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Research Article **Botany**

STUDIES ON PHYSICO-CHEMICAL PARAMETERS IN THE NAGAPPATTINAM MARINE WATER SAMPLES, SOUTH EAST COAST OF TAMIL NADU, INDIA

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ABSTRACT

Monthly fluctuations of physico-chemical characteristics were carried out in Nagapattinam marine water samples, South east coast of Tamil Nadu, India, for a period of twelve months (August 2016 to July 2017). Nine various physico-chemical parameters were analyzed by using standard methods (APHA, 1998). Water temperature varied from 25.65 to 33.40°C, Turbidity was from 23.57 to 45.36 cm, pH ranged from 7.20 to 8.52, dissolved oxygen content varied between 3.87 to 6.17 mg/L, salinity (28.10 to 32.09 mg/L), calcium (33.67 to 69.98 mg/L), phosphate (0.09 to 0.13 mg/L), nitrate (0.14 to 0.38 mg/L) and ammonia (0.11 to 0.56 mg/L) also varied independently. The maximum and minimum were noted during the study period August 2016 to July 2017.

Key words : Physico-chemical parameters, Monthly variations, Maximum and minimum, Water quality.

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INTRODUCTION

The marine environment includes the adjacent coastal areas supports productive and protective habitats such as mangroves, coral reefs and sand dunes. The marine environment is facing a number of pressures, arising out of the needs of people, and the multiple uses that coastal and marine areas can be put to. These pressures contribute to the depletion of marine resources and degradation of the marine environment. In the absence of good management, these pressures may result in severe stress.

The coastal ecosystems provide food and other incomes, also used for waste disposal, recreation and inspiration. Coastal environment is vital for all human activities including industrial growth. Without the coastal environment, success of any community or nation is impossible. The marine environment forms an essential constituent of the global life. In all the countries, the human activities can affect the physical characteristics of the coastal water. The Coastal ecosystem is the vibrant host for fauna and flora and it is the most important resource to provide a good plat-form for the coastal life. There are various sources which are responsible to change the biodiversity of the coastal ecosystem.

Marine habitat plays a major role in forecasting, localizing, and manipulating the marine resources (Asha and Diwakar, 2007). The coastal hydrography is much complicated due to the dynamic nature of the ecosystem. Changes in the hydrographical parameters such as salinity, dissolved oxygen, dissolved carbon dioxide; nutrients affect the activities and growth of the organisms in the ecosystem (Sridhar *et al*., 2008).

Marine environment is a complex system and mainly influenced by various physical chemical and biological process. The open ocean is more stable compare to the near shore waters where the interaction with terrestrial and makes the variations in hydrographical properties (Poonam Bhadja and Rahul Kundu, 2012). Coastal waters are considered to be the pillar and essential of marine life. The study of hydrographic properties of coastal environments is important, because the variations in the instantly influence on the floral and faunal production. To maintain optimum level of water quality parameters is better for the species survival and healthy ecosystem (James Balgan Anand and Mary Jelastin Kala, 2015).

James Balgan Anand *et al*. (2015) were noted the environmental factors of coastal areas are very important, because the variations in the physico-chemical properties, such as temperature, salinity, pH, dissolved oxygen and nutrients will impact the life span of the fauna and flora in the sea. It regulates the species richness in the coastal area. The variations in the nutrients load along the coastal waters is due to the natural weathering, riverine, land and anthropogenic input .However, the natural seasonal changes keep the coastal waters well mixed and aerated, which help to scatter the nutrients useful for the Biota. The data suggests that during the monsoon period, a significant increase of fresh water and land side input into the coastal area and have elevated nutrient concentration compared with other seasons. In the present investigation attempts to provide such vital information for future references. All the physico-chemical parameters were studied from Nagapattinam marine water samples, south east coast of Tamil nadu, India for a period of August 2016 to July 2017.

MATERIALS AND METHODS

Water samples were collected from Nagapattinam marine water samples, south east coast of Tamil Nadu, India, which is located at latitude 110º 05´ North South and longitude 79 º 5´ East West on Southern part of India. 2 litre capacity of plastic cans for physico-chemical samples were used to collect surface water samples and kept immediately in an ice box and transported to the laboratory. The samples were analyzed every month during August 2016 to July 2017. The various physico-chemical parameters were analyzed by using standard methods (APHA, 1998).

Temperature: In the present study water temperature of the pond water recorded by using Mercury field celcious thermometer. pH: The pH was determined by using Elico, model LI. 120 Digital pH meter. Turbidity: It can be determined by using turbidity meter. Dissolved oxygen: The Dissolved oxygen was determined by the modified Winkler's method (1888). Salinity: The salinity content was determined by Mohr’s titration method. The other parameters like, calcium estimated by EDTA Titrimetric method, The phosphate and nitrate were determined by the Brucine method and ammonia was determined by the Nesslerization method (APHA, 1998).

RESULTS

In the present study, the water temperature fluctuated from 25.65 to 33.40ºC in marine water samples. It was found to be low (25.65ºC) in the month of November 2016 and high (33.40ºC) in May 2017 (Table 1 and Fig. 1).Turbidity of the marine water depends on availability of either zooplankton or phytoplankton and suspended soiled particles. The transparency of the water samples varied from 23.57 to 45.36 cm. It was found to be low (23.57cm) in the month of November 2016 and high (45.36 cm) in the month of May 2017 (Fig. 2). pH is another important biological parameter. The pH of the estuarine water showed alkaline ranges throughout the study period. It varied from 7.20 to 8.52. It was found to be minimum (7.20) in January 2017 and maximum (8.52) in the month of May 2017 (Fig. 3). The salinity content ranged from 28.10 to 32.09 ppt. It was found to be high (32.09 ppt) in the month of June 2017 and low (28.10 ppt) was recorded in January 2017 (Fig. 4).

