

Changes of physico-chemical parameters due to the seasonal influence of coastal waters in Karaikkal coast, southeast coast of India

R. Balasubramanian

Centre of Advanced Study in Marine Biology, Faculty of Marine Sciences Annamalai University, Parangipettai – 608 502, Tamil Nadu, India
balaram_r2@rediffmail.com

Abstract

Background/Objectives: Coastal waters are involving the dynamic process of marine environment. The physico-chemical parameters of water and sediment provide base for all life process of the living organisms. It is desirable factors to make an effective environment. Hence, the present work has been carried out the physico-chemical characteristics of Karaikkal coastal waters.

Methods/Statistical Analysis: Samples of water and sediment were collected from Karaikkal coastal waters for a period of one year from July' 2016 – June 2017 to analyze various physico-chemical parameters in water and nutrient in sediments.

Findings: The maximum concentration of organic materials were received from the catchment area during monsoon season due to rainfall and fresh water inflow, etc. This trend of large amount of total organic carbon in sediment during monsoon could be attributed to the effluent discharge.

Application/Improvements: The amount of nutrients determines the potential fertility of the water masses and thus it is necessary to collect several data regarding their distribution and behavior in many coastal ecosystem.

Keyword: Coastal water, Sediments, Physical parameters, Nutrients.

1. Introduction

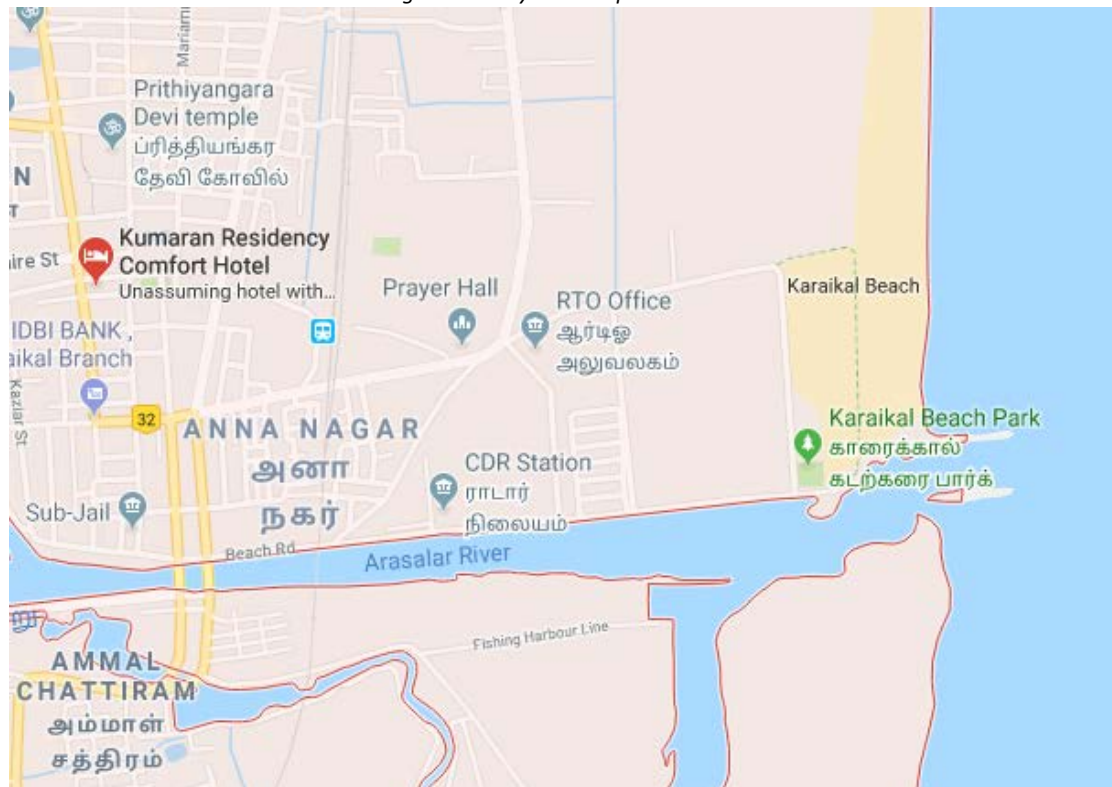
The marine environment is a complex system is mainly influenced by various Physical, chemical and biological processes. In recent years, due to anthropogenic activities, industrial effluents, domestic wastages seriously affect on aquatic system may result in decreased species abundance, diversity and change the biology of the species. The anthropogenic impacts account for considerable ecologic and economic losses worldwide and constantly changing the natural processes which occurred along the coastal systems [1-2].

