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Seasonal variations in the physico-chemical characteristics of water from various tourist spots of Kanyakumari District

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ABSTRACT:

The present study was carried out to determine the Physico-chemical characteristics of water from selected tourist spots of Kanyakumari district during the period of twelve months from June 2016 to May 2017. Five sampling stations were selected and water samples were collected for the study. Surface water temperature varies from 24.2 to 31.5^{o}C, atmospheric temperature varies from 25 ^{0}C to 32.5 ^{0}C, pH was ranged between 6.23 to 8.12. Variation of Dissolved Oxygen content was 4.2 to 6.7 mg/l. The ranges of chloride from 10 to 21100 mg/l. TDS value ranges from 30 to 41234 mg/l. The ranges of nitrate, nitrite and phosphate were 0.5 to 4 mg/l, 0.03 to 0.43 mg/l and 0.1 to 1.05 mg/l respectively. Electrical conductivity ranges from 45 to 62114 µs/cm. Total hardness ranges from 12 to 17300 mg/l.

KEYWORDS: Physico-chemical characteristics,Water, Tourist spots ,Permissible limit

INTRODUCTION

Kanyakumari district is one of the most popular tourist destinations in India, due to its awesome beauties Kanyakumari is second smallest district in Tamilnadu with an area of 1684 sq.km. The climate of Kanyakumari remains pleasant throughout the year. There have no winter due to proximity of world Torrid Zone. The district is surrounded by three neighboring oceans which make a nice breezy wind across the district at evening and produce a heavy rainfall during the month from early June to late September.Average temperature of Kanyakumari varies from 20^{o}C to 36^{o}C and it receive an annually rainfall of 120cm (approx). Some major tourist spots in and around the district are Kanyakumari Temple, Gandhi Memorial, Thirparappu water falls, Suchindram Temple, Padmanathapuram Palace, several beaches and many more.

Water is a precious resource on our earth and is a vital component for human being and animals for their day today survival. Its quality is likely to change day by day and from source to source. Any change in the natural quality may disturb the equilibrium system and would become unfit for designated uses Water quality has become an important water resource issue due to rapid increase in population, industrialization, unplanned urbanization, discharge of pollutants and much use of fertilizers and pesticides. During the last decade it was observed that the surface water get polluted because of increased human activities.

The present study is to assess and interpret the water quality of various tourist spots of Kanyakumari district like ThirparappuFalls(S_1), Mandaikadu Beach(S_2), Muttom Beach(S_3), Chothavilai Beach(S_4), Kanyakumari Beach(S_5) due to their utility by tourists and other domestic activites.

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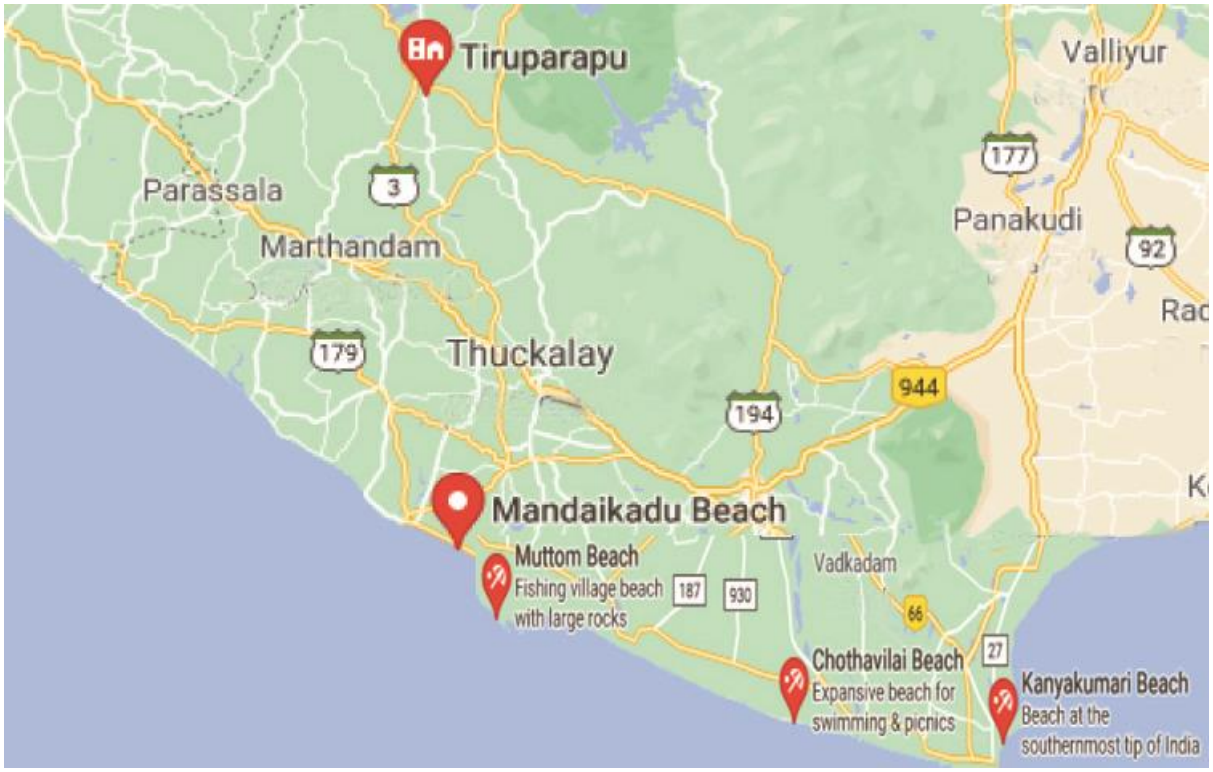
MATERIALS AND METHODS

