

## Characteristics of Water Quality in the Palk Strait, South East Coast of India

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**Abstract:** Hydrological variables and dissolved nutrients such as inorganic phosphate, nitrite, nitrate and silicate were analyzed in coastal water biotopes of Palk Strait coastal environment. Air and surface water temperatures varied from 29.4 to 34°C and from 28 to 31°C respectively. Salinity ranged from 31 to 35‰ and the pH ranged from 7.5 to 8.5. Variation in dissolved oxygen content was from 2.31 to 3.96 ml<sup>-1</sup>. Concentration of nutrients viz. nitrite (2.94 to 3.98 μM), nitrate (3.18 to 4.14 μM), inorganic phosphate (2.43 to 3.68 μM) and reactive silicate (3.90 to 2.42 μM) also varied independently. The concentration of chlorophyll a ranged from 3.11 to 8.98 mg/l.

**Key words:** Coastal water • Nutrients • Physico-Chemical Characteristics • Water Quality

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### INTRODUCTION

Water quality is an important environmental variable, because it affects human health and economic activity [1]. Suspended sediments due to soil erosion are the largest pollutant by volume and weight affecting water quality [2, 3]. Besides this, about half of the total suspended sediment load (i.e. 34 x10<sup>8</sup> tones) received by the Indian Ocean comes from the rivers flowing through the Indian subcontinent. Bay of Bengal has several distinguishing features, which make it a particularly unique and dynamic area of study. It is usually considered less productive compared to the Arabian Sea. Although many major river systems bring in large quantities of nutrients, narrow shelf, persistent cloud cover and low light penetration are responsible for low productivity [4]. Palk Bay region has not been paid much attention when compared to the adjacent Gulf of Mannar and most of the available literature and studies do not indicate the present scenario of the bay. Kannan and Kannan [5] have studied the physio-chemical characteristics of the seaweed beds of the Kattumavadi and Kottipattinam regions of the Palk Strait. Hence, the

present study was undertaken on the water quality characteristics for a period of six months from Jan-2008 to June 2008 at Nagapattinam coastal region in the Palk Strait.

### MATERIALS AND METHODS

Sampling program was carried out during the period Jan-2008 to June-2008. Atmospheric and surface water temperatures were measured using standard mercury filled centigrade thermometer. Salinity was observed with the help of hand refractometer and pH measured using an Elico pH meter. Dissolved oxygen was estimated by the modified Winkler's method, described by Strickland and Parsons [6]. For the analysis of nutrients, the surface water samples were collected in clean polythene bottles and kept in an ice box and transported immediately to the laboratory. Water samples were filtered using a Millipore filtering system (MFS) and analyzed for dissolved inorganic phosphate, nitrate, nitrite and reactive silicate by adopting the standard methods described by Strickland and Parsons [6]. All the nutrient concentrations were expressed in μM.

For the estimation of chlorophyll *a* and Phaeophytine, one-liter seawater was collected and filtered immediately through 47 mm GF/C glass filter papers (Whatmann International Ltd.). 1 ml of 1% magnesium carbonate suspension was added on to the filter paper to form a thin bed, which will serve as a precaution against the development of any acidity and subsequent degradation of pigments. The aim for the filtration of seawater sample was to concentrate adequate amount of particles on the filters to permit accurate spectrophotometric measurements, avoid contamination and particle degradation and maximize retention. After filtration, the filter papers were flooded with 10 ml of respective solvents (90% acetone) and incubated for 20-24 hr in darkness in fridge. All the samples were centrifuged at 4°C at 3000 rpm for 5min. Chlorophyll *a* was estimated by the spectrophotometer at the wave length of 530, 645 and 665nm.

## RESULTS AND DISCUSSIONS

Atmospheric temperature ranged from 29.4 to 33.7°C with the minimum (29.4°C) during the post monsoon season and the maximum (33.7°C) during the summer season. The maximum surface water temperature (30.4°C) was recorded during the summer season and the minimum (28.4°C) was recorded during the post monsoon. The present study showed several important factors influencing the coastal water quality (Fig. 1). The minimum temperature recorded during the monsoon season could be ascribed to the rainfall caused by the northeast monsoon at Kattumavadi. During the present study period, the surface water temperature was always lower than that of air temperature. This indicates that the water temperature is mainly influenced by air temperature, besides water currents. Similar seasonal patterns are reported by Rajpandian *et al.*, [7] from the Tuticorin coast, Sampathkumar and Kannan [8] from the Tranquebar-Nagapattinam coast and Subramanyan and Kannan [9] from Tuticorin region, all are lying along the southeast coast of India including the present study area. Salinity ranged between 31 and 34‰ recording the maximum (34‰) during the summer season and the minimum (30‰) during the post monsoon season. Salinity is one of the important factors that influences the functional physiology and reproductive activity of the organisms [10].

In the present study, salinity was lighter during the post monsoon season than summer season. This could be due to the continuous evaporation of water from the

study area especially during summer season [8]. Dissolved oxygen content varied from 3.39 to 4.57 ml l<sup>-1</sup> with the minimum (3.39 ml l<sup>-1</sup>) during the post monsoon and the maximum (4.57 ml l<sup>-1</sup>) during the summer season (Fig. 2). This variation could be due to the decrease in oxygen solubility because of increase in temperature and salinity of the water column. Similar observations were reported [11] from the coastal water of the Godavari. Hydrogen-ion concentration (pH) ranged from 7.3 to 8.4 with the maximum (8.4) recorded during the summer season and the minimum (7.3) during the post monsoon season (Fig. 2).