The physical and chemical disturbances in the seabed etc. colliery wastes and fly ash dumping will cause the water to turbid and covers the entire seabed and decrease the reduction potential of the substrate, thus lowering the density and diversity of the benthic organisms [3-4]. Oil spills leads to entire eradication of the benthic organisms of affected area due to unavailability of dissolved oxygen [5]. They remain poorly understood, despite the fact that they are extremely abundant and diverse, often numbering millions per square meter in sediments, and occur in more habitats than any other metazoan group [6].

2. Study area

Karaikkal coast (Lat.10046 N., Long. 79051E) is situated in the Bay of Bengal. This coastal area is actively functioning harbor and also consider as an important fish landing centre (Figure 1).

Figure 1. Study area map



3. Materials and Methods

1. Physico-chemical parameters of water and sediments

Water samples were collected from Karikal coastal waters for a period of one year from July' 2016 – June 2017 to analyze various physico-chemical parameters (Figure 1). The nitrogen, phosphorous and total organic carbons were determined in sediment samples with adopting standard methods [7].

4. Results

1. Physico-chemical parameters

The water temperature values varied from 22 ° to 35 ° C. Minimum temperature (22 ° C) was observed in the month of Dec' 2016 (monsoon) and maximum (35 ° C) was recorded during summer season in the month of May' 2017 (Figure 2). The salinity ranged from 31ppt to 33ppt was recorded during the study period. Minimum salinity (30ppt) was observed in the month of Dec' 2016 (monsoon) and maximum (35ppt) was recorded during summer and pre-monsoon seasons (Figure 2).

The hydrogen ion concentration (pH) in surface water was observed in alkaline condition throughout the study period. Minimum pH (7.6) was observed in the month of Dec' 2016 (monsoon) and maximum (8.3) was recorded during summer season in the month of May' 2017 (Figure 2). The dissolved oxygen (DO) values varied from 3.48 ml L⁻¹ to 5.03 ml L⁻¹ were recorded during the study period. Minimum DO (3.48ml L⁻¹) was observed in the month of May 2017 (summer) and maximum (5.03ml L⁻¹) was recorded during monsoon season in the month of Dec' 2016 (Figure 2).

2. Water nutrients

The nutrient concentration values varied from NO_2 0.496 – 2.798 $\mu\text{g L}^{-1}$, NO_3 1.23 $\mu\text{g L}^{-1}$ to 5.209 $\mu\text{g L}^{-1}$, TN 4.301 – 13.72 $\mu\text{g L}^{-1}$, IP 0.325 – 1.198 $\mu\text{g L}^{-1}$ and TP 0.581 – 2.003 $\mu\text{g L}^{-1}$ respectively were recorded during the study period. Almost all the nutrients were minimum observed in summer and maximum were recorded during monsoon season in the month of Dec' 2016 (Figure 3).

Figure 2. Physico-chemical parameters in waters during July 2016 – June 2017 at Karaikal coast