The samples were collected from all the five stations for physico-chemical examinations, different methods of collection and handling were adopted based on standard procedures. The samples were collected in plastic cans of 5 liter capacity without any air bubbles. The temperatures of the samples were measured in the field itself at the time of sample collection. The study period was from June 2016 to May 2017. Standard methods were used for the analysis of various water quality parameters. All the reagents used were AR grade and double distilled water was used for the preparation of solutions. The water sampling stations are shown below. Station I is ThirparappuFalls(S_1), Station II is andaikadu Beach(S_2), Station III is Muttom Beach(S_3), Station IV Chothavilai Beach(S_4), Station V is Kanyakumari Beach(S_5)



Location map of the study area showing sampling stations

RESULTS AND DISCUSSION

1. PHYSICO CHEMICAL ANALYSIS

1.1. a) Atmospheric Temperature:

Atmospheric temperature of five different sampling stations throughout the year from June 2016 to May 2017 is shown in figure1.1.a.Maximum atmospheric temperature (32.5^0C) was recorded at station IV in the month of March during pre-monsoon season and minimum temperature (25^0C) was recorded at station I in the month of December during post monsoon season.

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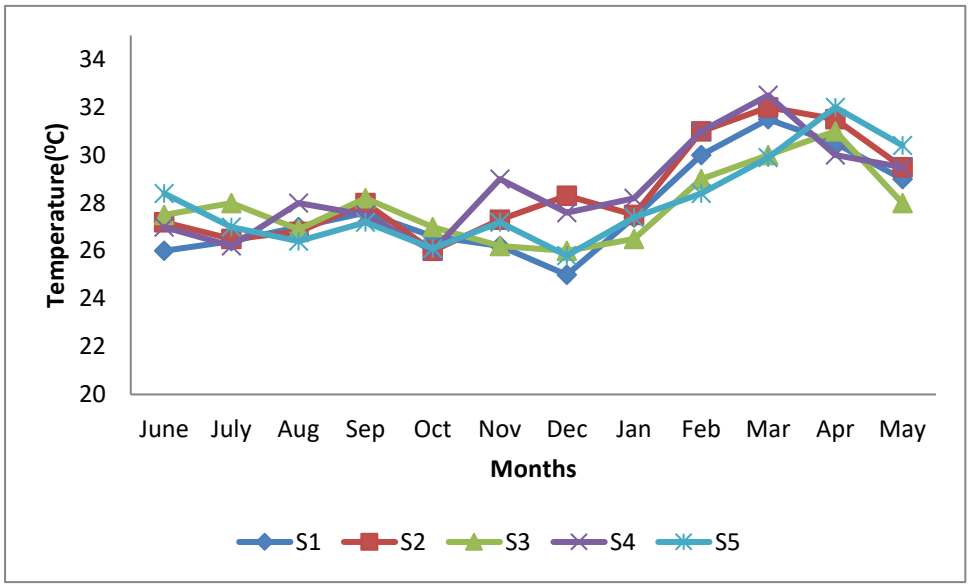

Fig.1.1.a) Monthly variation in Atmospheric temperature (^{0}C) at five stations

1.1. b) Water temperature

Water temperature recorded during study period is shown in fig 1.1.b. Maximum water temperature (31.5^{0}C) was recorded in station IV in the month of March during pre-monsoon season and minimum temperature (24.2^{0}C) was recorded in station III in the month of December during post monsoon season.

Temperature is a primary abiotic factor controlling key physiological, biochemical and life history process of aquatic life (Betinger and Fitzpatrick, 1979).From the results of the present study it was observed that the surface water temperature as expected as relatively lower than the atmospheric temperature and all five stations showed similar pattern. The surface water temperature varied from 24.2^{0}C to 31.5^0 C .The minimum water temperature was recorded during post monsoon season(Dec 2016) and maximum was recorded during pre-monsoon season(Mar 2017).Surface water temperature is influenced by the intensity of solar radiation,evaporation,fresh water influx ,cooling and flow from adjoining neritic waters(Govindasamy et al ,2000). The observed low value during December was due to strong land sea breeze and precipitation. Anitha and Sugirtha, (2013) observed similar results in Thengapattanam estuary. In the present study it has been observed that high temperature is associated with longer photoperiod, bright sunshine and dry wind and lower temperature was due to cloudy sky and rainfall brought down the temperature to the minimum. Similar observations have been reported by Senthilkumar et al,(2002),Santhanam and Perumal,(2003),Gupta et al,(2008),Sundaramanickam et al,(2008) from different wetlands.

