is thickly populated along the coast by fishing communities and is prone to the dumping of garbage and industrial effluents into the marine environment.

4) Foreshore

Natural calamities always create an instant upset in the environmental parameters. Many land areas of the Foreshore were submerged by sea water during the 2004 Tsunami. This site is a water logged area as a riverlet of the Adyar river that is consistently affected by inflects of water by the cyclic tidal flows from Bay of Bengal. This sampling site is positioned at $13^{°}02'23"$N latitude and 80 º 27'63" E longitudes. The river end samples were extremely polluted therefore, the samples were collected adjacent to the bar mouth.

B. Collection of water and soil samples

Samples were collected from the above mentioned sampling sites at monthly intervals from June 2007 to May 2008. Sampling period was broadly divided into four seasons as the southwest monsoon (SWM) – June to August'07; northeast monsoon (NEM) – September to November'07; winter (WTR) – December'07 to February'08 and summer (SMR) – March to May'08.

The water samples collected were usually 50 cm below the water surface and stored in amber-colored glass bottles (1L) with Teflon-lined caps [21]. Temperature and pH of the samples were recorded on the spot. Samples were immediately kept in an ice box, brought to the laboratory and processed on the same day.

C. Studies on the influence of climatic conditions of pH and temperature

Seasonal variation affects the pH and temperature, two of critical physico-chemical parameters of the environment. Over the period of sampling, these factors were analyzed to establish a correlation among the samples and cluster analysis was performed by SPSS (Version 14.0).

III.   RESULTS AND DISCUSIIONS

A. Influence of climatic conditions of pH in the sampling sites

The water samples were collected from Ennore, Royapuram, Marina and Foreshore named as MEW, MYW, MBW and MFW respectively. The influence of climatic conditions in the pH and temperature of the water was studied during SWM, NEM, WTR and SMR seasons of the year.

The range of pH values (7.5 to 8.5) obtained from the samples is presented in the Fig. 1A. Throughout the sampling period, all the samples were slightly alkaline. Among the samples, the highest alkalinity was observed with samples from MFW followed by MEW, MYW and MBW. Maximum

fluctuations were observed in MFW; more stable pH was in MEW and moderate fluctuations in MBW and MYW.

The site wise dendrogram of pH, MYW, MBW and MEW falls in one group as the pH range is similar and MFW falls as a different group as there is a significant pH difference (Fig. 1B). As MFW site is a low-lying area, the water gets stagnated. Therefore, depending on the seasons as well as due to stagnation, there might be a change in pH.

The dendrogram of seasonal pH fluctuations, during SMR, SWM in one group and NEM, WTR falls in another group (Fig. 1C).This data shows clearly that there is a cyclic sequence of variation of pH with the season throughout the year. The above mentioned fluctuations in pH observed in MFW in different seasons may be due to an influx of water from Adyar River and ocean or rains.

B. Influence of climatic conditions of temperature in the sampling sites

Temperature is one of the critical parameter in an ecosystem. MEW recorded a higher mean temperature during the period of this study (Fig. 2A). Since, MEW site is near the Ennore TPP, the disposal from the plant throughout the year to tend to increase the temperature of water in the site. While considering the water temperature, maximum was observed in SWM. Highest temperature ($38^{°}$C) was in MEW and lowest ($25^{°}$C) in MBW during NEM and WTR.

The climate wise dendrogram of temperature was formed into two groups. The first and second groups were classified with NEM, WTR and SWM, SMR respectively (Fig. 2B). Two distinct groups were formed for site wise temperature analysis carried out by dendrogram. The first group classified with MYW, MBW and MFW, whereas MEW clustered into another group (Fig. 2C).

