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# Biochemical changes with influence of nutrient in polychaetes *Laeonereis ankyloseta*, south east coast of India

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**ABSTRACT**

*The polychaete in monitoring the marine environmental quality is due to their direct contact with the water column and the sediments of their environment thus showing sensitivity to physico-chemical which is expressed through changes in their biochemical activities. They respond quickly to changes in environmental conditions. The ability to monitor different phases in the recovery of disturbed sites is possible because the different species of polychaetes appear after the cessation of the impact.*

**Key words:** Polychaete, physico-chemical, biochemical, affected, *Laeonereis ankyloseta*

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## INTRODUCTION

Benthic animals have an intimate relationship with the substratum and the components, texture and chemical attributes of the sediment has a regulatory effect on the species that can live in any particular area (Parulekar, 1980; Varadharajan *et al.*, 2010; Manoharan *et al.*, 2011). Hydrological study is a prerequisite to the assessment of the potentialities, distribution of plants and animals and also to understand the realities between its different trophic level and food webs (Babu *et al.*, 2010; Varadharajan *et al.*, 2010). It has been suggested that protein, carbohydrate and lipid levels may reflect food shortages in benthic aquatic organisms (Beukema and de Bruin, 1977; Galap *et al.*, 1997; Cavaletto and Gardner, 1998). In the Kiel Fjord both abundance and nutritive value of *N. succinea* change continuously due to fluctuations in abiotic and biotic factors, such as temperature, salinity and food supply have investigated the correlations between these factors and annual changes in population strength as well as changes in the main body components and energy content. The results obtained facilitate a better evaluation of *N. succinea* as a food organism for fishes. Many organisms commonly used energy storage to cope with seasonal food shortage (Willmer *et al.*, 2000). Very little work has been dealt with the nutrients and biochemical composition in polychaetes (Fernandez, 1998; Danovaro *et al.*, 1999; Mayzaud *et al*., 1999), probably, starvation in the context of food scarcities has not previously been considered other than extreme ecosystems (Gili *et al.*, 2001). Hence, in the present study was investigated on seasonal variations in physico-chemical parameters with influence on biochemical composition of the polychaete, *Laeonereis ankyloseta* from the Gadilam River in Cuddalore coast of southeast coast of India.

## MATERIALS AND METHODS

The surface water and sediment samples were collected from the Gadilam river (Lat11° 42' 27" N and Lon 79° 46' 5" E) in Cuddalore district, Tamil Nadu, (Southeast coast of India). The sampling period was one year from January 2011 to December 2011. The atmospheric and water temperature were measured using a digital centigrade thermometer. Salinity was estimated with the help of a hand refrectometer (ERMA, Japan) and pH was measured using an ELICO Grip pH meter. Dissolved oxygen was estimated by the modified Winkler's method (Strickland and Parsons, 1972).

For the analysis of nutrients, surface water and sediment were collected in clean polythene bottles and kept immediately in an icebox and transported to the laboratory. The water samples were than filtered using a Millipore filtering system and analyzed for dissolved nitrate, nitrite, total nitrogen and total phosphorus and sediment samples were ground to fine powder and dried in the hot plate at 110°C to constant weight for an hour. Concentrations of sediment nutrient viz., total nitrogen, total phosphorus and total organic carbon were determined by the following method described by Strickland and Parsons (1972). The proximate composition were determined by using standard methods; viz., protein (Raymont *et al*., 1964), carbohydrate (Dubois *et al*., 1956), lipid (Folch *et al*., 1956).

## RESULTS

**Temperature:** The water temperature was ranged from 20°C to 32°C. The minimum (20°C) was recorded at months of October 2011 and December 2011 while the maximum (32°C) was observed at months of May 2011(Fig 2).

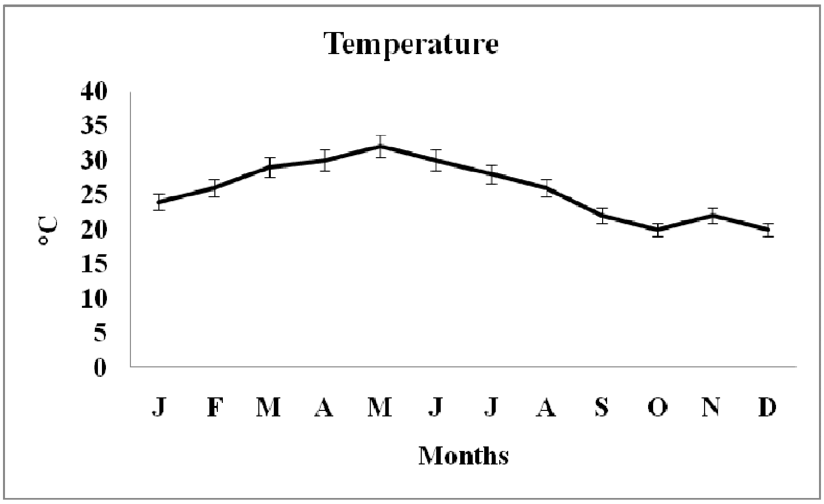


**Fig 2. Variations in temperature**

**Salinity:** Salinity was varied between 10.0 to 32.0 ‰. The minimum (10.0‰) was observed at month of December 2011, while the maximum (30.0‰) was found at month of May 2011(Fig 3).