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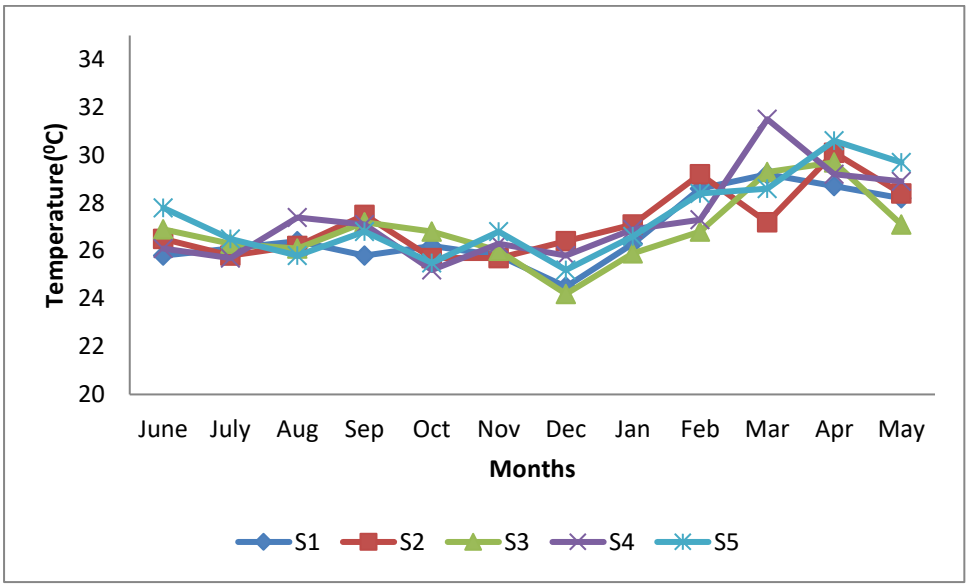

Fig.1.1.b) Monthly variation in Water temperature (^{0}C) at five stations

1.2. Variation of pH

pH is an indicator of acidic or alkaline condition of water. The pH values observed during the study period is given in figure 1.2. The highest value of pH (8.12) was recorded at station IV in the month of March during pre-monsoon season and lowest value (6.23) was recorded at station I in the month of June during monsoon season.

pH is an important water quality parameter. It is the measure of free hydrogen or hydroxyl ion in water. From the results of the present study pH of the water samples varied from 6.23 to 8.12. pH was maximum in March 2017 at station IV due to the influence of daily photosynthetic activity by phytoplanktons (Das et al,1997) which removes dissolved carbondioxide in the water column thereby increasing the pH level.Generally,fluctuations in pH values during different seasons of the year can be attributed to factors like removal of CO_2 by photosynthesis through bicarbonate degradation, dilution of seawater by freshwater influx, reduction of salinity and temperature and decomposition of organic matter as stated by Upadhyay(1998),Rajasegar(2003) and Paramasivam and Kannan(2005).

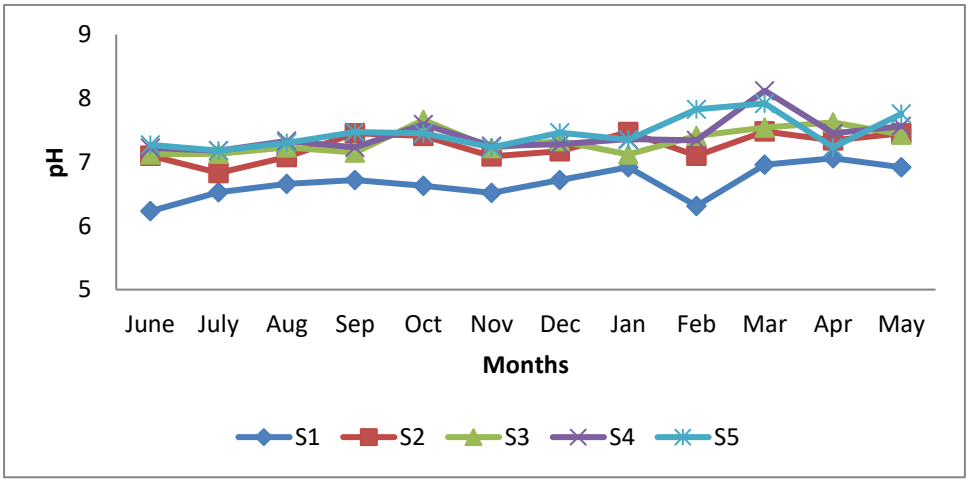

Fig.1.2.Monthly variation of pH at five stations

1.3. Variation of Electrical Conductivity

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Electrical conductivity is a measure of water capacity to convey electric current. It signifies the amount of total dissolved solids in water (SudhirDahiya and Amarjeetkaur, 1999). Monthly variations in electrical conductivity recorded at the study area during twelve months showed in figure1.3. Maximum value (62114 µS/cm) of electrical conductivity was recorded at station IV in the month of February during pre-monsoon season and minimum value (45µS/cm) of electrical conductivity was recorded at station I in the month of July during monsoon season.

Electrical conductivity is an indirect indicator of pollution because of its close relationship with the dissolved salt content present in the water column of water bodies that often is associated to sewage discharge and is therefore a well established water quality parameter (Thompson et al, 2012).According to WHO standards, the EC values of freshwater zone were not exceeded the permissible limit. In saline water zones the high conductivity values indicated that the sea water contained high concentration of dissolved ionisable solids. (Suruchi Gupta et al, 2003).Higher conductivity values may be due to evaporation, high salinity or the amount of fresh water discharge. High temperature affect the conductivity values to a great extent (Sujitha et al, 2012).The high value of conductivity was recorded pre-monsoon season and low during monsoon season. According to Trivedy and Goal (1986), the variation in the conductivity values seasonally is mostly due to increase in the concentration of salts, because of evaporation; the dilution resulted from precipitation brings down its values.