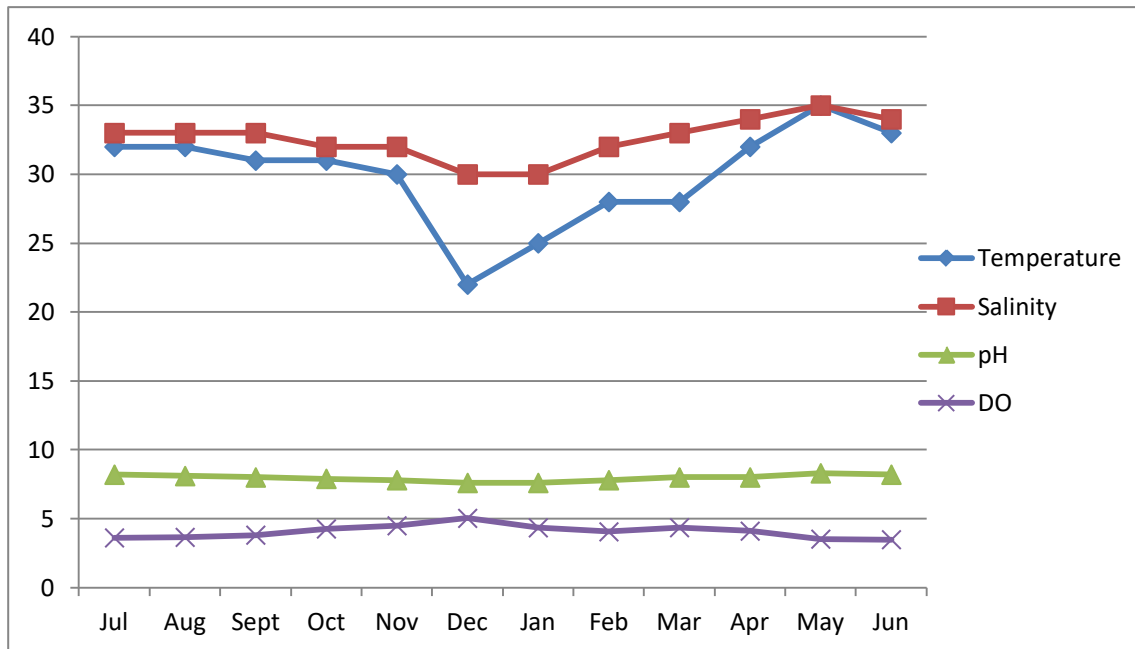
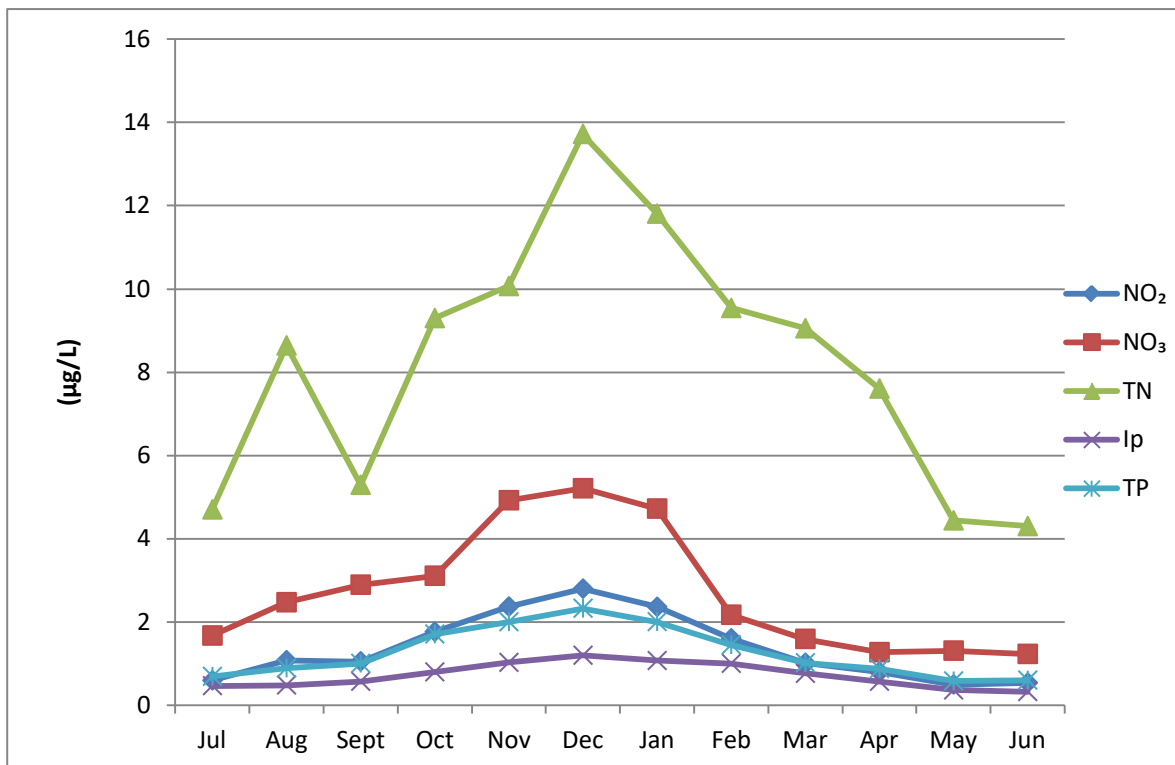