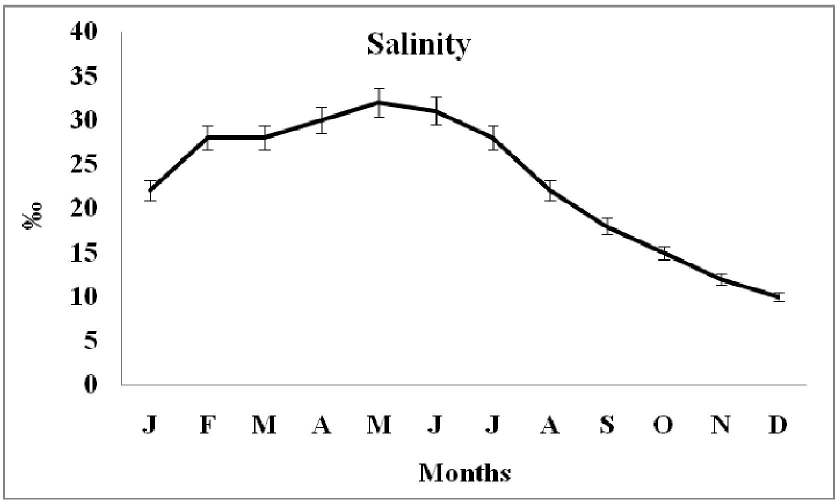


**Fig 3. Variations in salinity**

**Hydrogen-ion concentration (pH):** The pH fluctuation between 7.6 to 8.2. The minimum of 7.6 was recorded at the month of December 2011, while the maximum (8.2) was observed at the season of postmonsoon and summer (Fig 4).

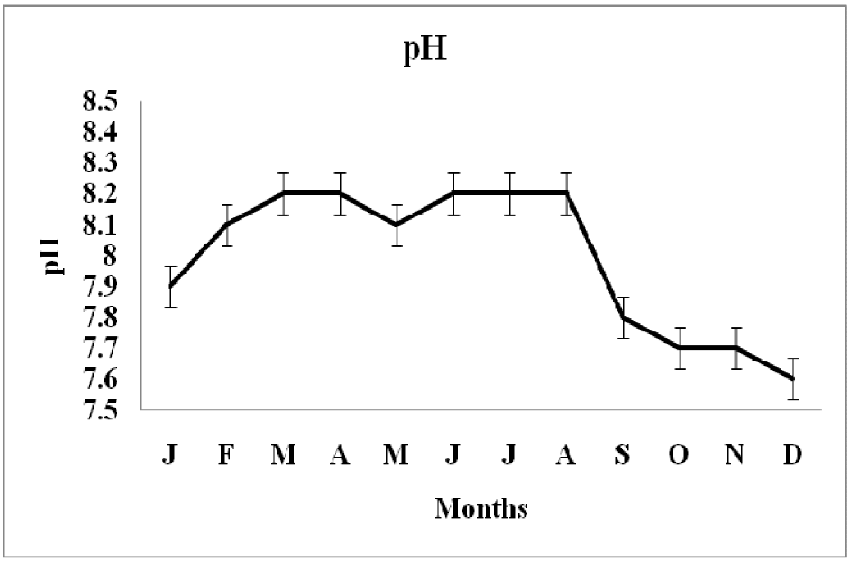


**Fig 4. Variations in pH**

**Dissolve oxygen (DO):** Dissolve oxygen concentration was ranged from 3.6 to 5.6 mg/l. The minimum (3.6 mg/l) was recorded at May 2011 while the maximum (5.5 mg/l) was recorded at the month of December 2011 **(**Fig 5).