The minimum concentration of nitrate (4.66 μM) was recorded during the post monsoon season and the maximum (5.71 μM) during the summer season. Qasim and Reddy [12] also observed a similar trend in the back waters. Nitrite concentration showed a marginal difference in its seasonal distribution [12]. This seasonal difference in nitrite concentration could be attributed to the variations in phytoplankton excretion, oxidation of ammonia and reduction of nitrite in addition to the bacterial decomposition of planktonic detritives [13]. Reactive silicate concentration was minimum (6.53 μM) during the post monsoon season and maximum (13.63 μM) during the summer season (Fig. 2). The sudden fall in the silicate concentration during the post monsoon season could be attributed to the increased population density of phytoplankton. Inorganic phosphate concentration was minimum (3.64 μM) during the post monsoon season and the maximum (4.83 μM) during the summer season. Nutrient concentrations showed district seasonal variations. The concentration of inorganic phosphate observed during the monsoon in the study area could be due to the land run off from the irrigation channels and release of phosphate from the sediments due to high wind action during this season.

The concentration of chlorophyll ranged from 3.11 to 8.98 mg l<sup>-1</sup> with the minimum (3.11 mg l<sup>-1</sup>) during the post monsoon and maximum (8.98 mg l<sup>-1</sup>) during summer (Fig. 3). Krishnamurthy and Sundararaj [14] found that chlorophyll *a* concentration varies between 2.91 – 65.56 μg l<sup>-1</sup> in Porto novo coastal waters. Chandran [15] Observed that the seasonal and tidal variations of phytoplankton in the Vellar estuary and Salinity play a major role in determining the species composition, succession and density of phytoplankton there by the concentration of chlorophyll *a*. [16] Gopinathan and Rodrigo (1991) studied the seasonal variation of some hydro biological parameters and their relationship with the primary production and phytoplankton density.

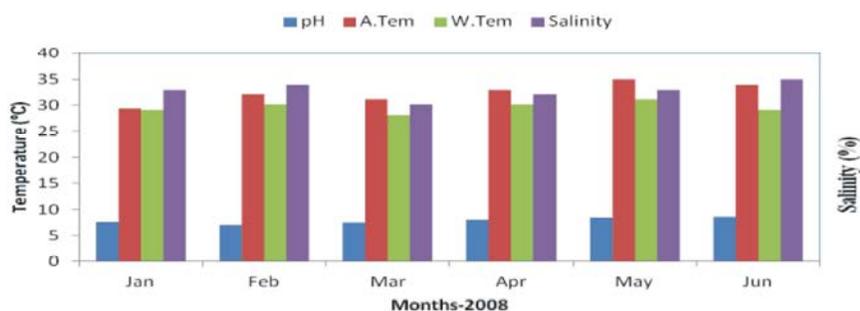


Fig. 1: Physico-chemical variables were of examined water recorded during Jan to Jun 2008

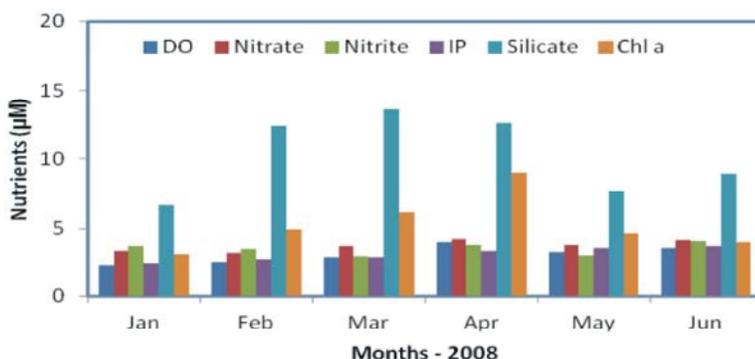


Fig. 2: Dissolved concentrations of nutrients, oxygen and chlorophyll recorded during Jan 2008 to Jun 2008

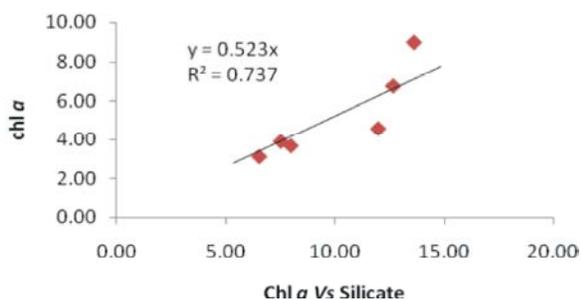


Fig. 3: Linear regression for Chl a

### CONCLUSIONS

From the results of the present study it can be concluded that Physico-chemical parameters, nutrients and Chlorophyll- *a* content of the examined water samples in the Nagapattinam Coastal region in the Palk Strait showed spatial and temporal variations.

### ACKNOWLEDGEMENTS

The authors are thankful to Alagappa University, University authorities and A.V.V.M. Sri Pushpam College (Autonomous) Poondi, Thanjavur district, Tamilnadu, for providing necessary facilities to carry out this work.

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