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ORIGINAL ARTICLE

**SEASONAL VARIATION IN PHYSICO-CHEMICAL PROPERTIES OF MALLIPATTINAM
COASTAL WATERS, SOUTH EAST COAST OF TAMIL NADU, INDIA.**

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ABSTRACT

The present hydrological parameters such as temperature, turbidity, pH, salinity, dissolved oxygen, carbon dioxide, calcium, phosphate, silicate, nitrate and ammonia were studied in coastal water of Mallipattinam, south east coast of Tamil Nadu, India during October 2013 to September 2014. All the physico –chemical parameters were measured by using standard methods. Water temperature varied from 27 to 35⁰c, turbidity varied from 45 to 70 cm, pH varied from 7.4 to 8.7, salinity ranged between 25 to 36 ppt, dissolved oxygen ranged from 4.14 to 5.93 mg/lit, calcium level ranged from 75 to 256 mg/lit, phosphate varied between 0.140 to 0.297 mg/lit, silicate fluctuated from 30.29 to 53.75 mg/lit nitrate varied from 0.46 to 0.94 mg/lit and ammonia ranged from 0.15 to 0.35 mg/lit also varied independently.

Key words: seasonal variations, physico- chemical parameters, coastal waters, Mallipattinam.

1.INTRODUCTION

The maintenance of good water quality is essential for survival and optimum growth of aquatic organisms. Good water quality is characterized by adequate oxygen and limited levels of metabolites. Water quality parameters should be monitored to serve as guide for managing a coastal waters so that conditions that can adversely affect the growth of aquatic species can be avoided.

Water quality refers to anything in the water, be it physical, chemical and biological that affects the production of marine fishes (Ajith Kumar *et al.*, 2006). Through water is a renewable resource, reckless usage and improper management of pond water system may cause serious problems in availability and quality of a water is usually determined but its physico-chemical characteristics (Choudhury and Panigrahy, 1991). Sea water is unfinite resource, essential for fish and prawn culture, without sea water of adequate quantity and quality, sustainable development will not be possible (Satpathy,1996). Sea water provide an ecologically important for a wide diversity of many species. Their distribution depends upon the biological, ecological and physico-chemical characteristics of the water. Sea water have always been the most important marine resources, and most developmental activities are still dependent upon them (Pradhan *et al.*, 2009). Water is most important chemical compound for the perpetuation of life on

this planet. It is not only essential for lives but also important physical and chemical compound from engineering point of view (VijayaKumar *et al.*, 2000). For effective maintenance of water quality through appropriate control measures, continuous monitoring of large number of quality parameters is essential. However it is very difficult and laborious task for regular monitoring of all the parameters even if adequate manpower and laboratory facilities are available (Upadhyay *et al.*, 2010).

Coastal water are important as sources of fishery products, as nursery grounds for marine fish, prawn and as habitats for a wide variety of aquatic flora and fauna. They, however, generally experience widely fluctuating physico chemical conditions that induce immense stress on the organisms inhabiting them (Kannan and Kannan,1996; Srivastava *et al.*, 2009). The complete water quality monitoring program will consists of four discrete monitoring events including premonsoon, monsoon, and summer and post monsoon. Hence, the present study deals with the seasonal changes of physico-chemical parameters of Mallipattinam coastal waters, southeast coast of Tamil Nadu, India.\

2.MATERIALS AND METHODS

Study Area: The present study was carried out on Mallipattinam coastal water situated in Thanjavur District, Tamil Nadu, India.

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Sample Collection: Water samples were collected every month during October 2013 to September 2014. Surface water samples were collected in clean sterile plastic containers. Preservation and transportation of the water samples to the laboratory were as per standard methods (APHA, 1998).

Analysis of Physico-Chemical characters: Water temperature was measured on the site using mercury thermometer. The water samples were analyzed for 11 different parameters. Light penetration in the water column was measured with the help of a Secchi disc. pH was using an Elico meter (Model L1-120). Salinity was estimated with the help of a Salinometer (Model-E-2). Dissolved oxygen was estimated by the modified Winkler's method (1888). The water samples were filtered using a Millipore filtering system and analyzed for dissolved calcium, phosphate, silicate, nitrate and ammonia adopting the standard procedures described (APHA, 1998).