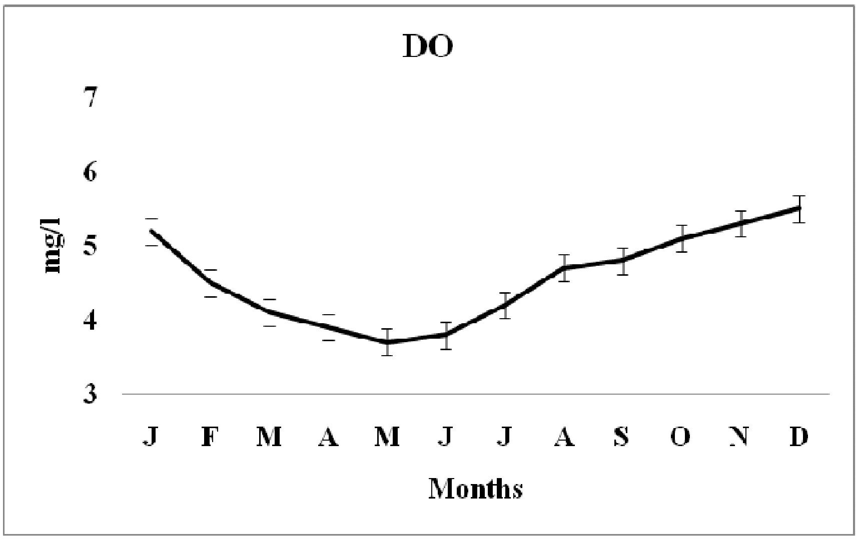


**Fig 5. Variations in Dissolve oxygen**

**Nitrite:** Nitrite concentration was ranged from 0.27 to 0.437 µmol/l in Feb' 2011 to Jan'2012. The minimum (0.27 µmol/l) was recorded at Sep'2011 and the maximum (0.437 µmol/l) was found in May' 2011 (Fig 6).

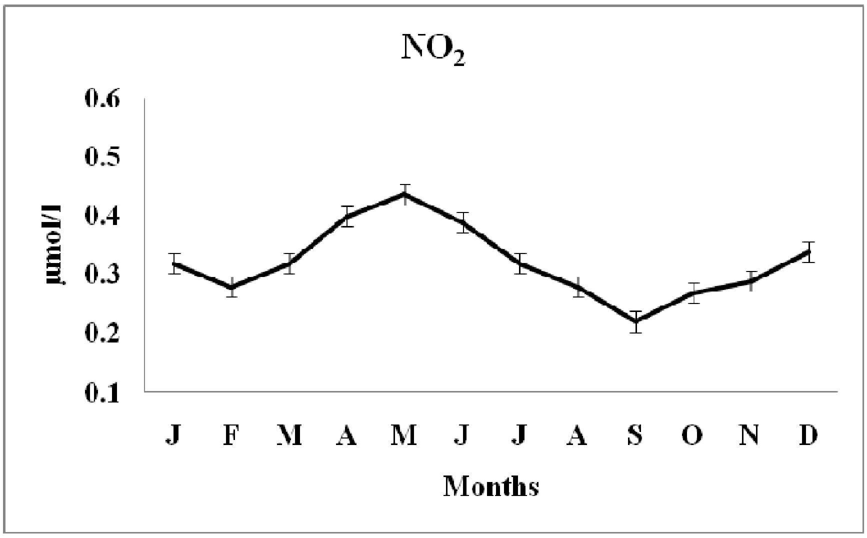


**Fig 6. Variations in Nitrite**

**Nitrate:** Nitrate concentration was ranged from 16.5 to 29.8 µmol/l. The minimum (16.5 µmol/l) was recorded at Sep'2011 while the maximum (29.8 µmol/l) was observed at Apr'2011 (Fig 7).

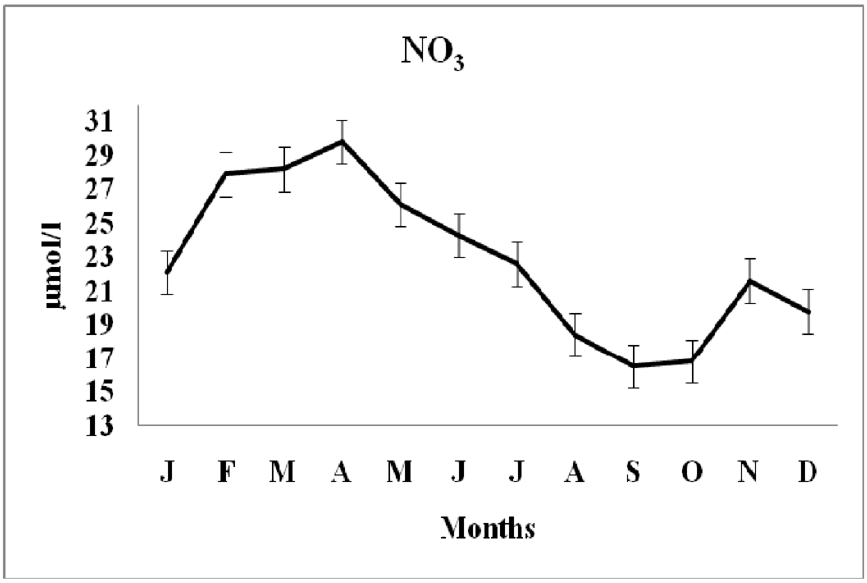


**Fig 7. Variations in Nitrate**

**Total nitrogen:** Total nitrogen concentration was ranged from 0.12 to 1.40 mg/l. The minimum (0.12 mg/l) was recorded at Sep'2011 and the maximum (1.40 mg/l) was observed Mar'2011 (Fig 8).