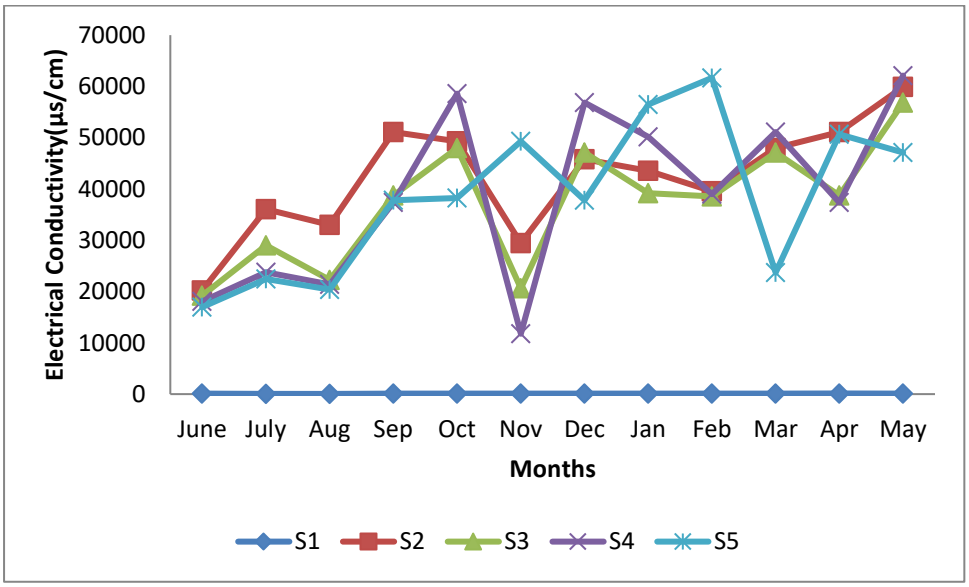

Fig1.3. Monthly variation of EC (µS/cm) at five stations

1.4.Variation of DO

Dissolved Oxygen (DO) is the dissolved gaseous form of oxygen. It is essential for respiration of fish and other aquatic organisms. DO enter water by diffusion from the atmosphere and as a by-product of photosynthesis by algae and plants. The threshold limit of DO is 5 mg/l for drinking water (Ayedun.H.Umar, 2011). Monthly variation of DO for water samples collected from the study area were shown in fig 1.4.The maximum value of DO (6.7 mg/l) was recorded at station I in the month of August during monsoon season and minimum value of DO (4.2 mg/l) was recorded at station IV in April during pre-monsoon season.

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Dissolved oxygen content varied from 4.2 mg/l to 6.7 mg/l. Maximum value of dissolved oxygen was observed at station I in the month of August during monsoon season and minimum value was observed station IV in the month of April during pre-monsoon season. Higher dissolved oxygen observed during the monsoon season might be due to the cumulative effect of higher wind energy coupled with heavy rainfall and the resultant fresh water mixing. Similar results were reported by Manikannan et al (2011) and Damotharan et al (2010). Dissolved oxygen showed an inverse relationship with salinity and temperature. (Chandran et al ,1984 , Govindasamy et al ,2000 ,Kumar et al ,2011 ,Ashok Prabu et al ,2008). An imbalance between the processes of photosynthesis, degradation of organic matter, re-aeration and photochemical properties of water can result in oxygenation of the aquatic systems (Satpathy et al, 2010). As per studies, the great solubility of oxygen is attributed to low values of temperature and salinity (Satpathy, 1996).