The dissolved oxygen is important biological factor. The dissolved oxygen content ranged from 3.87 to 6.17 mg/L. It was found to be minimum (3.87 mg/L) in May 2017 and maximum (6.17 mg/L) in December 2016 (Fig. 5). Calcium content was fluctuated from 33.67 to 69.98 mg/L. It was found to be low (33.67 mg/L) in the month of November 2016 and high (69.98 mg/L) in May 2017 (Fig. 6). The phosphate content ranged from 0.09 to 0.13 mg/L. It was found to be lowest value (0.09 mg/L) in December 2016 and highest value (0.13 mg/L) in January 2017 (Fig. 7). Nitrate content was fluctuated from 0.14 to 0.38 mg/L. It was found to be low (0.14 mg/L) in the month of December 2016 and high (0.38 mg/L) in May 2017(Fig. 8).The ammonia content ranged from 0.11 to 0.56 mg/L. It was found

to be minimum (0.11 mg/L) in the month of November 2017 and maximum (0.56 mg/L) in June 2017 (Fig. 9).

Table 1: Physico-chemical parameters of Nagapattinam coastal area water samples (August 2016 to July 2017).

Month and Year	Temp. (°C)	Turbidity (cm)	pH	Salinity (ppt)	DO (mg/L)	Calcium (mg/L)	Phosphate (mg/L)	Nitrate (mg/L)	Ammonia (mg/L)
Aug-16	31.47 ± 0.26	38.19 ± 0.20	7.57 ± 0.05	30.07 ±0.01	4.58 ± 0.29	54.55 ± 0.31	0.11 ± 0.01	0.28 ± 0.02	0.28 ± 0.03
Sep-16	30.28 ± 0.13	32.87 ± 0.19	7.35 ± 0.06	31.26 ±0.01	4.72 ± 0.46	45.53 ± 0.36	0.12 ± 0.00	0.25 ± 0.02	0.16 ± 0.02
Oct-16	29.42 ± 0.27	28.59 ± 0.27	7.67 ± 0.39	30.45 ±0.01	4.97 ± 0.30	47.59 ± 0.24	0.10 ± 0.00	0.24 ± 0.03	0.18 ± 0.03
Nov-16	25.65 ± 0.17	23.57 ± 0.27	7.46 ± 0.10	29.67 ±0.02	5.84 ± 0.23	33.67 ± 0.24	0.12 ± 0.00	0.18 ± 0.02	0.11 ± 0.02
Dec-16	28.64 ± 0.33	26.58 ± 0.15	7.27 ± 0.09	28.14 ±0.01	6.17 ± 0.18	52.45 ± 0.27	0.09 ± 0.00	0.014 ± 0.03	0.18 ± 0.02
Jan-17	28.59 ± 0.22	27.20 ± 0.13	7.20 ± 0.08	28.10 ±0.03	5.65 ± 0.30	37.42 ± 0.22	0.12 ± 0.00	0.20 ± 0.03	0.25 ± 0.03
Feb-17	29.57 ± 0.63	32.06 ± 0.66	7.38 ± 0.13	29.54 ±0.03	5.09 ± 0.16	52.45 ± 0.26	0.11 ± 0.00	0.35 ± 0.05	0.37 ± 0.06
Mar-17	30.43 ± 0.24	35.42 ± 0.22	7.37 ± 0.09	30.72 ±0.01	5.15 ± 0.13	63.51 ± 0.16	0.10 ± 0.01	0.25 ± 0.03	0.31 ± 0.04
Apr-17	31.59 ± 0.19	36.60 ± 0.27	8.32 ± 0.12	30.94 ±0.02	4.58 ± 0.30	56.56 ± 0.24	0.11 ± 0.00	0.31 ± 0.03	0.32 ± 0.04
May-17	33.40 ± 0.26	45.36 ± 0.18	8.52 ± 0.13	31.11 ±0.01	3.87 ± 0.36	69.98 ± 0.24	0.12 ± 0.00	0.38 ± 0.04	0.39 ± 0.05
Jun-17	32.43 ± 0.25	43.22 ± 0.11	8.02 ± 0.09	32.09 ±0.01	4.28 ± 0.19	52.49 ± 0.28	0.13 ± 0.00	0033 ± 0.03	0.56 ± 0.04
Jul-17	30.48 ± 0.16	35.27 ± 0.14	7.76 ± 0.08	30.37 ± .01	4.73 ± 0.17	45.50 ± 0.24	0.12 ± 0.00	0.32 ± 0.02	0.52 ± 0.06