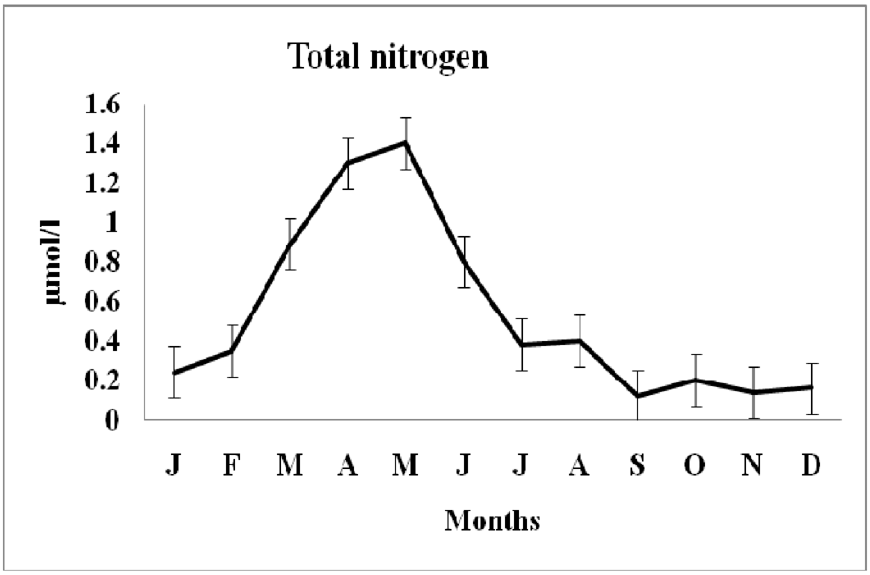


**Fig 8. Variations in Total Nitrogen.**

**Total phosphorus:** Total phosphorus concentration was ranged from 0.60 to 1.8 µmol/l. The minimum (0.6 µmol/l) was recorded in the month of Aug'2011 while the maximum (1.8 µmol/l) was recorded at Mar'2011 (Fig 9).

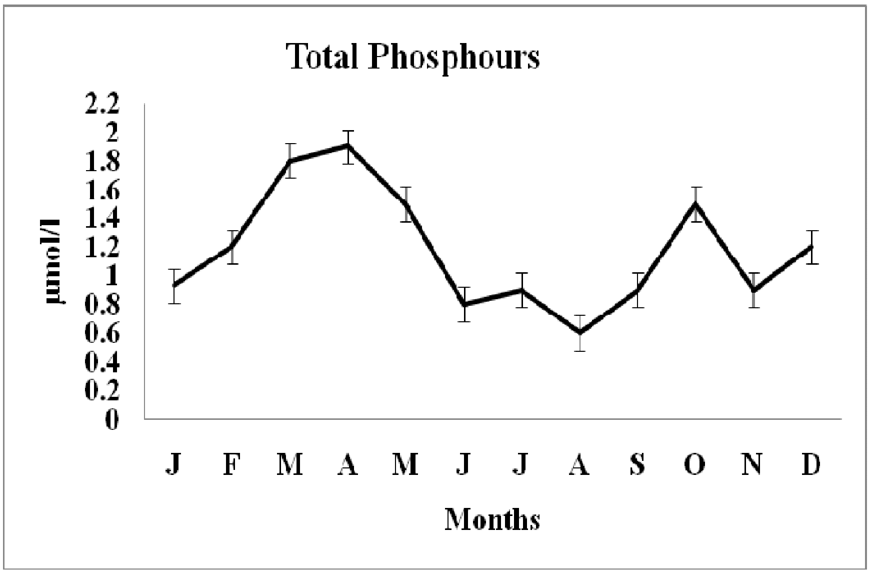


**Fig 9. Variations in Total Phosphorus.**

**Sediment nutrients: Total nitrogen:** Total nitrogen concentration was ranged from 0.35 to 3.06 mg/g. The minimum (0.35 mg/g) was recorded in the month of December'2011 while the maximum (3.06 mg/g) was recorded at May'2011 (Fig 10).