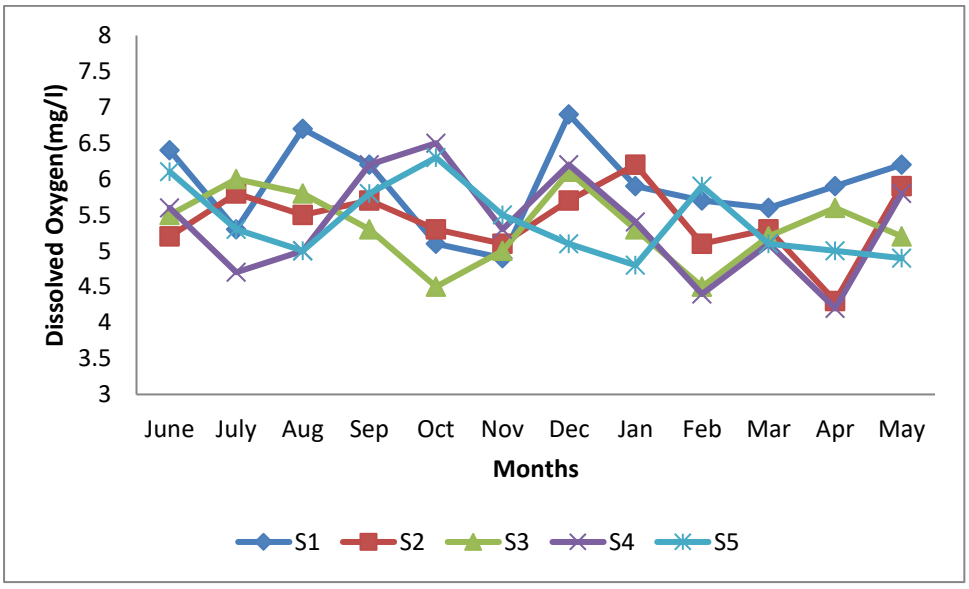

Fig1.4. Monthly variation of DO (mg/l) at five stations

1.5.Variation of TDS

Total Dissolve Solids (TDS) is a metric used in water treatment that measures all dissolved minerals, salts, chlorides, metals, organics and many other contaminants in water. TDS impacts water conductivity and is related to corrosion, chemical efficiency and water clarity. Water containing TDS level below 500 mg/l is free of contamination and good for drinking purpose. Monthly variation of TDS in the study areas are shown in fig 1.5. Maximum TDS value (41234 mg/l) was observed in the month of February at station V during pre-monsoon season and minimum TDS value (30 mg/l) recorded at station I in the month of November during post-monsoon season.

TDS is a useful parameter in describing the chemical density of water as a fitness factor(Jhingran,1982).Dissolved solids in water include all inorganic salts , silica, soluble organic matter (Ahipathy and Puttaiah,2006) and carbonates,bicarbonates,chlorides ,sulphates and nitrates of Ca,Mg,Na,K and Mn(Mishra and Saksena,1991).Kataria et al (1996) reported that increase in TDS value reflects the pollutant burden on the aquatic systems originating from both natural as well as extraneous sources like sewage,urbon runoff, industrial wastewater and chemicals used in the water treatment processes and hence adversely affect

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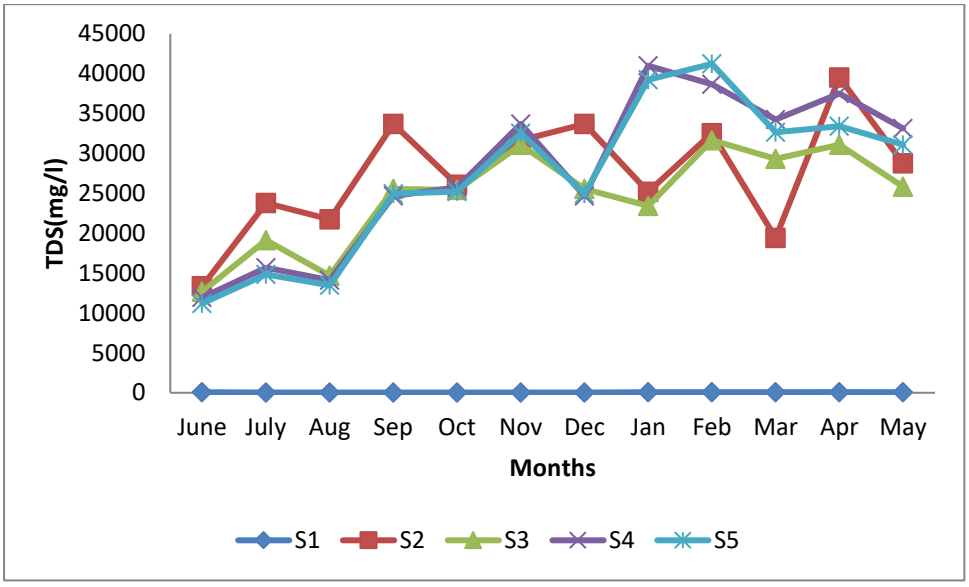
the quality of water. High level of dissolved solids in water systems increases the biological and chemical oxygen demand and depletes the dissolved oxygen level in aquatic systems (Suthar et al, 2009).



1.5. Monthly variation of TDS (mg/l) at five stations

1.6. Variation of Total Hardness:

The hardness of water is due to the presence of soluble bicarbonates, chlorides and sulphates of Calcium and Magnesium. Water which does not give lather with soap is hardwater.Hardness gives unpleasant taste to water. Monthly variation of total hardness observed during the study period is given in fig. 1.6. The highest value of total hardness (17300 mg/l) was recorded at station IV in the month of April during pre-monsoon season and lowest value of total hardness (12 mg/l) was recorded in station I in the month of August during monsoon season.

The hardness in water is due to the presence of Calcium and Magnesium salts. The hardness was definitely higher in saline water stations when compared with fresh water station. The higher total hardness in the riverine zone in the pre-monsoon season may also be due to the dissolution of calcium from sedimentary rocks and detergents and decomposition of plants, twigs and branches falling into the river due to dry climatic conditions. According to Indian Standard BIS the desirable limit of total hardness in drinking water is 300 mg/l and maximum permissible limit is 600 mg/l. In the present study the hardness value of fresh water station is below the desirable limit and fit for domestic usage. I n saline water stations the total hardness values are very high due to various dissolved salts. Sea water is slightly alkaline due to hardness of water. Total hardness showed highly significant positive correlation with calcium and magnesium. Calcium and Magnesium both play an important role in antagonizing the toxic effects of various ions and neutralizing the excess acid produced(Raj Narayan,2007).In the present investigation , there was a gradual increase in total hardness of water samples from monsoon to pre-monsoon season. The reason may be due to high evaporation of water and lack of dilution.

