

Seasonal influence on physico-chemical properties of coastal waters in Nagapattinam, southeast coast of India

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Abstract

Background/Objectives: Near shore or coastal water bodies are important sources of marine environment. Water is inevitable properties for the living being. Water quality assessment is important in understanding biological phenomena of coastal zone.

Methods/Statistical analysis: Water and sediment samples were collected from Nagapattinam coastal water at monthly interval from July' 2016 – June' 2017 to analyze various physico-chemical parameters in water and sediments.

Findings: The water temperature values ranged from 22 °C to 32 °C. Salinity ranged from 28ppt to 35ppt. The pH values ranged from 7.6 – 8.2. DO values varied from 4.1 ml L⁻¹ to 5.2ml L⁻¹. The water nutrient concentrations observed as: NO₂:0.96 – 4.509 µg L⁻¹, NO₃:0.603 µg L⁻¹ to 2.498 µg L⁻¹, TN: 6.004 – 14.52 µg L⁻¹, IP: 0.398 – 1.0198 µg L⁻¹ and TP: 0.516 – 2.127 µg L⁻¹ were recorded respectively. The nutrient concentration observed in sediment ranged from TN, 5.408 µg L⁻¹ – 13.918 µg L⁻¹, TP, 7.54 µg L⁻¹ – 16.872 µg L⁻¹ TOC, 6.68 µg L⁻¹ – 13.882 µg L⁻¹ respectively.

Application/Improvements: Physico-chemical variations of water are accountable for the aquatic organisms. Which is interactive with physical, chemical and biological processes of the coastal ecosystem for sustain life. The nutrients provide the potential fertility for water masses and it is necessary to collect the data for their distribution. Hence, the present work has been carried out the physico-chemical characteristics of Nagapattinam coastal waters in Tamil Nadu, India.

Keyword: Water, Sediments, Physical parameters, Nutrients, coastal zone.

1. Introduction

Ocean is an important source as it houses biotic and a biotic resources for mankind to exploit. Its fishery source is the main protein food resource along the coastal area. The industrialization along the coastal area has brought water quality in declining trend [1,2], [3,4]. Water quality study is essential to assess tropic levels and food webs. Usually in the near shore waters and estuaries, exhibit the temperature seasonal variation due to the climatic conditions [3]. Effluents are considered to be major addition of nutrients to aquatic ecosystem which posing threat to fish stocks [5,6]. Its impacts vary with minor to major disruptions.

It is essential to grasp the interrelationships between the organism and performance of the coastal ecosystem. Coastal water has become a major concern of its values for socio-economic status and human health [7-8]. Hence, the present work has been carried out for the water quality of Nagapattinam coastal waters.

2. Study area

Nagapattinam (Lat. 10046N. Long.79051E) is a coastal area situated in the Bay of Bengal. It is also considered as one among the important fishing harbors in Tamil Nadu coast.

Figure 1. Study area



3. Materials and Methods

1. Physico-chemical parameters of water and sediment

Water and sediment samples were collected from Nagapattinam coast at monthly interval from July 2016 to June 2017 (Figure 1) to analyze various physical parameters in water [9].

2. Nutrient analysis in water

For the nutrient analysis, surface samples were collected and kept in proper condition for quality analysis [10].

3. Nutrient analysis in sediments

The sediments nutrients were determined by adopting [10]. The samples were dried in oven and grounded in mortar and pestle.

Then the samples were sieved through a 63 micro meter size, without dispersion agent, to avoid contamination of samples. The sediment samples 0.5g was weighed for nutrient analysis.

4. Results

The water temperature varied from 22 °C to 32 °C. Minimum temp° (22 °C) was observed in Dec.' 2016 (monsoon) and maximum (32 °C) was recorded in summer (May' 2017). The salinity ranged from 28ppt to 35ppt. Minimum salinity (28ppt) was observed in Dec.' 2016 (monsoon) and maximum (35ppt) was found in summer (May' 2017). pH concentration varied from 7.6 to 8.2.

Minimum pH (7.6) was observed in Dec.' 2016 (monsoon) and maximum (8.2) was recorded during summer season. DO (dissolved oxygen) conc. varied from 3.6 ml L⁻¹ to 5.1ml L⁻¹ was recorded in this station. Minimum DO (3.6 ml L⁻¹) was observed in May' 2017 and maximum (5.1ml L⁻¹) was recorded during monsoon season (Dec' 2016).