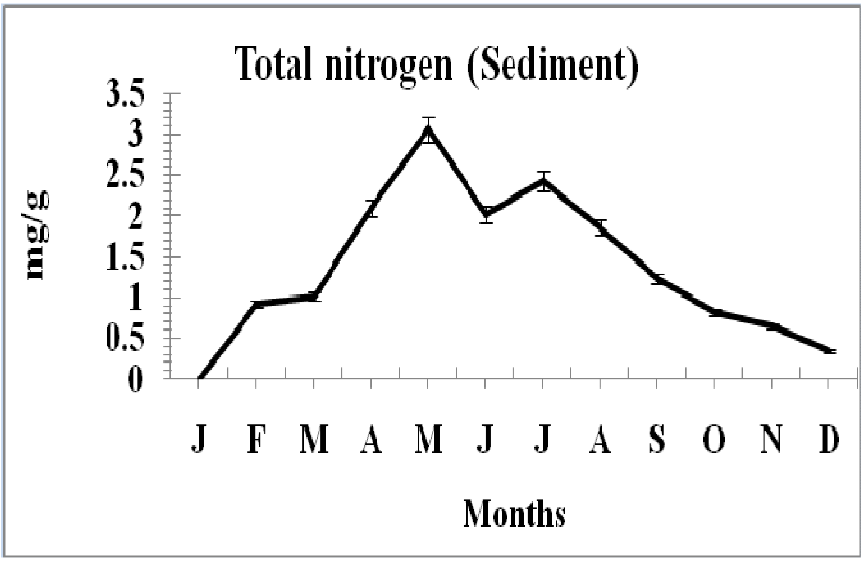


**Fig 10. Variations in Total Nitrogen (Sediment)**

**Total phosphorus:** Total phosphorus concentration was ranged from 0.76 to 1.49 mg/g. The minimum (0.76 mg/g) was recorded in the month of December 2011 while the maximum (1.49 mg/g) was recorded at July 2011 (Fig 11).

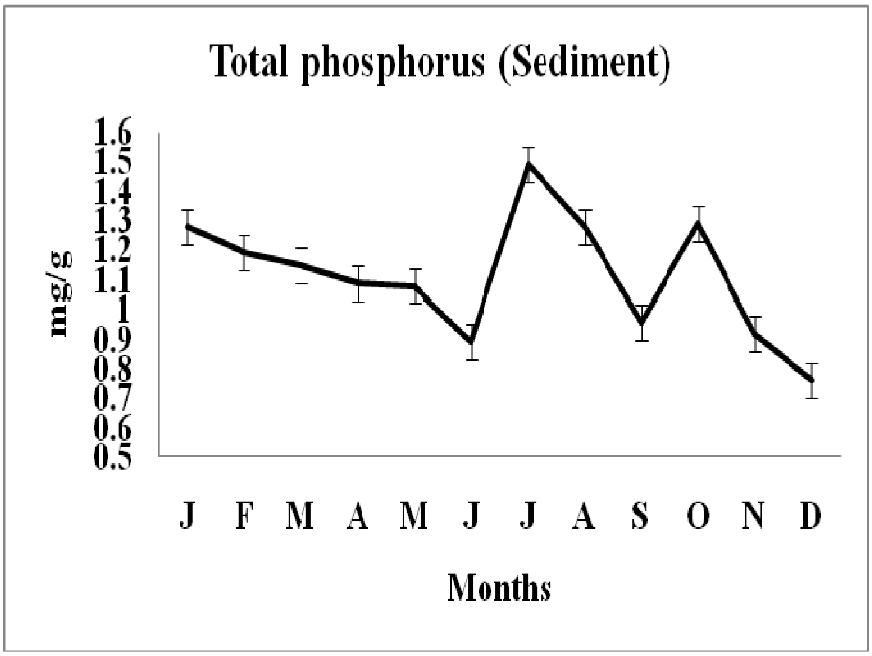


**Fig 11. Variations in Total Phosphorus (Sediment)**

**Total organic carbon:** Total organic carbon concentration was ranged from 0.19 to 5.10 mg C/g. The minimum concentration of carbon source (0.19 mg C/g) was recorded at September 2011 and maximum (5.10 mg C/g) was recorded in month of April 2011 (Fig 12).