Each value is the mean ± S.D. of four observations

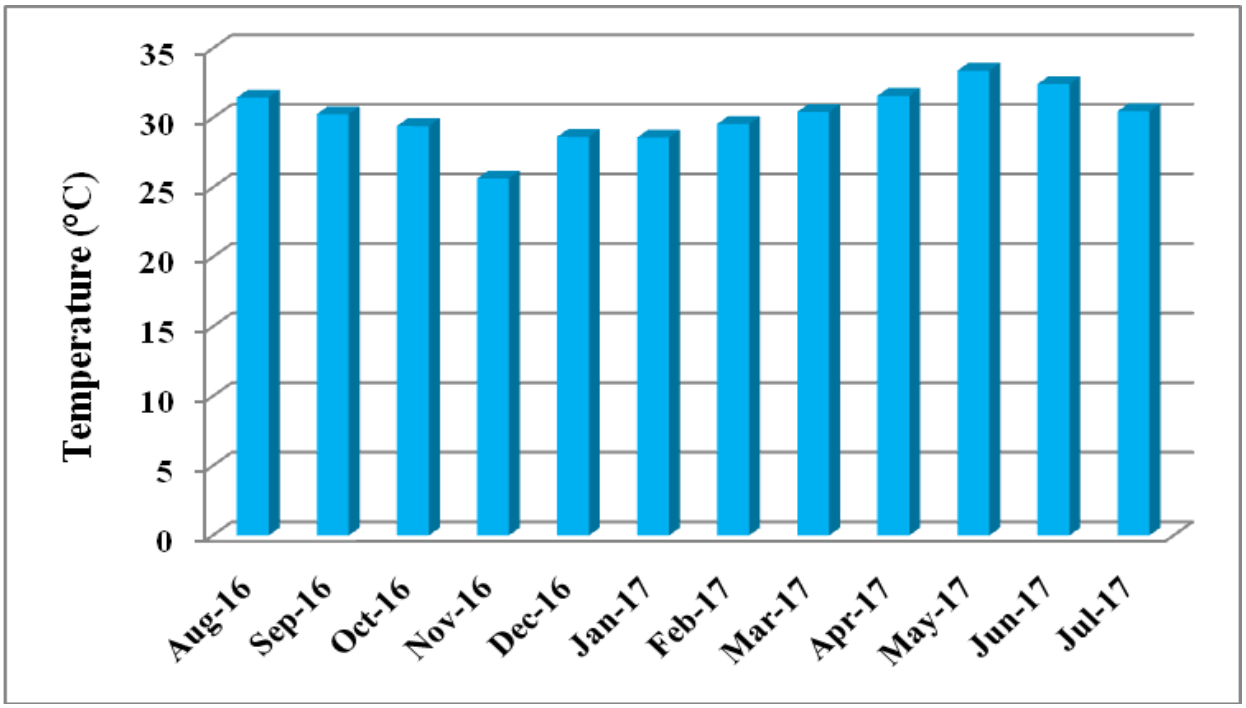

Fig. 1. Monthly variations of temperature (^{0}C) in the marine water samples.

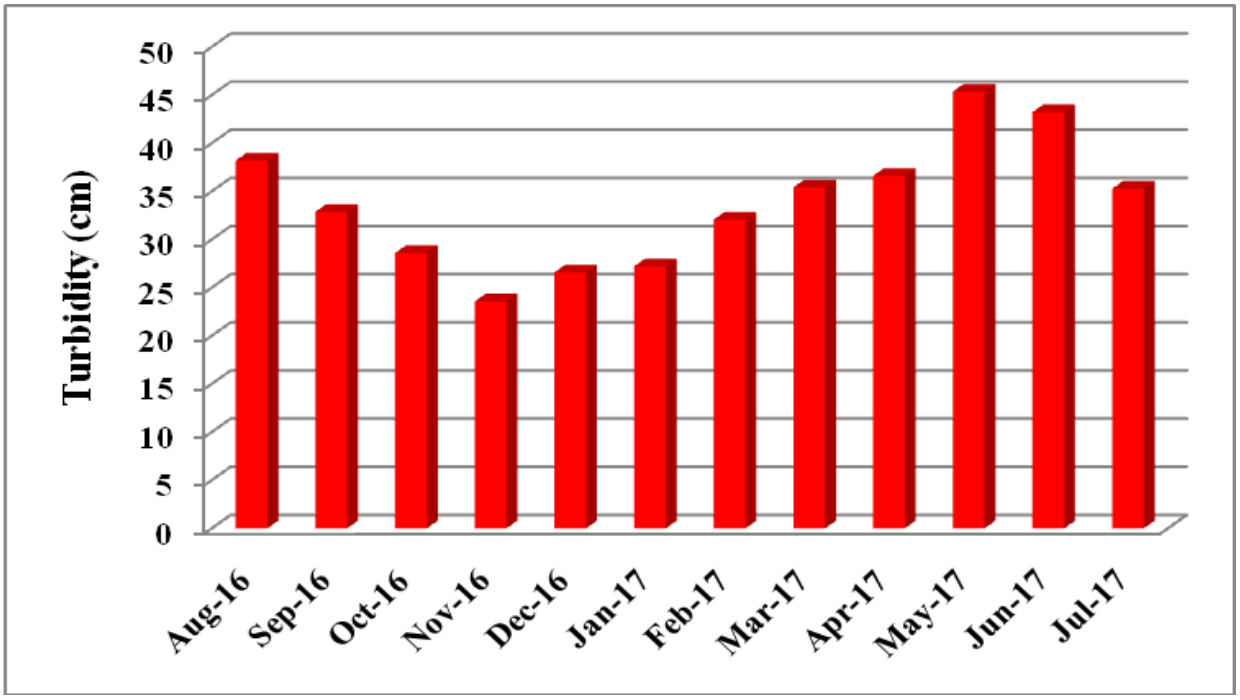

Fig. 2. Monthly variations of turbidity (cm) in the marine water samples.