IV.   CONCLUSION

The results were clearly revealed that there is a cyclic sequence of variation in the pH and temperature with the different seasons of the sampling period. pH and temperature are having the same pattern during SMR, SWM whereas NEM, WTR followed the same throughout the year. Variations in the pH and temperature directly related to the seasonal changes irrespective of the sampling sites. The research outcome of the meticulously planned sampling and analysis was ensured its reliability with support of statistical analysis. This could be the ground level information for taking up further extensive environmental assessment studies in the Southeast Coast, Chennai, Bay of Bengal.

V.   ACKNOWLEDGMENT

VI. REFERENCES

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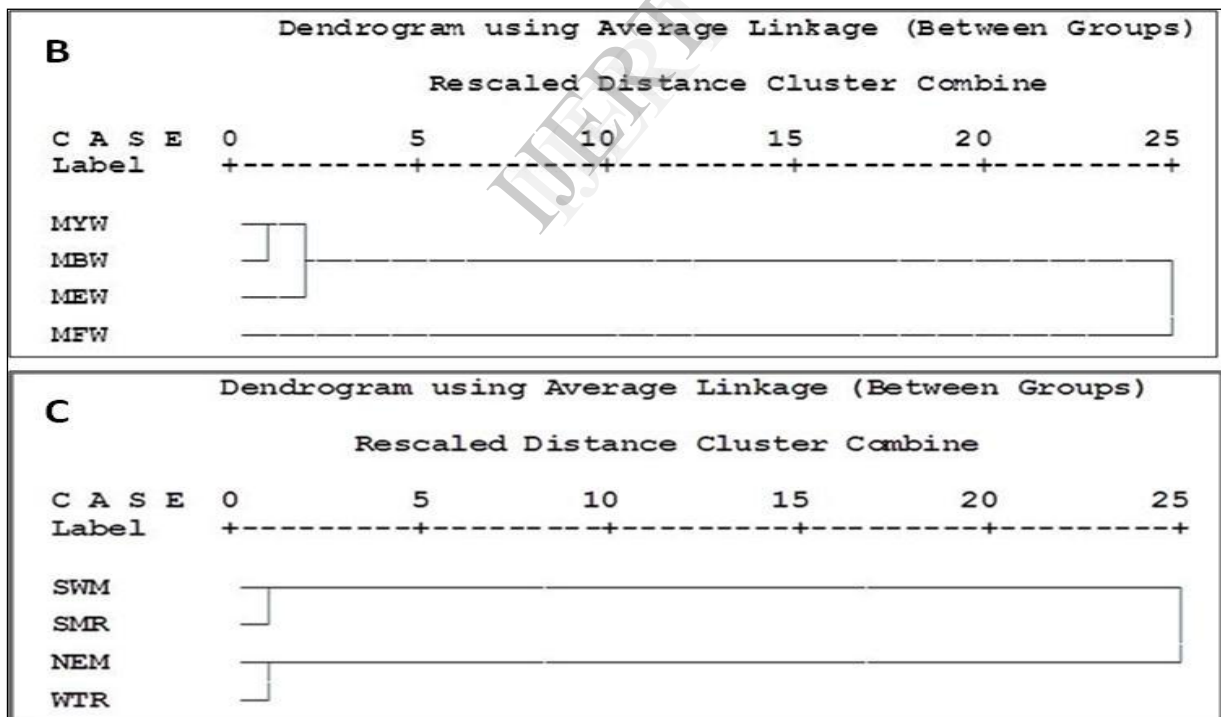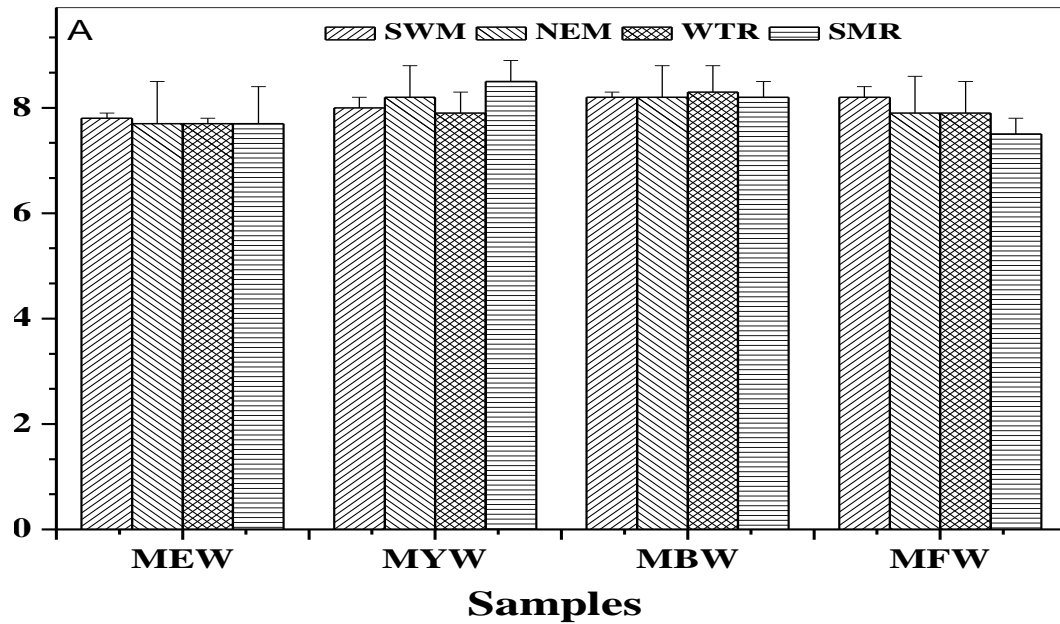
Fig. 1. Influence of climatic conditions of pH in the sampling sites