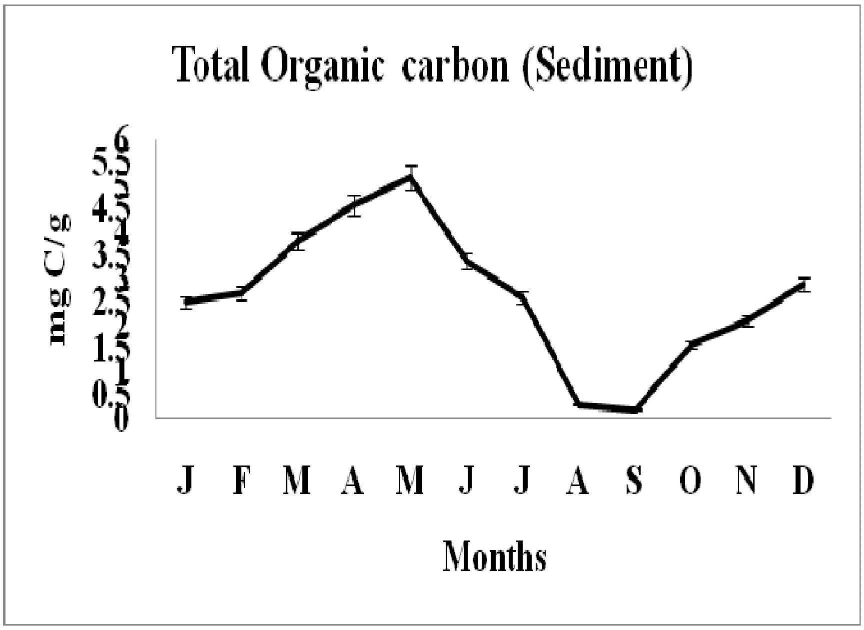


**Fig 12. Variations in Total Organic Carbon (Sediment).**

**Biochemical composition: Carbohydrate:** Carbohydrate concentration was ranged from 4.5 to 10.2%. The minimum (4.5 %) was observed at June2011 while the maximum (10.2%) was recorded in the month of April 2011 (Fig 13).

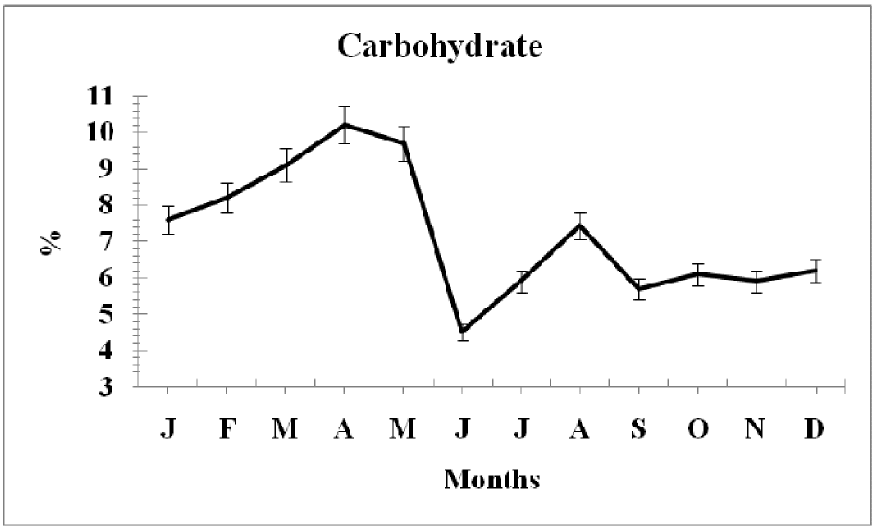


**Fig 13.Variations in Carbohydrate.**

**Protein:** Protein concentration was ranged from 3.40 to 7.8 %. The minimum (3.40%) was recorded at November 2011 while the maximum (7.8 %) was observed in the month of May 2011(Fig 14) .

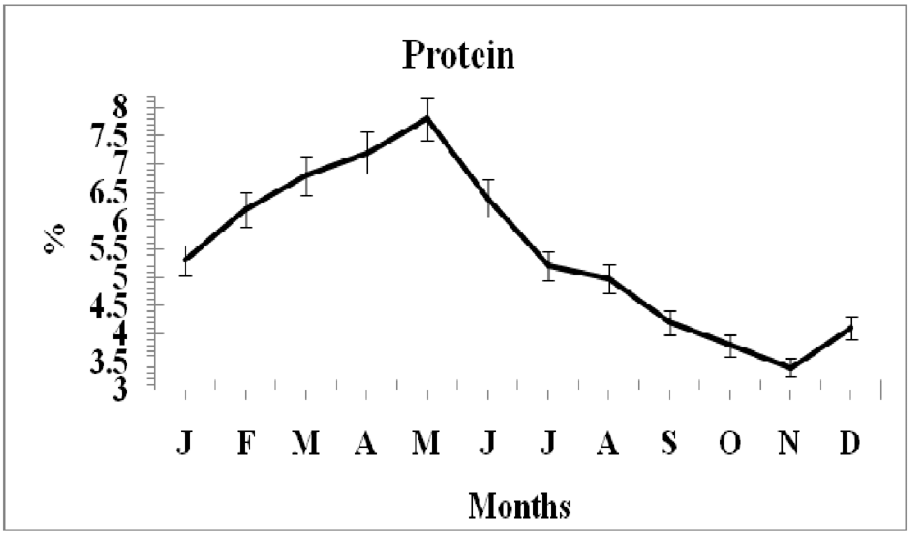


**Fig 14. Variations in Protein.**

**Lipid:** Lipid concentration was ranged from 0.18 to 0.47 % in February 2011 to January 2012. The minimum (0.18 %) was recorded at September 2011 while the maximum (0.46%) was recorded at May 2011 (Fig15).