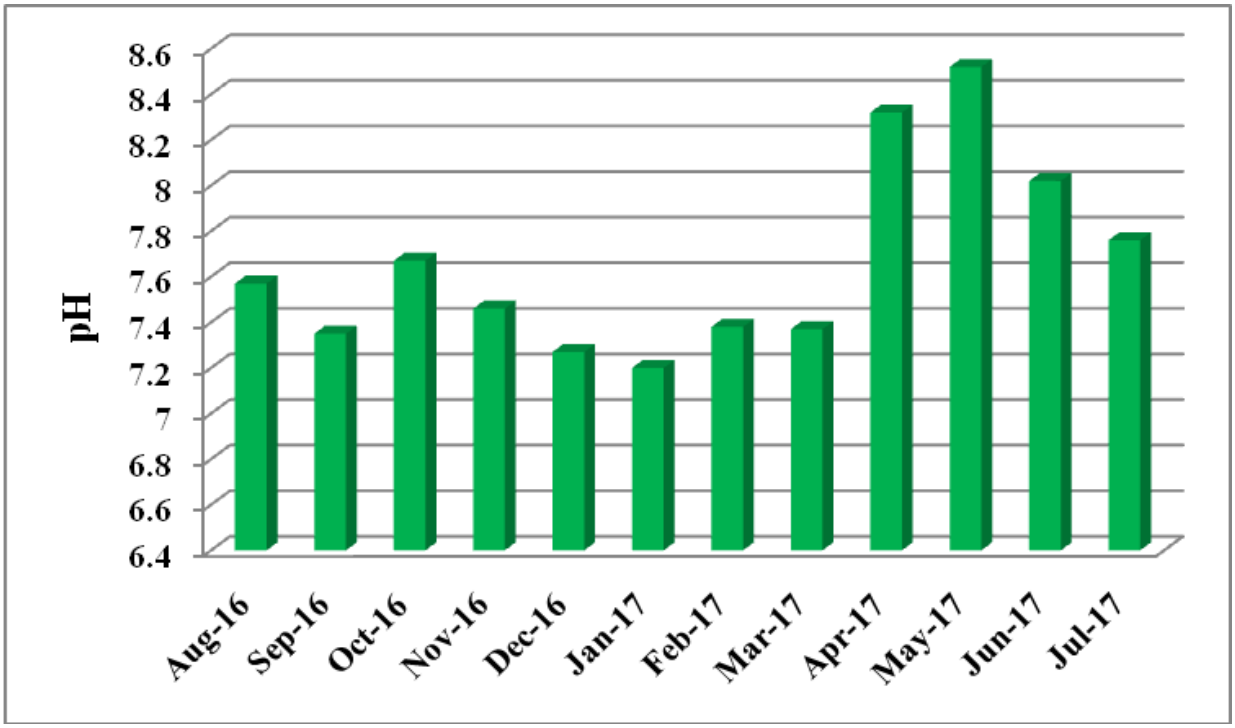

Fig. 3. Monthly variations of pH in the marine water samples.

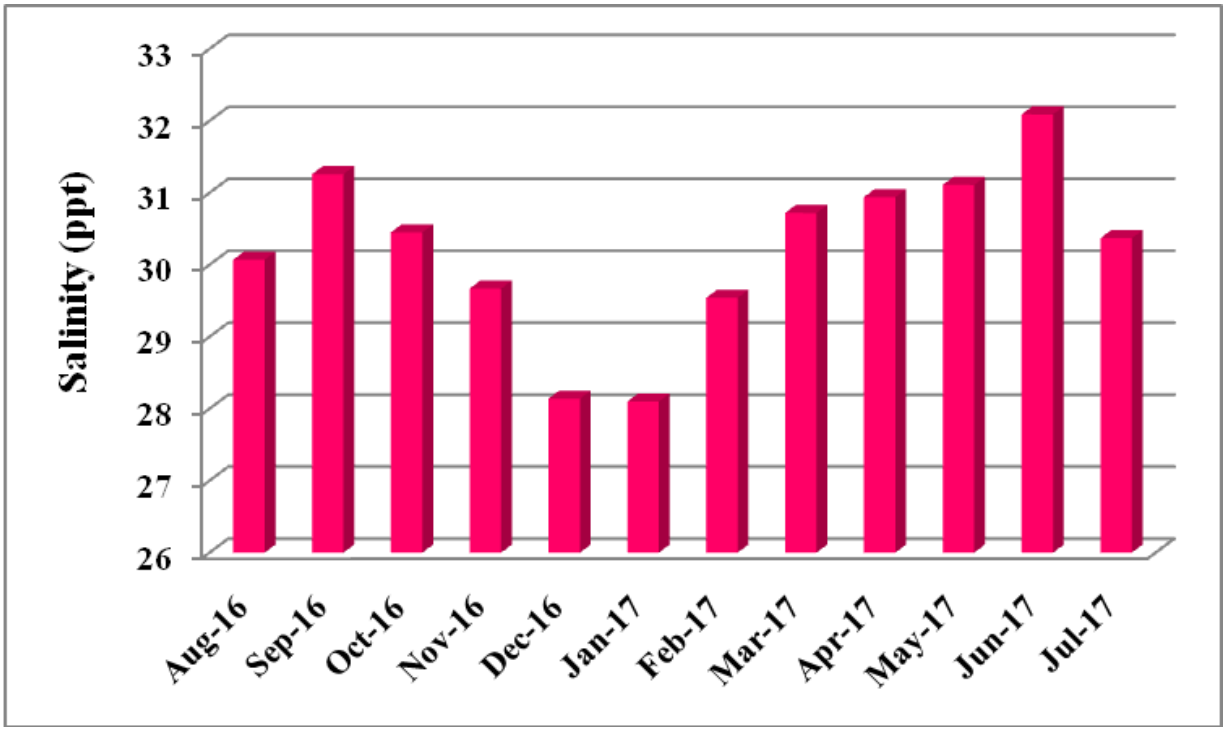

Fig. 4. Monthly variations of salinity (ppt) in the marine water samples.