5. Water nutrients

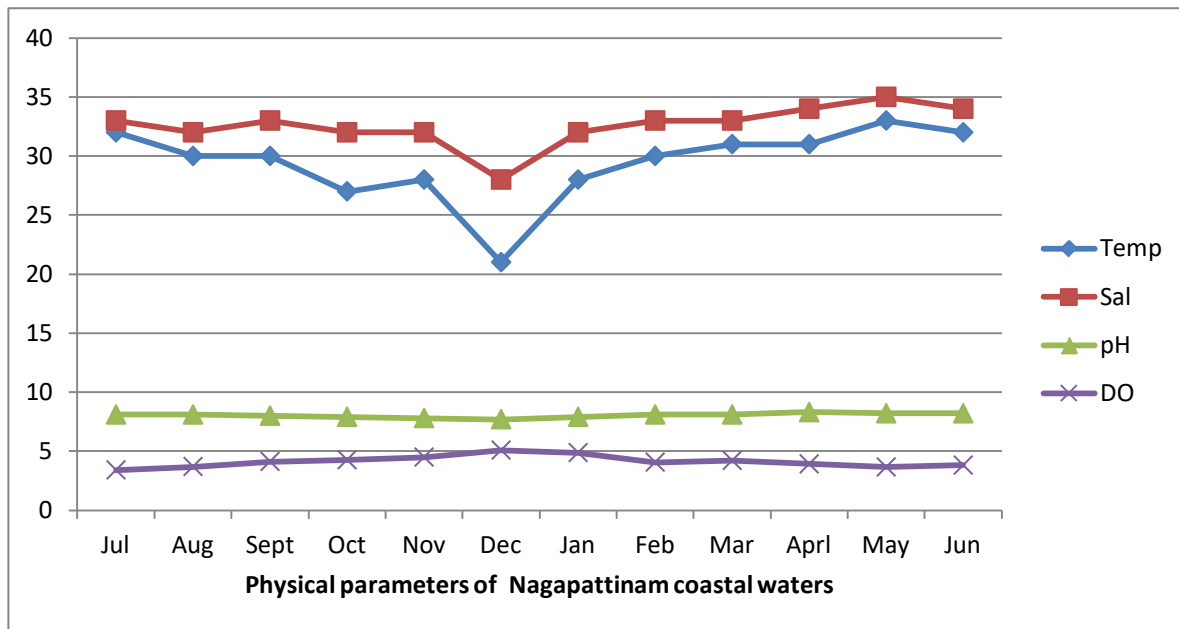
The nutrient concentration varied as NO_2 : $0.603 \mu\text{g L}^{-1}$ to $2.498 \mu\text{g L}^{-1}$, NO_3 : $0.96 - 4.509 \mu\text{g L}^{-1}$ TN: $6.004 - 14.52 \mu\text{g L}^{-1}$, IP $0.398 - 1.019 \mu\text{g L}^{-1}$ and TP: $0.516 - 2.127 \mu\text{g L}^{-1}$ during the study period. Minimum concentration of nutrients was observed during summer and maximum were recorded in December 2016 (monsoon). The nutrient concentration ranged as TN: 5.408 to $13.918 \mu\text{g L}^{-1}$, TP: $7.54 \mu\text{g L}^{-1} - 16.872 \mu\text{g L}^{-1}$, TOC: $6.68 \mu\text{g L}^{-1} - 13.882 \mu\text{g L}^{-1}$ respectively. Minimum nutrient concentration was observed in June 2017 (summer) and maximum during monsoon (December 2016).

6. Discussion

The important contributors of fisheries in India suffer in fish production due to the increasing industrialization and urbanization along the coastal zone [11]. The physico-chemical variability in coastal water influences the biotic and abiotic components profoundly. Data of surface water temperature, pH, salinity, dissolved oxygen, are given in the Figure 2. Temperature is an important limiting factor, which regulates the biogeochemical activities in aquatic environment. Generally water temperature corresponds with air temperature. It has been indicated that the samples of shallow coastal waters to have direct relevance with air temperature [12]. Temperature controls the solubility of gases and salts in water [13]. The seasonal variations in atmospheric temperature warm up the surface water during summer which raises the water temperature. The increased pattern of temperature from winter to summer has pointed out the earlier reports [14, 15]. The increasing temperature has to decrease the DO [15].

In the present study, water temperature varied from 18°C to 32°C (Figure 2). Similar findings were also recorded [15]. Salinity is an important factor for benthic organisms and its changes are caused by precipitation and evaporation. Salinity variation influences the fauna in the marine environment particularly in intertidal zones.