3.RESULTS AND DISCUSSION

In the present study water temperature fluctuated from 27 to 35^o c. It was found to be low (27^o c) in December 2013 and high temperature (35^o c) was recorded in May 2014. The transparency of the sea water varied from 45 to 70 cm. It was found to be maximum (70cm) in November 2013 and minimum (45cm) was recorded in April 2014. pH is another important hydrological parameter. The pH of the coastal water showed alkaline range throughout the study period. It varied from 7.4 to 8.7. It was found to be minimum (7.4) in October 2013 and maximum (8.7) in June 2014.

The salinity is an important ecological factor which influence the growth, metabolism and mortality of aquatic species. In the present study observation the salinity of sea water showed slight fluctuation. It varied from 25 to 36 ppt. It was found to be low (25ppt) in December 2013 and high (36ppt) was recorded in May 2014. The dissolved oxygen content varied from 4.14 to 5.93 mg/lit. It was found to be low (4.14 mg/lit) in April 2014 and high (5.93 mg/lit) was recorded in September 2014.

Dissolved carbon dioxide of the sea water fluctuated from 0.061 to 0.187 mg/lit. The maximum level (0.187 mg/lit) was recorded in July 2014 and minimum carbon dioxide (0.061 mg.lit) was observed in October 2013. Calcium content of the sea water varied between 75 to 256 mg/lit. The maximum dissolved calcium (256 mg/lit) was recorded in June 2014 and minimum (75 mg/lit) in February 2014. Phosphate of the sea water fluctuated from 0.140 to 0.297 mg/lit. It was found to be low (0.140 mg.lit) in January 2014 and high (0.297 mg/lit) was recorded in July 2014.

The Silicate content of the coastal water varied from 30.29-53.75 mg/lit. It was found to be maximum (53.75 mg/lit) in May 2014 and minimum (30.29 mg/lit) was recorded in December 2013. The nitrate content varied between 0.46 to 0.94 mg/lit. It was found to be maximum (0.94 mg/lit) in April 2014 and minimum (0.46 mg/lit) was recorded in October 2013. Ammonia content of the water varied from 0.15 to 0.35 mg/lit. It was found to be low (0.15 mg. /lit) in

November 2013 and high (0.35 mg/lit) was recorded in June 2014.

Temperature variation is one of the factors in the coastal eco systems, which can influence the physico-chemical characteristics of coastal waters to a great extent. In the present study the water temperature was observed maximum in summer and minimum in pre monsoon season. Similar finding was reported (Pillai *et al.*, 2000). One of the most familiar properties water is its transparency. Turbidity was minimum summer and maximum in pre monsoon season. Similar findings was earlier reported (Bagde and Verma,1985).

In the present study summer season maximum value of pH was recorded in the Mallipattinam coast and minimum pH value was recorded in pre monsoon season. Most marine organisms prefer conditions with pH values ranging from 6.5 to 8.5. The pH in marine and brackish water system is always taken as the function of the salinity and was governed by amount free CO₂ and HCO₃ (Panigrahy, 1999). Dissolved oxygen affects the growth, survival, distribution behavior and physiology of shrimps and other aquatic organisms (Subramanian and Mahadevan ,1999). In the present study, dissolved oxygen content level was recorded maximum in post monsoon and minimum in summer season. Similar work was reported (Ashok prabu *et al.*, 2008).

Salinity is considered to be the basic and prime factor among the environmental variable in the marine environment which influences greatly the dynamic situation of the estuarine and coastal waters by the inflow of freshwater and prevailing temperature. In the present study, the salinity range maximum was recorded in summer and minimum in pre monsoon season. This study agreement with previous studies (Govindasamy *et al.*, 2000). Free carbon dioxide, highly soluble gas in water, main source of carbon path way in the nature, is contributed by the respiratory activity of animals and can exist in water as bicarbonate or carbonate in the dissolved or bound form in earth crust, in limestone and coastal regions. When dissolved in water it forms carbonic acid which decrease the pH of any system, especially insufficiently buffered systems, and this pH drop can be harmful for aquatic organisms. In the present study, carbon dioxide content was recorded maximum in post monsoon season and minimum was recorded in pre monsoon season. Similar conditions was observed (Suganthini and Dias,1982).

Calcium is generally present in soil as carbonate and most important environmental, divalent salt in fish culture water. Fish can absorb calcium either from the water or from food. In the present study, calcium content maximum was recorded in summer and minimum was recorded in monsoon season. Similar trend was reported (Patra *et al.*, 2010). Phosphate content in coastal water is more than previous value. This may be due to release of phosphate from bottom sediment and organic load of water. In the present study, phosphate content maximum was recorded in post monsoon season and minimum was recorded in monsoon period. Similar findings was recorded (Ashok prabu *et al.*, 2008).