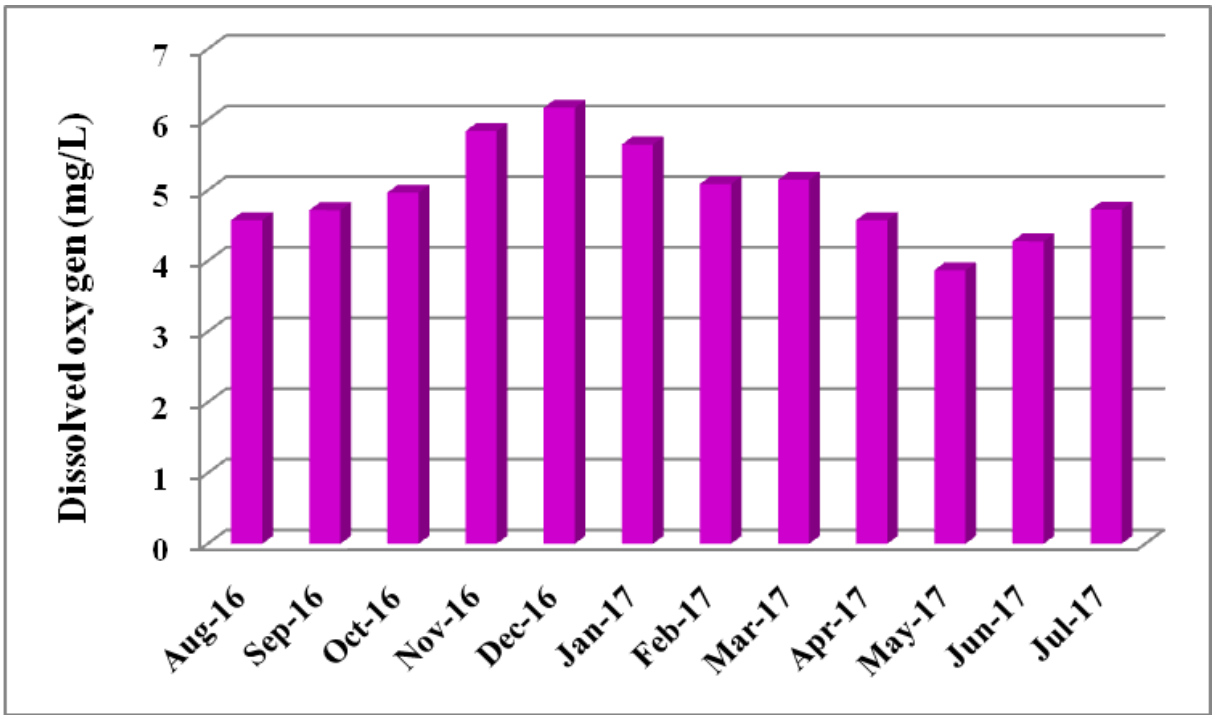

Fig. 5. Monthly variations of dissolved oxygen (mg/L) in the marine water samples.

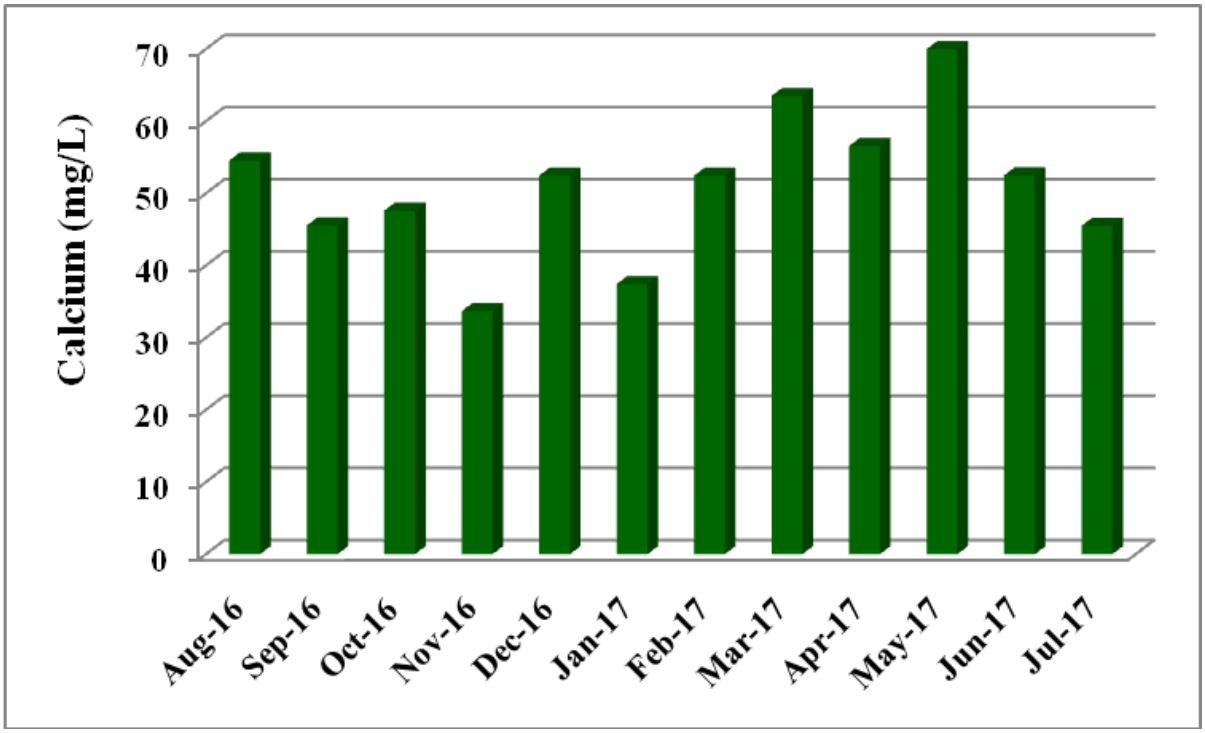

Fig. 6. Monthly variations of calcium (mg/L) in the marine water samples.