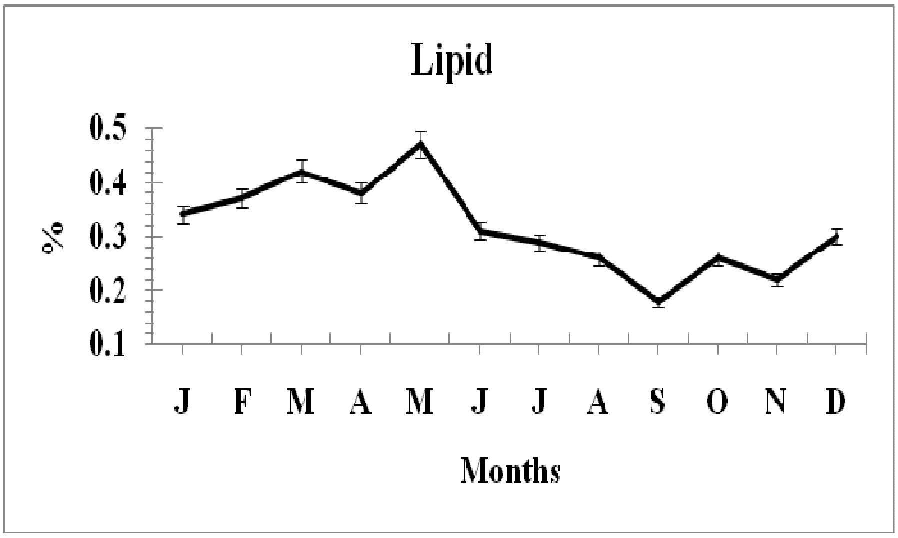


**Fig15. Variations in Lipid.**

## DISCUSSION

The surface water temperature showed an increasing trend from February to May. Generally, surface water temperature is influenced by the intensity of solar radiation, evaporation, fresh water influx and cooling and mix up with ebb and flow from adjoining neritic waters. It is one of the most important factors controlling the physiological activities of tropical marine organisms. In the present study, the higher water temperature of 30$^{o}$C was recorded in May 2011 and it could be attributed to the solar radiation with clear sky. This similar observation was made earlier by (Rajasekar, 2003; Rajaram *et al.,* 2005; Srilatha, 2010) from coastal environment. Salinity is one of the most important key factors which determine the composition of biological component in the marine environment. The fluctuations in salinity affect the biological characteristics of the environment. Chandramohan and Sreenivas (1998); Gowda *et al.,* (2001) stated that the salinity at any point in an estuary will be depended on the topography of the estuary, the state of tide (high or low and spring or neap), the time of the year controlling rainfall and the extent of freshwaters flow. High salinity values could be attributed to the high degree of evaporation and also due to neritic water dominance from the sea on the contrary. Higher salinity value of 32.0 ‰ was recorded in May 2011 and this might be due to the high temperature and absence of freshwater inflow. Oswin and Kannadasan (1998) noticed that this average values of 5-47 ‰. Salinity showed an inverse relation with fresh water discharge, this term agrees with previous studies, Upadhyay (1988); Soundarapandian *et al.,* (2009); Srilatha *et al.,* (2010).

In the present study, the pH range was minimum 7.6 (monsoon) due to the freshwater runoff and maximum 8.2 was recorded (postmonsoon and summer) due to the absence of freshwater flow and high temperature. Similar range of pH has also been reported by earlier workers from estuary environments (Oswin and Rahman, 1997; Subramanian and Mahadevan, 1999). It is well known that the temperature and salinity affect the dissolution of oxygen (Mitra *et al.,* 1990; Srilatha *et al.,* 2010). In the present investigation, a low value of dissolved oxygen was recorded during the month of May and also the month wise observation of dissolved oxygen showed an inverse trend against temperature and salinity. The observed high values might be due to the cumulative effect of higher wind velocity and the resultant freshwater mixing (Mitra *et al*., 1990; Srilatha *et al.,* 2010).