In the present study silicate content maximum was recorded in summer season and minimum was recorded in pre monsoon season. Similar trend was recorded (Sankar *et al.*, 2010). Silicate content was found to be high in low salinity area and low in high salinity area. Relativity lower values of silicate were observed during pre-monsoon season period, which could be due to update of phytoplankton (Nayak and Behera., 2004).

Table;1. Seasonal Variation of Physico –Chemical Properties of Sea water at Mallipattinam, Thanjavur District , Tamil Nadu. During October 2013 - November 2014..

| Month & Year | Seasons | Temperature (° C) | Turbidity (cm) | pH | Salinity(pppt) | Dissolved Oxygen (mg/lit) | arbon dioxide (mg/lit) | Calcium(mg/lit) | Phosphate (mg/lit) | Silicate (mg/lit) | Nitrate(mg/lit) | Ammonia(mg/lit) |
|------------------|--------------|-------------------|----------------|-----|----------------|---------------------------|------------------------|-----------------|--------------------|-------------------|-----------------|-----------------|
| October – 2013 | Pre monsoon | 31 | 65 | 7.4 | 29 | 5.61 | 0.061 | 106 | 0.173 | 34.28 | 0.46 | 0.19 |
| November - 2013 | | 29 | 70 | 7.7 | 28 | 5.88 | 0.064 | 94 | 0.161 | 31.74 | 0.53 | 0.15 |
| December - 2013 | | 27 | 68 | 7.9 | 25 | 5.91 | 0.079 | 99 | 0.152 | 30.29 | 0.59 | 0.21 |
| January - 2014 | Monsoon | 29 | 59 | 8.1 | 26 | 4.79 | 0.083 | 86 | 0.140 | 42.53 | 0.66 | 0.26 |
| February – 2014 | | 30 | 61 | 8.0 | 29 | 4.35 | 0.086 | 75 | 0.156 | 44.85 | 0.78 | 0.25 |
| March – 2014 | | 32 | 53 | 8.2 | 30 | 4.22 | 0.095 | 88 | 0.149 | 49.69 | 0.72 | 0.21 |
| April – 2014 | Summer | 34 | 45 | 8.4 | 33 | 4.14 | 0.158 | 121 | 0.260 | 46.32 | 0.94 | 0.33 |
| May – 2014 | | 35 | 49 | 8.5 | 36 | 4.83 | 0.176 | 179 | 0.259 | 53.75 | 0.91 | 0.31 |
| June – 2014 | | 33 | 47 | 8.7 | 32 | 4.78 | 0.164 | 256 | 0.276 | 51.28 | 0.89 | 0.35 |
| July – 2014 | Post monsoon | 31 | 55 | 8.3 | 29 | 5.11 | 0.187 | 180 | 0.297 | 42.52 | 0.87 | 0.29 |
| August – 2014 | | 31 | 58 | 8.1 | 31 | 5.46 | 0.153 | 172 | 0.244 | 45.71 | 0.85 | 0.27 |
| September - 2014 | | 30 | 56 | 7.7 | 32 | 5.93 | 0.169 | 164 | 0.231 | 48.19 | 0.81 | 0.26 |

The recorded highest nitrate value during summer season could be mainly due to the organic materials received from the catchment area during ebb tide (Das et al., 1997). In the present study, nitrate content of the coastal water was recorded aximum in summer and minimum was recorded in pre monsoon season. Similar conditions was recorded (Jakher and Rawal, 2003).

Ammonia is the second gas of importance in fish culture, its significance to good fish production is overwhelming. High ammonia levels can arise from overfeeding, protein rich, excess feed decays to liberate toxic ammonia gas, which in conjunction with the fishes, excreted ammonia may accumulate to dangerously high levels under certain conditions. Fortunately ammonia concentrations are partially curbed buffered by conversion to nontoxic nitrate in by nitrifying bacteria. Additionally, ammonia is converted from toxic ammonia to nontoxic ammonia ion at pH below 8.0. In the present study, ammonia level was recorded maximum in summer and minimum in pre monsoon season period. Similar trend was recorded (Reddi et al., 1993). The present baseline information of the seasonal variation of the physico-chemical parameters in sea water analysis would form a useful tool for further ecological assessment and monitoring of these marine ecosystems of Mallipattinam coastal waters.

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