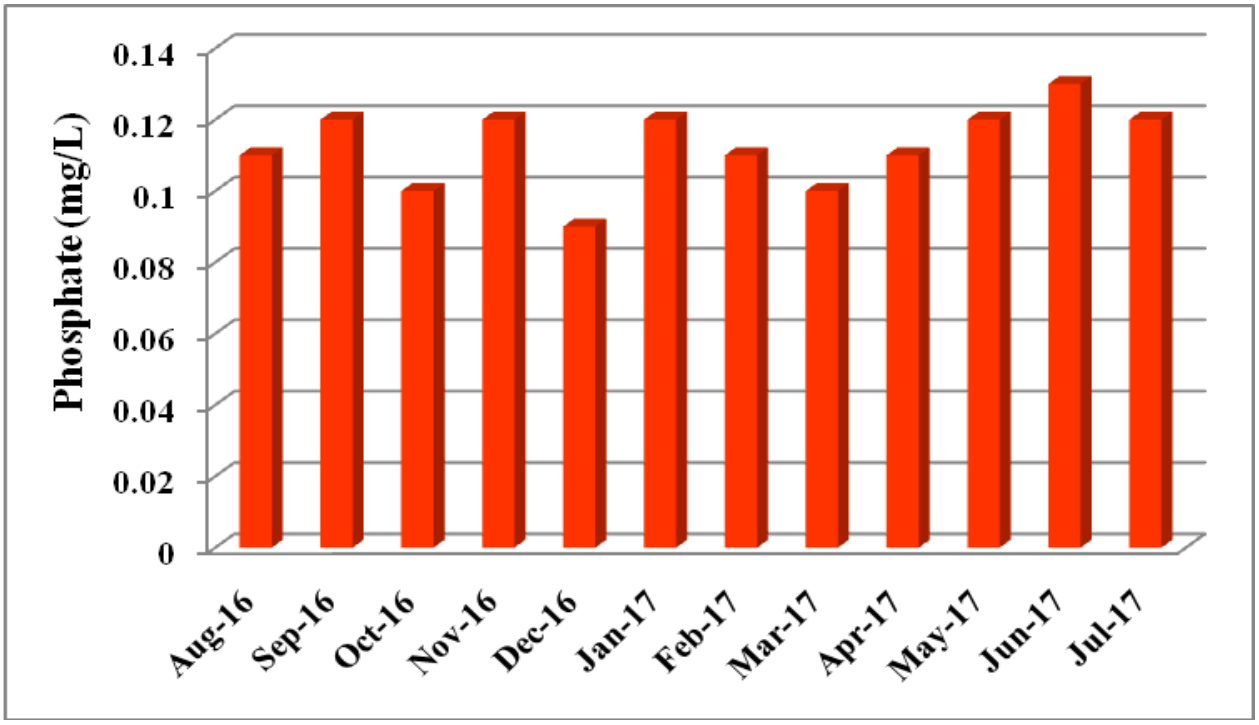

Fig.7. Monthly variations of phosphate (mg/L) in the marine water samples.

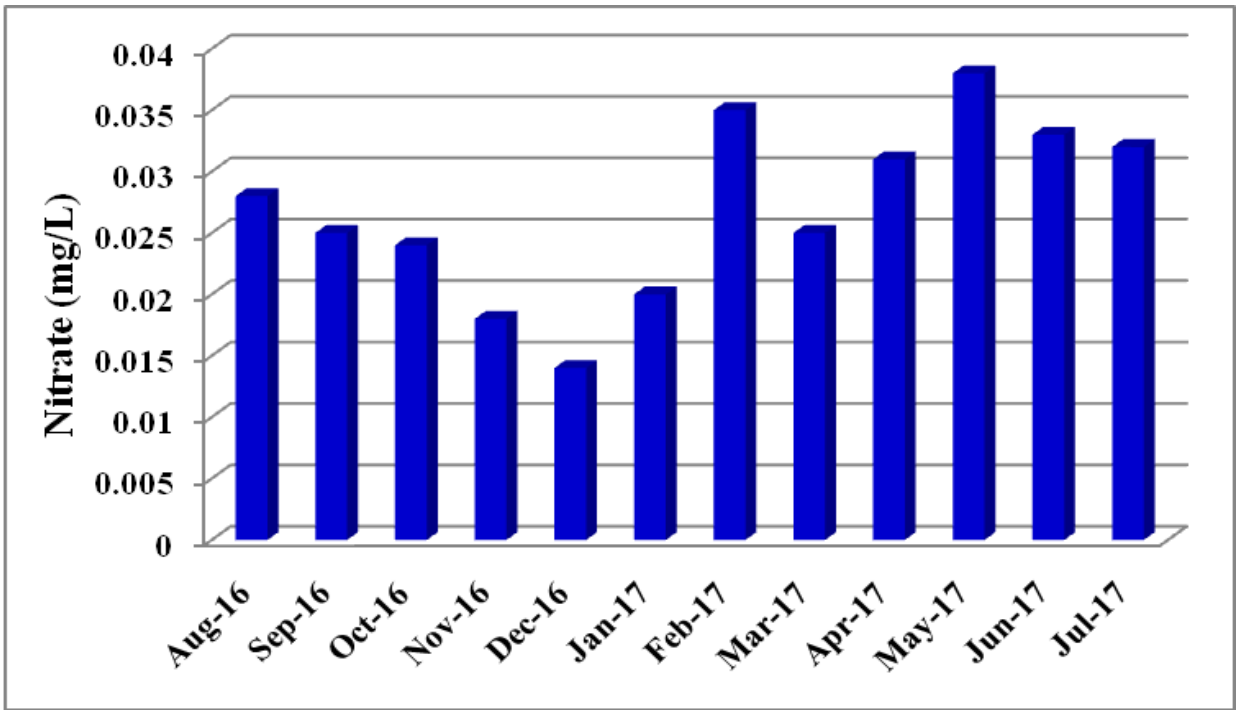

Fig.8. Monthly variations of nitrate (mg/L) in the marine water samples.