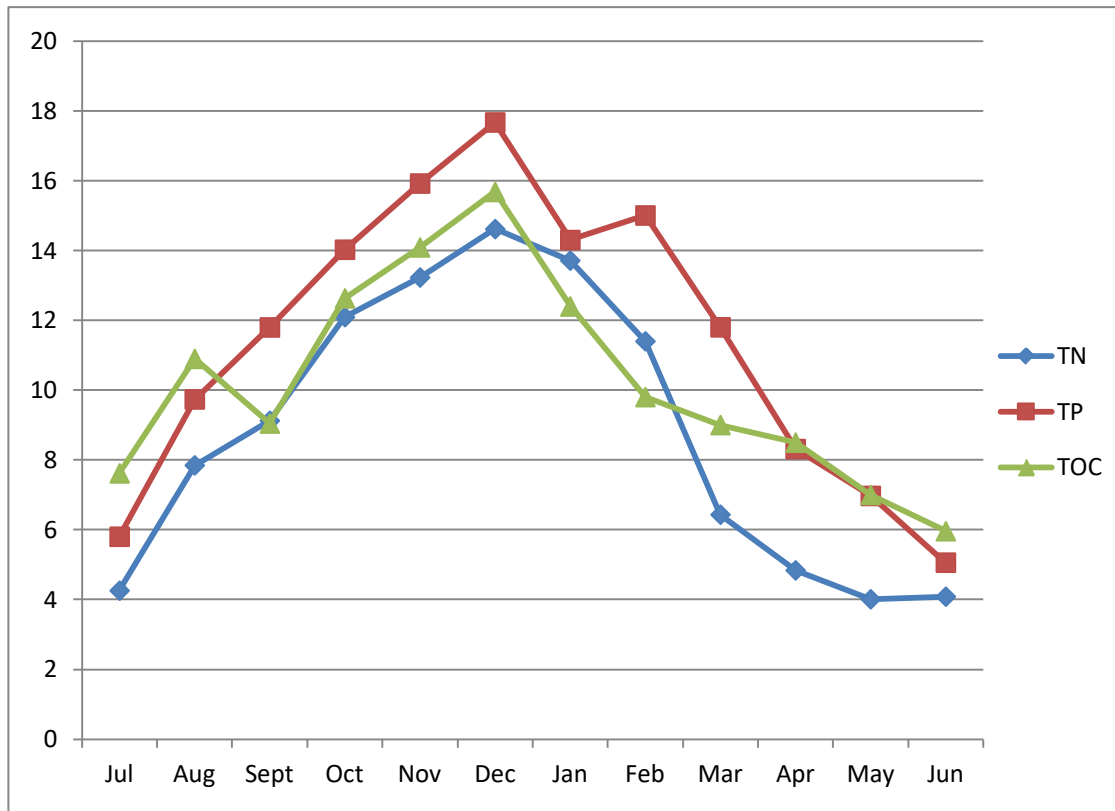
Figure 3. Nutrients concentration ($\mu\text{g/l}$) in water during July' 2016 - June'2017 in Karaikal coast



3. Sediment nutrients

The sediment nutrient concentration ranged from TN, 4.013 $\mu\text{g L}^{-1}$ – 14.618 L^{-1} , TP, 5.062 $\mu\text{g L}^{-1}$ – 17.672 $\mu\text{g L}^{-1}$, TOC, 5.963 L^{-1} – 15.682 $\mu\text{g L}^{-1}$ were observed respectively during the study period. Almost all the nutrients the minimum concentrations were observed in summer and maximum were recorded during monsoon season in the month of Dec' 2016 (Figure 4).

Figure 4. Nutrients concentration ($\mu\text{g L}^{-1}$) in sediments during July' 2016 - June'2017 at Karaikkal coast



4. Discussion

The important contributors of fisheries in India suffer from severe loss of fish production due to increased industrialization and urbanization along the coastal zone by continuous discharge of industrial effluents. Data on the range of surface water temperature, pH, salinity, dissolved oxygen are given [8-10]. Temperature is an important limiting factor, which regulates the biogeochemical activities in the aquatic environment. Generally water temperature correspond with air temperature indicating that the samples collected from shallow zones has a direct relevance with air temperature, shallow water reacts quickly with changes in atmospheric temperature [11, 2].

Temperature controls behavioral characteristics of organisms, solubility of gases and salts in water [12-13]. The up and down of atmospheric temperature impact on water temperature is clearly appeared. The seasonal variations in atmospheric heating and warming up of surface waters during summer may be causes for relatively high temperatures. The increased pattern from winter to summer is pointed the earlier reports [14-15] [8]. Temperature is an important limiting factor, which regulates the biogeochemical activities in the aquatic environment. Generally, the surface water temperature is influenced by the intensity of solar radiation, evaporation and fresh water influx. Any increase in temperature decreases the DO. In the present study, the surface water temperature varied with the seasons as lowest in monsoon months (22 °C) and highest during summer (35 °C) (Figure 2). Similar findings were also recorded [2].