Figure 2. Physical parameters of Nagapattinam coastal waters from July 2016 to June 2017



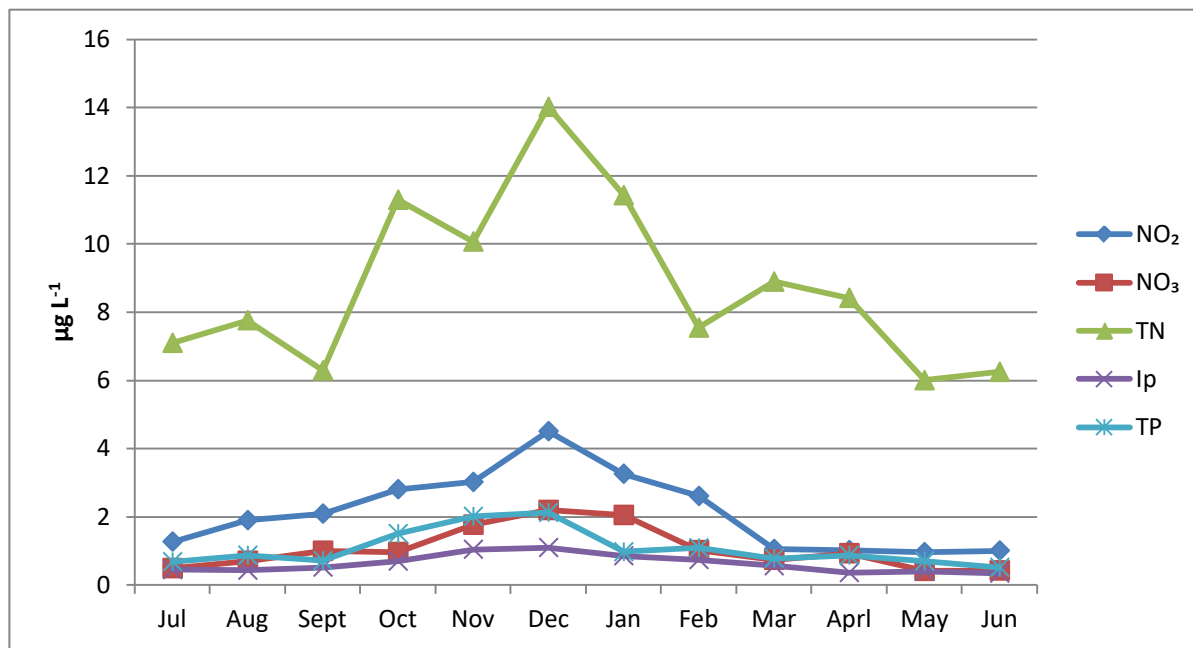
The changes of the salinity in the estuaries are occurring due to river runoff, influenced by monsoon or tidal variation. In the present study, the salinity is not having much variation because of open coastal waters. The seasonal variations of salinity were observed as lowest conc. in monsoon (28ppt) and highest conc. during summer (35ppt) (Figure 2). Similar findings were also recorded [4,16]. The fluctuation of water pH is linked with chemical changes, species composition and life processes. It is generally considered as an index for suitability of the environment.

In the present study, the water pH varied from 7.6 to 8.2 was found in this station. The low concentration of pH 7.6 observed in monsoons and high concentration has in summer (Figure 2). The fluctuated environment has observed that a pH range of 6.7 to 8.4 is suitable for the growth of Aquatic biota. In Adyar estuary pH ranged from (7.17 to 9.90) indicating slightly high alkaline nature of water [4,16].

The influence of the temperature and salinity is affecting the diffusion of oxygen in water. The increase of water temperature directly raising the salinity due to this the solubility of DO will be lost by water bodies. In the present study, DO concentration from 3.6ml/l – 5.1ml/l were observed in this station (Figure 2). Highest value of DO was recorded in monsoon due to the rainfall and freshwater inflow. The low value of (3.6ml/l) was found in summer. The same results were reported [15,17].NO₂ conc. from 0.603 µg L⁻¹ to 2.498 µg L⁻¹ was recorded (Figure 3). It is showed optimum values in this station. NO₂ conc. was found lower than that of NO₃.