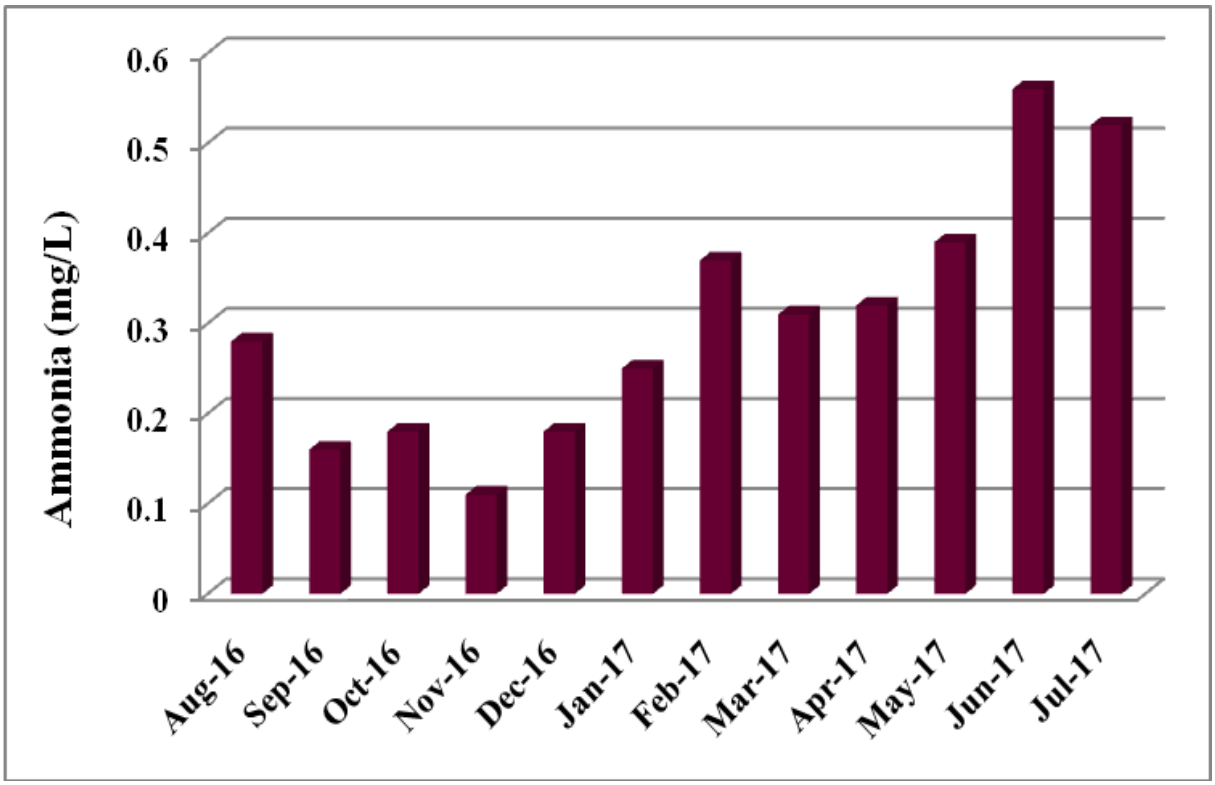

Fig.9. Monthly variations of ammonia (mg/L) in the marine water samples.

DISCUSSION

In the present observation, the water temperature fluctuated from 25.65 to 33.40ºC in marine water samples. It was found to be low in the month of November 2016 and high in May 2017. The water temperature during monsoon season (October to December) was low because of strong land sea breeze and precipitation and the recorded high value during summer season (April to June) could be attributed to high solar radiation (Sampathkumar and Kannan, 1998 and Ajithkumar *et al*., 2006). The seasonal variation in the water temperature depends upon the wind force, freshwater discharge influx of the inshore water and atmospheric temperature (James Balgan Anand and Mary Jelastin Kala, 2015). The results are coincides the present investigation.

Turbidity in water is caused by suspended and colloidal matter such as clay, silt, finely divided organic and inorganic matter, plankton and other microscopic organism. Turbidity of the fresh water samples depends on availability of either zooplankton or phytoplankton and suspended soiled particles. Turbidity is the important factor in the estuarine environment.

In the present investigation, the transparency of the water samples varied from 23.57 to 45.36 cm. It was found to be low in the month of November 2016 and high in the month of May 2017. Turbidity is caused by the suspended particle in water brought about both biotic and abiotic factors. The turbidity of brackish water samples was found to be low in the post monsoon season and high in the pre-monsoon season during the study period of first year.It was found to be lowest in the monsoon season and highest in pre-monsoon seasonduring the study period of second year.The results of the present study agreed earlier observations of Srivastava *et al.* (2003). ThommaiArockia Gaspar and Lakshman, (2014) reported that the monsoon time the level of turbidity is very high due to the estuary received rain water along with industrial waste and manmade waste. In summer, low level of turbidity was observed it may be due to the low level of inflow of fresh water.

In the present research, the pH varied from 7.20 to 8.52. It was found to be minimum in January 2017 and maximum in the month of May 2017. pH is an important factor that etermines the suitability of water for various purposes including toxicity to aquatic organisms. Hydrogen ion concentration or pH as one of the vital environmental characteristics decides the survival, metabolism, physiology and growth of aquatic organisms. pH is influenced by

acidity of the bottom sediment and biological activities (Balasubramanian and Kannan., 2005). pH may be affected by total alkalinity and acidity, run off from surrounding rocks and water discharges (Velsamy *et al*., 2013).

The pH of the natural water system depends on the concentration of carbonate, bicarbonate and hydroxyl ion present. pH is known as the master variable in water since many properties, processes and reaction are pH dependent. Due to the buffering capacity of the sea water, generally the pH ranges from 7.8 to 8.3 in the coastal water (Omstedt *et al*., 2010). The low pH 7.96 at Thoothukudi is due to the dilution of seawater by fresh water flow and runoff during the monsoon season (Subramanian and Mahadevan, 1999). Generally, fluctuations in pH values during different seasons of the year is attributed to factors like removal of CO2 by photosynthesis through bicarbonate degradation, dilution of seawater by freshwater influx, reduction of salinity and temperature and decomposition of organic matter (Upadhyay, 1988 and Rajasegar, 2003). The pH values ranged from 7.96 to 8.30. The minimum was recorded December, monsoon season and the maximum was observed June, summer season (James BalganAnand *et al*., 2015).