Salinity is an important factor of distribution of benthic organisms and its changes caused by precipitation and evaporation. Salinity variations influence the fauna in the marine environment particularly intertidal zones. The changes of the salinity in the estuaries are occurring due to river runoff, influenced by monsoon or tidal variation [2]. In the present study, the salinity is not having much variation because of open coastal waters. The seasonal variations of salinity were observed as lowest in monsoon months (30ppt) and highest during summer (35ppt) (Figure 2). Similar findings were also recorded [2, 16]. PH of water is an important environmental factor, the fluctuation of pH is linked with chemical changes, species composition and life processes. It is generally considered as an index for suitability of the environment. In the present study, the water pH varied with the seasons as lowest in monsoon months (7.6) and highest during summer (8.3) (Figure 2). The surface water remained alkaline throughout the study period without any marked differences in this station. The fluctuated environment has observed that a pH range of 6.7 to 8.4 is suitable for the growth of Aquatic biota. In Adyar estuary pH ranged from (7.17 to 9.90) indicating slight alkaline nature of water [16, 9].

The influence of the temperature and salinity which are affect the diffusion of oxygen in water. When it is increasing the temperature on water which is directly rise salinity due to this the solubility DO will be lost by the water bodies. In the present study, the DO concentration from 3.48ml/l – 5.03ml/l were observed in this station (Figure 2). Highest value of DO (5.03ml/l) was recorded due to the rainfall and freshwater inflow in monsoon. The low value of (3.48ml/l) was recorded during summer season. The same results were reported [14, 13]. Nitrite concentration from 0.496 $\mu\text{g L}^{-1}$ to 2.798 $\mu\text{g L}^{-1}$ was recorded during the present study period (Figure 3). Nitrite concentration was found to be much lower than that of nitrate.

However, earlier reports found even higher concentration of nitrite from estuaries lagoons and mangrove environment and Lower concentration of nitrate was recorded at open sea may be due to utilization of nitrate by the benthic algae and phytoplankton [14, 12, 17]. Nitrate concentration from 1.23 – 5.209 $\mu\text{g L}^{-1}$ was recorded during the present study period (Figure 3). Higher concentration of nitrate might be occurring due to heavy rainfall, land drainage and agricultural discharge. The addition of nitrogenous nutrients mainly through freshwater and terrestrial runoff in the lagoon definitely increased the level of nitrate [9]. TN concentration from 4.301 – 13.72 $\mu\text{g L}^{-1}$ was recorded in this station (Figure 3). About the similar values were recorded [9, 18]. TP concentration from 0.581 – 2.003 $\mu\text{g L}^{-1}$ was recorded in this station (Figure 3). The maximum TP value was recorded during monsoon season which is influenced by the freshwater inflow. The minimum TP concentration was observed during summer season due to lack of freshwater inflow and by utilization of seaweeds sea grass and phytoplankton. About the similar values were recorded [19, 9]. Here it can conclude that, the physical and chemical properties of marine ecosystems are representative of the climatic and pollution conditions.

The sediment nutrient concentration ranged from TN, 4.013 $\mu\text{g L}^{-1}$ – 14.618 $\mu\text{g L}^{-1}$, TP, 5.062 $\mu\text{g L}^{-1}$ – 17.672 $\mu\text{g L}^{-1}$ TOC, 5.963 $\mu\text{g L}^{-1}$ – 15.682 $\mu\text{g L}^{-1}$ respectively were observed during the study period (Figure 4). The maximum value of TN, TP and TOC were recorded during monsoon season. The maximum concentration of organic materials were received from the catchment area during monsoon season due to rainfall and fresh water inflow, etc. This trend of large amount of total organic carbon in sediment during monsoon could be attributed to the effluent discharge and low amount of TOC in summer as evidenced [20, 14, 9].

5. Conclusion

Physico-chemical parameters are important properties for the aquatic organisms. It is interactive with biological processes of the coastal ecosystem for sustain life of animal diversity aquatic environment. The amount of nutrients determines the potential fertility of the water masses. The studies have become inevitable to know the potentiality and also for better management of an aquatic ecosystem.