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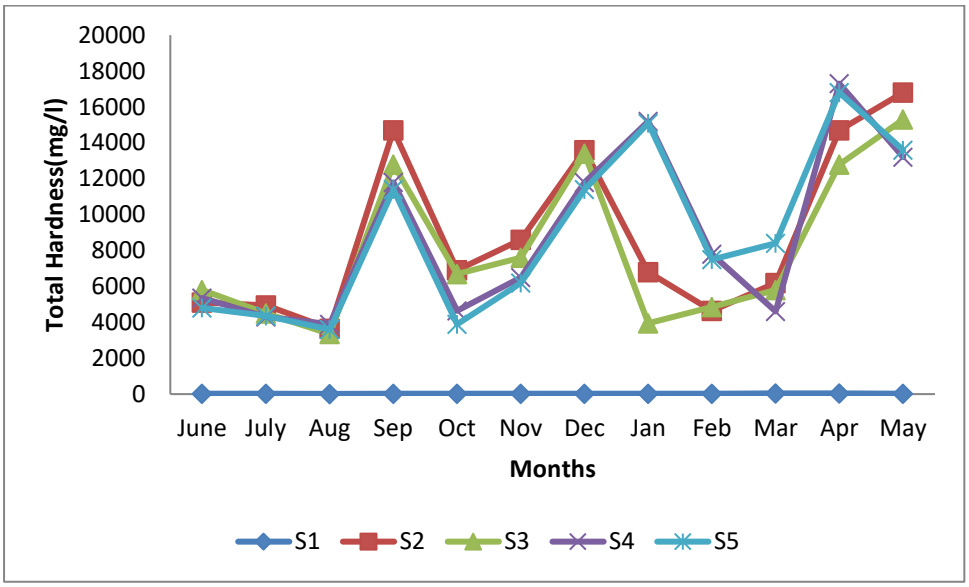

Fig 1.6. Monthly variation of Total Hardness (mg/l) at five stations

1.7. Variation of Nitrate

Nitrate is a highly oxidized form of nitrogenous compounds and is usually present in surface water as it is the end product of aerobic decomposition of organic nitrogenous matter present in animal waste and concentration may depend on the nitrification and denitrification activities of microorganisms. Monthly variation of nitrate was observed during the study period is shown in fig 1.7. Maximum nitrate value (4 mg/l) was observed at station V in the month of October during post-monsoon season and minimum value (0.5 mg/l) was observed at station I and IV in the months of April and March respectively during pre-monsoon season.

The nitrate concentration varied from 0.5 mg/l to 4 mg/l in the entire study period. Nitrate concentration was higher during the post-monsoon season and lower during pre-monsoon season. The higher nitrate content observed during post-monsoon is mainly due to the river water discharge containing nitrogenous particles of various origins such as land run off contaminated with fertilizers from the surrounding paddy fields, coconut rubber plantations. Similar results were also recorded by Muthukumaravel et al (2012) from Arasalar estuary Karaikal, Damotharan et al (2010) from Calimare coastal waters, AyyagariArchana et al (2013) from coastal waters of Visakhapatnam, RamalingamManikannan et al (2011) from Vedaranyam swamp. Most of the nitrate might have been derived from the decomposition of organic wastes (Ravaniah et al, 2010). According to Indian Standard BIS (ISI0500), the desirable limit of nitrate in drinking water is 45 mg/l and maximum permissible limit is 100 mg/l. In the present study, the observed values showed that, all are below the acceptable limit.

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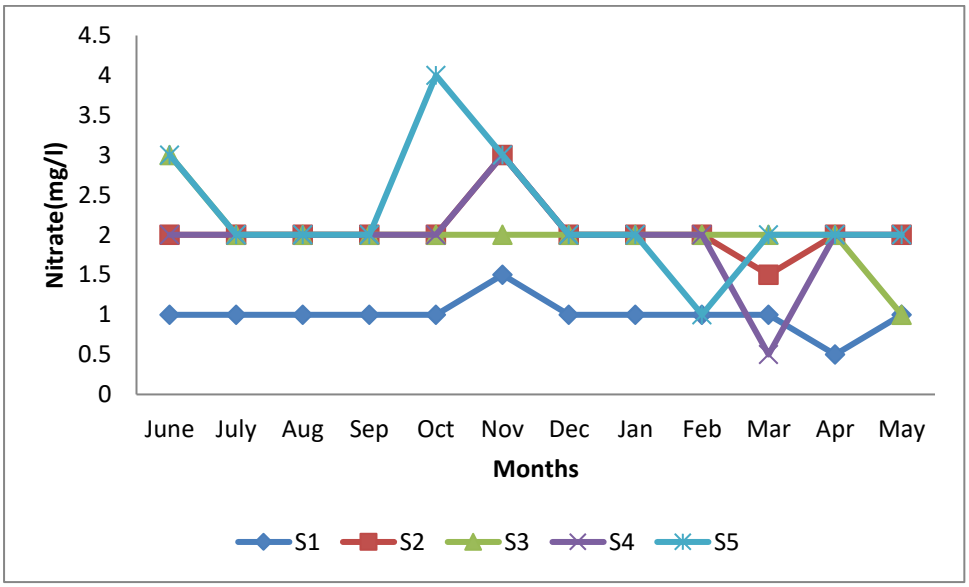

Fig 1.7. Monthly variation of Nitrate (mg/l) at five stations

1.8. Variation of Nitrite

Nitrites are a salt or ester anion of nitrous acid, which can be naturally or artificially occurring in groundwater. Nitrites come from fertilizers through run-off water, sewage and mineral deposits. Monthly variation of nitrite for collected water samples during the study period is shown in fig 1.8. Maximum nitrite value (0.43 mg/l) was observed at station V in the month of June during monsoon season and minimum nitrite value (0.03 mg/l) was observed at station I in the month of May during pre-monsoon season.