The nutrients pertaining to their contributory sources, utilization levels, mechanism and rates of their release will be of great value to assess the productivity of an estuary. There are several instances to show that river contribute nutrients in a significant measure to the estuary and also is more from the neritic end where mangroves fringe the estuary and their contribution might be enhance the nutrients in the estimated shallow coastal environment. Nitrite is known to be a momentary nutrient and the concentration is therefore determined by the balance between formation and distribution, which is highly influenced by factors. Nitrite concentration noticed during the present study showed optimum values at the all months. Nitrite concentration was found to be much lower than that of nitrate; the same trend was noticed in the present study. The excretion by plankton, reduction of nitrate and oxidation of ammonia combined together or individually contribute to the concentration of nitrite in the environment

(Anbazhagan, 1988). However earlier reports (Mitra *et al.,* 1990; Srilatha *et al.,* 2010) found even higher concentration of nitrite from this Muthupettai mangrove environment and Bay of Bengal. Higher concentration of nitrate could be possible due to heavy rainfall, land drainage and agricultural discharge in this study the maximum concentration of $NO_3$ was recorded at February 2011. Anbazhagan (1988) and Upadhyay (1988) suggested that the addition of nitrogenous nutrients mainly through freshwaters and terrestrial runoff in the lagoon definitely increased the levels of nitrate. Lower concentration of nitrate which was recorded may be due to utilization of nitrate by the benthic algae and phytoplankton. This observation is in agreement with Santhanam and Perumal (2003) have been reported higher concentrations of nitrate from Parangipettai coastal environment.

In the present study total nitrogen in water was low (16.1 mg/l) during in the month of December 2011. The higher concentration was observed in the month of (32.3 mg/l) April 2011 respectively. The recorded higher concentration of nitrogen released from the decay of a large number of phytoplankton (Saravanakumar, 2002). Phosphate constitutes the most important inorganic nutrient that can limit the phytoplankton production in tropical coastal marine ecosystems and thereby the overall ecological processes (Quasim, 1973). In the present study the maximum concentration of phosphate observed at March 2011. The phosphate concentration in coastal waters depends upon its concentration in the fresh water that mixed with the seawater within the land and sea interaction zone, phytoplankton uptake, addition through localized upwelling and replenishment as a result of microbial decomposition of organic matter. Usually, seawater serves as the main source of phosphate in estuarine and coastal waters except those receives fresh water contaminated with domestic wastes containing detergent and wastes from agro field rich with phosphate-phosphorous fertilizer. Higher phosphate value (2.24 µmol/l) might be influenced by the fertilizer inputs from the shrimp ponds and agriculture whereas the lower value (1.42 µmol/l) might be due to decreased land drainage and utilization of phosphate by the phytoplankton (Segar and Hariharan, 1989; Selvaraj, 2003 and Srilatha *et al.,* 2010).

The variations in water and temperature may cause changes in ionization and increased solubility and precipitation of bottom sediment deposits. This may ultimately lead to rapid decomposition of excessive oxidizable organic matter soon after the cessation of rains, leading to high nutrient levels. The sediments possess rich organic debris derived from plants and the decomposition of microbes. Rasheed *et al.,* (2000) reported that during monsoon, terrestrial run-off would result in high levels of organic matter and inorganic nutrients in the mangrove swamps. The high organic carbon was recorded (5.10 mg C/g) in April 2011. A similar trend was observed in the present investigation also which was evidenced by Rasheed *et al.,* (2000).

The carbohydrate concentration maximum (9.42%) was recorded at April 2011. Protein concentration maximum (7.71 %) was recorded at May 2011. Lipid concentration was maximum (0.46%) was recorded at May 2011. The maximum concentration of biochemical properties was observed in the postmonsoon and summer. Similar results were observed by Massicotte *et al*. (1994). The polychaetes are exposed to seasonal variations of abiotic factors that influence their metabolic responses and levels of proximate constituents. The effects are biochemical in origin as the most toxicants exert their effects at basic level of the organism by reacting with enzymes and other functional components of the cell. Such effects might lead to irreversible and detrimental disturbances of integrated functions such as behavior, growth, reproduction and survival (Fernandez, 1998; Danovaro *et al*., 1999; Mayzaud *et al*., 1999).

In the present study the polychaetes *Laeonereis ankyloseta* are known to be economically important. Both the adult and larvae of the family Nereidae has been reported to be food for many economically important fin and shellfishes. Increased human activities the accidental and intentional dumping of pollutants, effluent discharges into this river has created growing environmental concerns, especially loss of commercial fisheries. In the present study of the physico-chemical properties of coastal environments is very important, because the variations in the physico-chemical properties such as temperature, salinity, pH, dissolved oxygen and the dissolved nutrients influence on the biochemical compositions of annelids *Laeonereis ankyloseta* and influence the state of estuarine water. The relationship between the physico-chemical parameters and biochemical composition can be affect the annelids polychaetes production of water bodies are of great importance in management strategies of aquatic ecosystems.

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