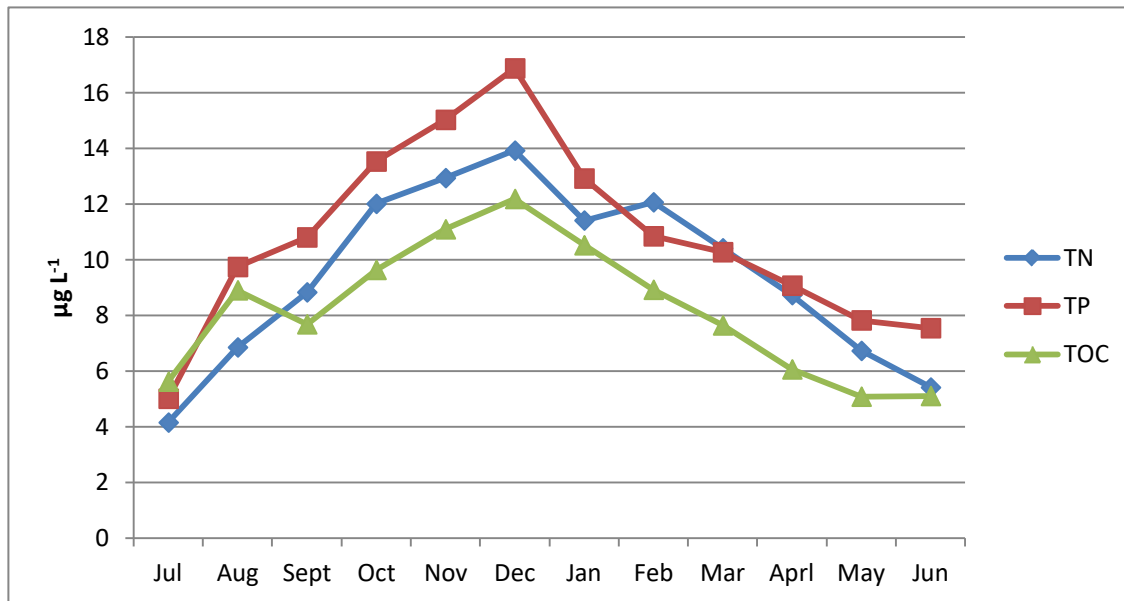
However earlier reports has been found even higher conc. of NO₂ from estuaries, lagoons and mangrove environs [13]. Lower concentration of NO₂ was recorded at open sea may be due to utilization by the benthic algae and phytoplankton.NO₃ concentration ranged from 0.96 to 4.509 µg L⁻¹ was recorded in this station (Figure 3). Higher concentration of NO₃ could be possible due to heavy rainfall, land drainage and agricultural discharge. Some reports suggested that the addition of nitrogenous nutrients mainly through freshwater and terrestrial runoff. Due to this increased the level of nitrate [11,14].

Figure 3. Nutrient conc. (µg L⁻¹) of Nagapattinam coastal waters from July 2016 to June 2017



TN concentration from 6.004 to 14.52 µg L⁻¹ was recorded in this station (Figure 4). Similar values were recorded by [11]. Here it can conclude that, the physical and chemical properties of marine ecosystems are representative of the climatic conditions [11].IP and TP concentration range of 0.398 to 1.019 µg L⁻¹, 0.516 to 2.127 µg L⁻¹ was recorded in this station (Figure 3). The maximum concentration was recorded during monsoon season which are influenced by the freshwater inflow.

The minimum concentration was observed during summer due to lack of freshwater inflow and by utilization of seaweeds sea grass and phytoplankton. About the similar values were recorded [11]. The sediment nutrient concentration ranged from TN, 5.408µg L⁻¹ to 13.918 µg L⁻¹, and TP7.54 µg L⁻¹ – 16.872 µg L⁻¹, TOC, 6.68 µg L⁻¹ – 13.882 µg L⁻¹ were observed respectively (Figure 3). The maximum value of TN (total nitrogen), TP (total phosphorous) and TOC (total organic carbon) were recorded during monsoon season. They might be influence by the rainfall and river runoff [4,13].

Figure 4. Nutrient concentration ($\mu\text{g L}^{-1}$) of sediment in Nagapattinam coastal water from July 2016 to June 2017

7. Conclusion

The near shore water exhibits the seasonal variations depending on the local conditions prevailing which are leading to nutrient cycle of different coastal environments. Such variation may influence on variety of body shapes, feeding style, reproductive modes and marine food web on the whole. The nutrients are important factor to determine the potential fertility of waters bodies. Hence, the physico-chemical parameters are accountable for the spatio-temporal variations of all aquatic organisms.

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