In the present study, the nitrite values varied from 0.03 mg/l to 0.43 mg/l. The maximum value was observed in station V during monsoon season and minimum value observed in station I during pre-monsoon season. Low value of nitrite during pre-monsoon was due to less fresh water input, higher salinity, higher pH and also uptake by phytoplankton . The variations were observed due to variation in phytoplankton excretion, oxidation of ammonia, reduction of nitrate and by recycling of nitrogen and bacterial decomposition of planktonic detritus (Asha and Diwakar, 2007). According to Environmental protection agency (EPA), recommended nitrite limit in water is 1 mg/l. In the present investigation, all observed values are below the recommended limit.

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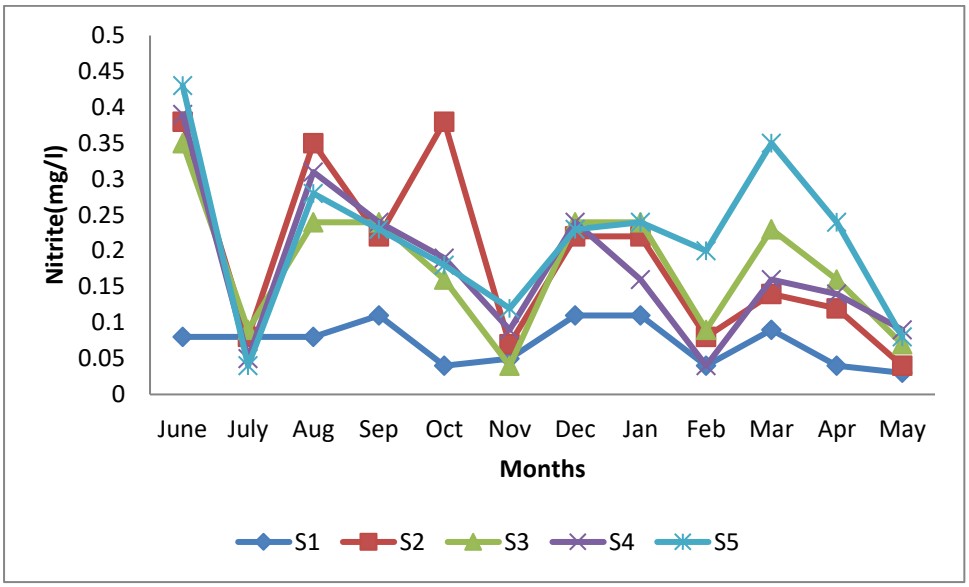

Fig 1.8. Monthly variation of Nitrite (mg/l) at five stations

1.9.Variation of Chloride

Chloride is the most dominant anion in water. In surface water it originates from natural and anthropogenic activities. Chlorides are harmful to plants. The values of chloride during the study period are shown in fig 1.9. The maximum amount of chloride (21100 mg/l) was observed at station IV in the month of May during pre-monsoon season and minimum amount of chloride (10 mg/l) was observed at station I in the month of August during monsoon season.

High chloride concentration is an indicator of pollution due to high organic wastes of animal or industrial origin. Human body releases very high quantity of chloride (Guru Prasad and SatyaNarayana, 2004). Excess chloride would reduce the DO content of water, which is harmful to aquatic organisms (Deepa et al, 2016). In the present study, chloride values ranged between 10 mg/l to 21100 mg/l. The chloride content was maximum (16650 mg/l) during pre-monsoon season and minimum (14 mg/l) during monsoon and post-monsoon seasons. Govindan and Sundaresan (1979) observed that higher concentration of chloride in pre-monsoon season may be due to sewage mixing and increased temperature and evaporation by water.

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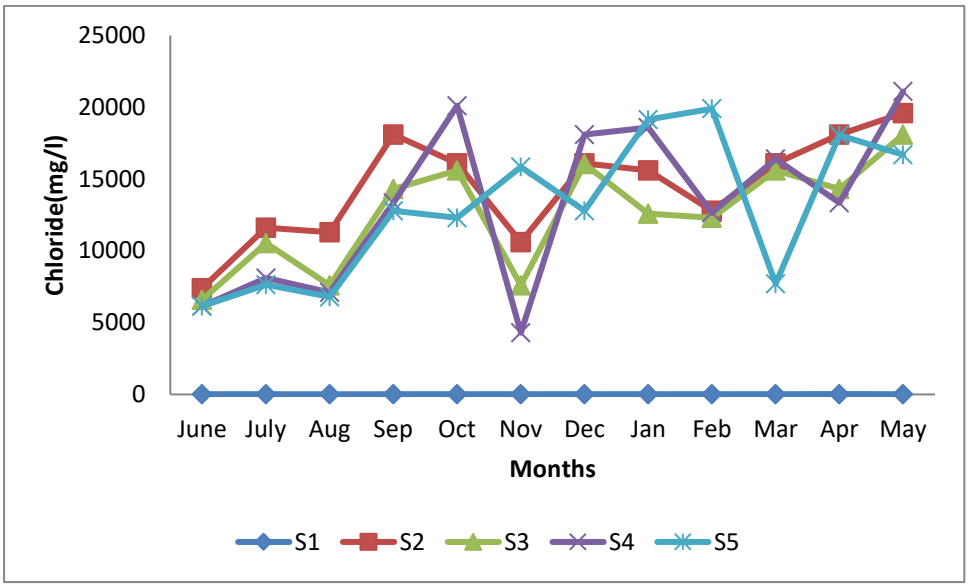