In the present work, the salinity content ranged from 28.10 to 32.09 ppt. It was found to be high in the month of June 2017 and low was recorded in January 2017. Salinity is regarded as the second important physical characteristic of the marine environment. This salinity factor has high influence on the fauna. In the present work, the salinity content of marine water sample maximum was recorded in the summer season and minimum was noted in the monsoon season during the study period of first year. It was found to be low in the post monsoon season and high in the summer season of second year. Less wave and tidal action with decreased freshwater inflow and land drainage may also be considered fluctuations in salinity (Sampathkumar and Kannan, 1998). Drop in salinity during monsoon season 31.54 (‰) at Mandapam is related to heavy showers and consecutive floodwater from up streams (Mitra *et al*., 1990 and Sundaramanickam, 2004).

The changes in the salinity in the coastal waters are due to the influx of freshwater from river, by land runoff caused by monsoon, or by tidal variations. Higher values in summer season 36.07 (‰) at Kanyakumari could be attributed to high degree of evaporation with decreased freshwater inflow and land drainage (James Balgan Anand and Mary Jelastin Kala, 2015) this coincides the present investigation.

Dissolved oxygen is one of the most important parameter. The dissolved oxygen is very essential for the respiratory metabolism of all aquatic animals. It favors the stability and availability of nutrients to the animals. Therefore, it increases the productivity of the ecosystems.

In the present observation, the dissolved oxygen content ranged from 3.87 to 6.17 mg/L. It was found to be minimum in May 2017 and maximum in December 2016. The dissolved oxygen content of marine water samples were noted maximum in monsoon season and minimum in summer season during the first year of study period. The O_2 content second year were found to be low in pre-monsoon season and high in post monsoon season. Usually the dissolved oxygen content in the water samples depends on the temperature and seasons. It has been observed that the dissolved oxygen concentration was low in summer and high in monsoon. During the monsoon period the inflow of freshwater from the adjacent water sources having higher oxygen content, the coastal waters showed an increased level of dissolved oxygen (Govindasamy and Jayapaul Azariah, 1997).

Dissolved oxygen can be removed from the water by discharges of the oxygen demanding anthropogenic wastes, other inorganic reductants like hydrogen sulphide, ammonia, ferrous, nitrate and other oxidizable substances tends to decrease dissolved oxygen in water. It is well known that the temperature and salinity affect the dissolution of oxygen (Saravanakumar *et al*., 2008). In the earilar investigation, higher values of dissolved oxygen 5.95 mg/l at Kanyakumari were recorded during monsoon season might be due to the cumulative effect of higher wind velocity coupled with heavy rainfall and the resultant freshwater mixing attributed that seasonal variation of dissolved oxygen is mainly due to freshwater flow and terrigenous impact of sediments (Govindasamy *et al.,* 2000 and Padmavathi and Satyanarayana, 1999).

In the present study, calcium content was fluctuated from 33.67 to 69.98 mg/L. It was found to be low in the month of November 2016 and high in May 2017. The high value of calcium noticed during monsoon season and low value was recorded during summer (Sridhar*et al,* 2006). Lowest value of calcium recorded during monsoon season and calcium varies from 3.20 mg/L. to 408 mg/L. during monsoon season and 22.40 to 656 mg/L. during winter season (Francis Andrade *et al*., 2011). The maximum calcium was observed in May and minimum value in March. Calcium reached at peak in May and then show gradual decline was reported (Muhammad Naeem *et al.,* 2011).

In the present investigation, the phosphate content ranged from 0.09 to 0.13 mg/L. It was found to be lowest value in December 2016 and highest

value in January 2017. The recorded high concentration of inorganic phosphate during post monsoon season might possibly be due to intrusion of upwelling seawater into the creek, which in turn increased the level of phosphate (Nair *et al*., 1999). The recorded low post monsoon phosphate values could be attributed to the high utilization of phosphate by phytoplankton (Rajasegar, 2003).The variation may also be due to the processes like adsorption and desorption of phosphate and buffering action of sediment under varying environmental conditions (Govindasamy, and Kannan,2000)

In the present observation, nitrate content was fluctuated from 0.14 to 0.38 mg/L. It was found to be low in the month of December 2016 and high in May 2017. Nitrate is one of the important nutrients in fish culture ponds and is the common form of nitrogen in natural water. Nitrate is oxidized to nitrate after entering an aerobic regime. The increasing nitrates level was due to the freshwater in flow, litter fall decomposition and terrestrial runoff water during the monsoon seasons (Mathivanan *et al.,* 2008). Plants and micro organisms reduce nitrate into nitrite but nutrition is quickly oxidized back to nitrate once in reenters the water. The observed high monsoonal phosphate value might be due to the regeneration and release of total phosphorus from bottom solid into the water column by turbulence and mixing (Khaiwal *et al.,* 2003).

In the present work, the ammonia content ranged from 0.11 to 0.56 mg/L. It was found to be minimum (0.11 mg/L) in the month of November 2017 and maximum (0.56 mg/L) in June 2017. Sankar Narayan Sinha and Mrinal Biswas, (2011) reported the nitrate content of lake water fluctuated between 0.80 and 1.82 mg/L with the mean value of 1.14 mg/L. The maximum and minimum concentrations were recorded during September and November respectively. The higher nitrate-nitrogen ($N0_3$-N) concentration during the rainy season could be due to surface run-offs as well as the decomposition of organic matter. Ammonia and nitrogen was observed maximum in the monsoon and post-monsoon seasons due to rainfall and the river runoff carrying large amount of detritus (Indirani *et al*., 2010). The highest ammonia concentration was recorded during the dry season (Kaniz Fatema *et al*., 2014) as a result of steamming from low precipitation. However, dilution of rainwater may be important in reducing the ammonium level in the estuary.

CONCLUSION

The present observation, the various physico-chemical parameters were recorded in the Nagapattinam marine water samples, south east coast of Tamil Nadu India. The data which showed that the physico-chemical properties of the marine zone were significantly varied when compared with study period. Thus, it can be concluded that the variations water quality parameters determine in the Nagapattinam marine water samples, south east coast of Tamil Nadu India during the study period.

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