6. References

1. Z.A. Ansari, M.U. Ganus. A quantitative analysis of fine scale distribution of area, Parakkani, Tamil Nadu. *International Journal of Environmental Science*. 1996; 1(6), 2-10.
2. A. Archana, K.R. Babu. Seasonal variations of physico-chemical parameters in coastal waters of Visakapatnam. *Middle-East Journal of Scientific Research*. 2013; 14(2), 161-167.
3. C. Palpandi. Hydrobiological parameters, population density and distribution pattern in the gastropod *Nerita (dostia) crepidularia* Lamarck, 1822, from mangroves of Vellar estuary, Southeast India, *International Journal of Biodiversity and Conservation*. 2011; 3(4), 121-130.
4. G. Chinnadurai, O.J. Fernando. Impact of mangrove leaves on meiofaunal density: an experimental approach. *The ICFAI Journal of Life Sciences*. 2007 ; 1(1), 62-70.
5. M. Ellis. Detection and measurement of stream pollution, *United States Fish Commission Bulletins*. 1937; 22, 367-437.
6. P. Fauvel. The fauna of India including Pakistan, Ceylon, Burma and Malaya. *The Indian Press*. 1953; 1-507.
7. J.G. Frederick, N.J. Maciolek. Deep-sea species richness; regional and local diversity estimates from quantitative bottom-sampling. *The American Naturalist*. 2000; 139(3), 13-41.
8. S.N. Harkantra, A. Nair, Z.A. Ansari, A.H. Parulekar. Benthos of the shelf region along the west coast of India. *Indian Journal of Marine Sciences*. 1980; 9, 106-110.
9. A.C. Harriague, G. Albertelli, C. Misic. Macro and meiofaunal community features in the critical environmental system of a tourist harbour (Rapallo, Ligurian Sea, NW Mediterranean). *Marine Environmental Research*. 2012; 74, 64-72.
10. C. Heip, M. Vincx, G. Vranken. The ecology of marine nematodes. *Oceanogr. Marine Biology: An Annual Review*. 1985; 23, 259-263.
11. M. Maduprathap. Status and strategy of zooplankton of tropical Indian estuaries. *A Review Bulletin on plankton society of Japan*. 1987; 34(1), 65-81.
12. A.D. McIntyre. Ecology of marine meiobenthos. *Biological Reviews*. 1969; 44(2), 245-290.
13. P. Soundarapandian, T. Premkumar, G.K. Dinakaran. Studies on the physico- chemical characteristics and nutrients in the Uppanar estuary of Cuddalore, South east coast of India. *Current Research Journal of Biological Sciences*. 2009; 1(3), 102- 105.
14. M. Prasannakumar, P.C. Ranjan. Physico chemical properties of water collected from Dharma estuary. *International Journal of Environmental Science*. 2010; 1(3), 334-342.
15. J.S.I. Rajkumar, J.M.C. Milton, T. Ambrose. Seasonal variation of water quality parameters in Ennore estuary with respect to industrial and domestic sewage. *International Journal of Current Research*. 2011; 33(3), 209–218.
16. J. Rani, A. Kannagi, V. Shanthi. Correlation of total heterotrophic bacterial load in relation with hydrographical features of Pazhayakayal estuary, Tuticorin, India. *Journal of Environmental Biology*. 2012; 33(4), 769-773.
17. S. Sajan, T.V. Joydas, R. Damodaran. Meiofauna of the western continental shelf Seasonal variation in physico-chemical properties and Seasonal variations of physico chemical characteristics. *Science of the Total Environment*. 2010; 4, 1-14.
18. G. Sivaleela, K. Venkatraman. Free living nematodes of Tamil Nadu coast, India. *Records of the Zoological Survey of India*. 2013; 336, 1-45.
19. J.D.H. Srtickland, T.R. Parsons. A practical hand book of seawater analysis. *Fisheries research board of Canada. Bulletin*. 1972; 167, 1-310.
20. M.V. Vincy, B. Rajan, P.A.P Kumar. Water quality assessment of a tropical wetland ecosystem with special reference to backwater tourism, Kerala, south India. *International Research Journal of Environmental Sciences*. 2012; 1(5), 62-68.

The Publication fee is defrayed by Indian Society for Education and Environment (www.iseeadyar.org)

Cite this article as:

R. Balasubramanian. Changes of physico-chemical parameters due to the seasonal influence of coastal waters in Karaikkal coast, southeast coast of India. *Indian Journal of Innovation and Developments*. Vol 6 (9), September 2017.