Fig 1.9. Monthly variation of Chloride (mg/l) at five stations

1.10. Variation of Phosphate

Phosphates are mostly from fertilizers, pesticides, industry and cleaning compounds. Natural sources include phosphate containing rocks and solid or liquid wastes. The monthly variation of phosphate in water samples during the study period is shown in fig1.10. The highest amount of phosphate (1.05 mg/l) was recorded at station I in the month of September during monsoon season and lowest amount of phosphate (0.1 mg/l) was recorded at station IV in the month of April during pre-monsoon season.

The element phosphorous is necessary for plant and animal growth. Nearly all fertilizers contain phosphates. Phosphates enhance the growth of plankton and water plants that serve as food for fish and aquatic life which results in increase of fish population that improves the quality of aquatic life. If excess phosphate is present, it may result in eutrophication. Many fish and aquatic organisms may not survive. In the present study, the maximum value of phosphate observed during monsoon season and minimum value was observed during pre-monsoon season. High concentration of phosphate observed during monsoon season might be due to heavy rainfall, mixing of land run off from agricultural fields contaminated with super phosphates and alkyl phosphates from soap and detergents used by the public for bathing and washing clothes . Low phosphate value recorded during pre-monsoon could be attributed to the limited flow of fresh water, high salinity and utilization of phosphate by phytoplankton.(Rajasegar, 2003).In the present study, station I(Thiruparapu falls) shows the higher concentration of phosphate in all seasons due to high anthropogenic activity during the holiday seasons. Phosphates from shampoo, detergent and soap may be found in this water. Phosphates are not harmful to people or animals unless they are present in very high concentrations. The levels of phosphates in all the stations were not exceeded the WHO maximum permissible limit of 5 mg/l. The phosphate value was low during pre-monsoon season and high during monsoon season. The same result was reported by Hannan et al (1975), Ramaraju et al (1992), Ramadhas (1997), Balusamy (1988) and Kaur et al (1997).

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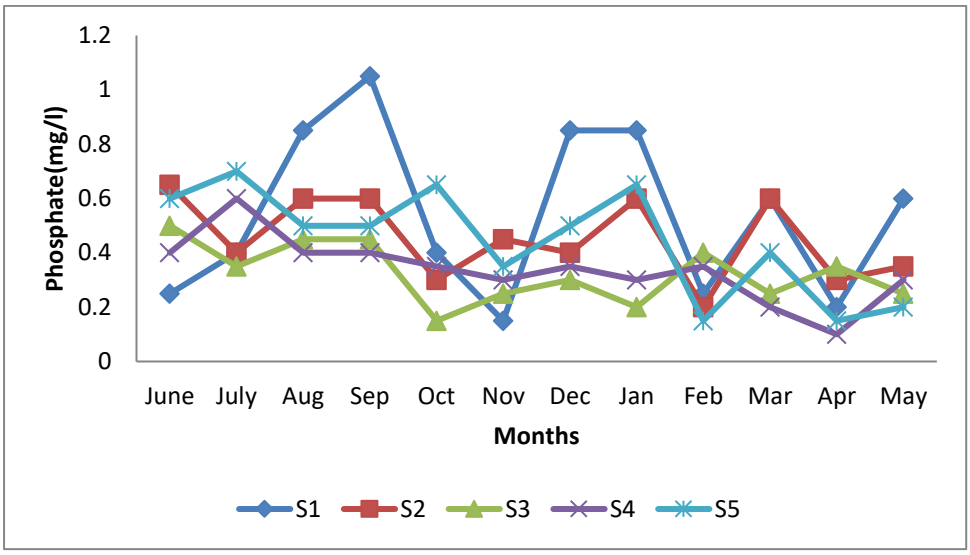

Fig1.10. Monthly variation of Phosphate (mg/l) at five stations

SUMMARY AND CONCLUSION

In this study different physico-chemical parameters were studied and compared with standard values to analyze the water quality of various tourist pots of Kanyakumari district. From the study it was observed that except station I, all other stations Electrical conductivity, Total dissolved solids, Total hardness and chloride content were high. All other parameters determined were within the permissible limit.

The results reveals that all the tourist spots and the depended organisms and human beings near by the tourist spots were highly disturbed by the waste water discharged through the sewage from the tourist resorts and other anthropogenic activities. This will cause serious health problems to the people living in the environment. It is the responsibility of the humans to avoid the entering of wastes into the water. So few years from now serious water quality determination could take place. Hence rapid and reliable monitoring measures are essential for keeping a close watch on water quality and health environment.

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