A. Variations of pH in the water sample, B. Dendrogram for pH (Site wise), C. Dendrogram for pH (Season wise)

Ennore (MEW); Royapuram beach (MYW); Marina beach (MBW); Foreshore estate (MFW);
Southwest monsoon (SWM) – June to August'07; northeast monsoon (NEM) – September to November'07; winter (WTR) – December'07 to February'08 and summer (SMR) – March to May'08.
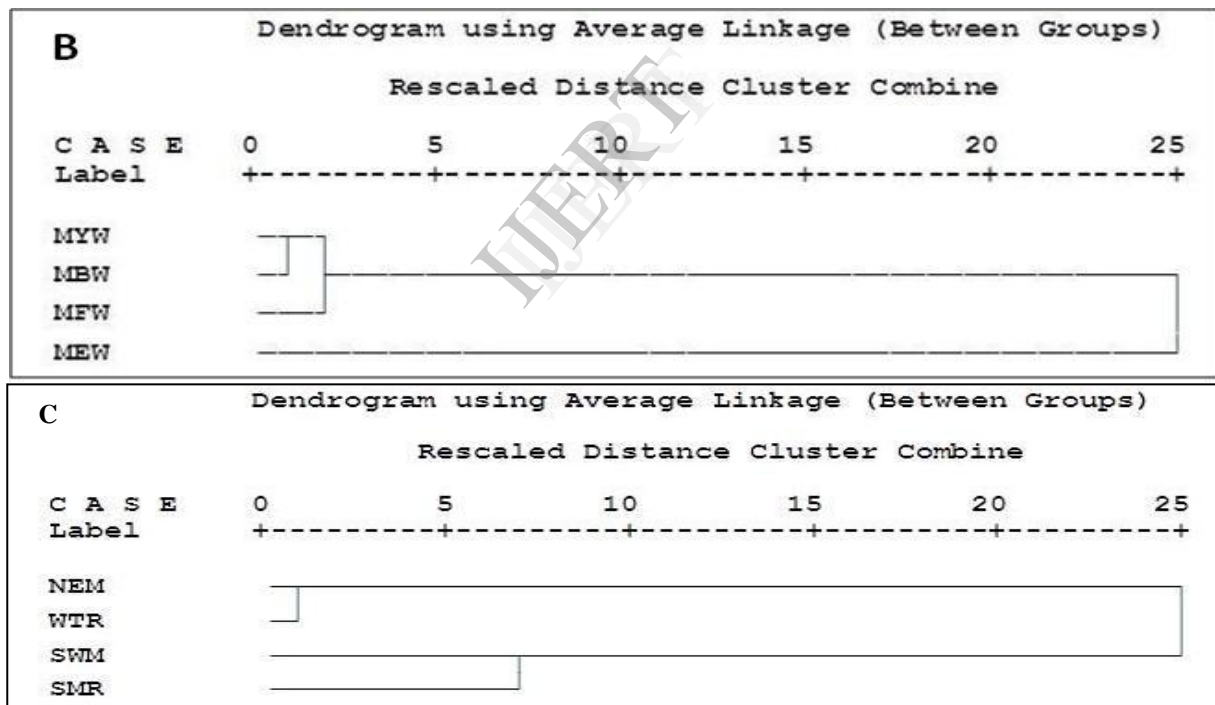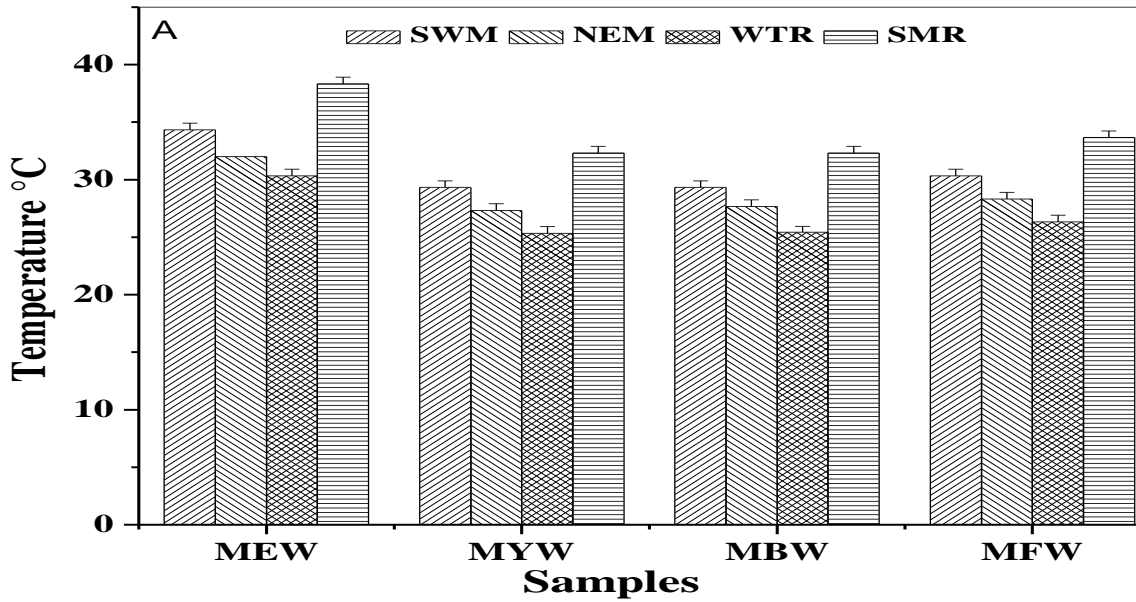
Fig. 2. Influence of climatic conditions of temperature in the sampling sites

A. Variations of temperature in the water sample, B. Dendrogram for temperature (Site wise), C. Dendrogram for temperature (Season wise)

Ennore (MEW); Royapuram beach (MYW); Marina beach (MBW); Foreshore estate (MFW);
Southwest monsoon (SWM) – June to August'07; northeast monsoon (NEM) – September to November'07; winter (WTR) – December'07 to February'08 and summer (SMR) – March to May'08.