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Study of physico-chemical parameters from within PFZ and outside PFZ from the coast of Raigad district at Maharashtra State, India

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Abstract

The determination of physicochemical parameters was carried out to examine changes in water parameters in three separate sites of within and outside PFZ from the coasts of Karanja, Murud, and Srivardhan in Raigad district coast Maharashtra, India. From April 2018 to March 2019, several factors such as pH, salinity, dissolved oxygen (DO), temperature, and total hardness (TH) were measured. The minimum and maximum atmospheric and surface water temperatures were 25.0-33.5 (0c), pH 7.1-8.5, salinity 30.0-35.0 (0/00), and dissolved oxygen 4.5-6.2 (ml/l), respectively. The minimum and maximum ranges of total hardness, (6.1-7.4 ml/l) were recorded. Results reveal that water parameters like pH, dissolved oxygen (DO), temperature (atmospheric and surface water), chlorides, calcium, total hardness (TH), of Raigad district coasts shows variations from within and outside PFZ during the study period of April, 2018 to March, 2019.

Keywords: Physico-chemical parameters, within PFZ and outside PFZ, PFZ forecast, Raigad coast, West Coast of India

1. Introduction

The coast and its adjacent areas on and off shore are an important part of a local ecosystem: the mixture of fresh water and salt water (brackish water) in estuaries provides many nutrients for marine life.

Salt marshes and beaches also support a diversity of plants, animals and insects crucial to the food chain. The coast, also known as the coastline or seashore, is the area where land meets the sea or ocean, or a line that forms the boundary between the land and the ocean or a lake.

A precise line that can be called a coastline cannot be determined due to the coastline paradox. There are around 620,000 km (372,000 miles) of coastline. The term coastal zone is a region where interaction of the sea and land processes occurs.

Both the terms coast and coastal are often used to describe a geographic location or region. The coastline is a complicated habitat that plays an important role in biodiversity and the transport of dissolved and particulate trace metals to the coastal boundary zone all over the world. Mangrove zones, salt marshes, mudflats, sea grass, and the seaward side beds are highly productive and serve as breeding and nursery grounds for many important species (Ingole *et al*, 2002; Ajithkumar *et al.*, 2006; Prabhu *et al.*, 2008; Telesh *et al.*, 2010) [8, 1, 14, 25]. Seasonal changes in the physicochemical characteristics and nutrition content of seawater within and outside PFZs have been observed (Subramanian and Mahadevan, 1999; Telesh, 2004; Nirmal *et al.*, 2009; Soundarapandian *et al.*, 2009; Babu *et al.*, 2010; Sivadas *et al.*, 2011) [24, 13, 12, 19, 4, 17]. Furthermore, it is generally known that human activities such as industrialisation, urbanisation, tourism, and domestic garbage have an impact on water quality. Valença and Santos, 2012; Jin *et al.*, 2012; Ananthan *et al.*, 2005, 2006) [27, 3].

In relation to the temporal and spatial fluctuations in physico-chemical parameters in numerous sea shores from the Indian coast, a variety of pollution inputs have been described (Balasubramanian and Kannan, 2005; Tripathi *et al.*, 2005; Paramasivam and Kannan, 2005; Ajithkumar *et al.*, 2006; Solai and Diwakar, 2007; Saravanakumar *et al.*, 2008; Sankar *et al.*, 2010; Jagadeesan *et al.*, 2011) [1, 6, 3, 26, 18, 16, 15].

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Actually, the sea's water quality along the west coast of India are highly disturbed and threatened, encountering problems due to the influx of river, pollution, siltation and erosion, flooding, saltwater intrusion, storm surges and other hazards. Studies of the water quality through the appropriate control measures, and monitoring of diverse quality parameters have become very important and essential to ensure the sustainable development and management of the coastal systems and their resources (Mishra, 2007) [11]. Therefore, the study assumption is that to assess the changes of physico-chemical parameters and nutrients in the water of the sea from the within and outside PFZ in the coast of Maharashtra, India.

Materials and Methods

The sea coast is of Karanja situated at (Long. 20.484125 and Lat. 77.486092) Murud situated at (Long. 17 27 10 N and Lat. 70 49 59 E) and in Srivardhan is situated at (Long. 19.990751 and Lat. 72.743675) Raigad, Maharashtra, India. Three sampling locations were selected for the current study: site 1 on the coast of the Karanja Sea, site 2 on the coast of Murud, and site 3 on the inside and outside of the PFZ. From April 2018 to March 2019, surface water samples were taken at monthly intervals from the locality inside and outside the PFZ for the assessment of physico-chemical parameters and the examination of nutrients. In the sterilised polythene bottle, samples were collected, preserved promptly in an icebox, and then transported to the lab. A standard centigrade thermometer was used to measure the temperature, a refractometer (Atago, Japan) was used to assess salinity, and an Elico Grip pH metre (Mode-2I-120) was used to measure pH. The modified Winkler's method was used to determine dissolved oxygen, which was then expressed as ml/l. Surface water samples were collected in bottles, kept in an icebox, and shipped to the lab for nutrient assessment. There, they were filtered using a Millipore filtration system, and nutrients like chloride, calcium, magnesium, sodium, and potassium were

estimated using the industry-standard procedures outlined by Strickland and Parsons (1972) [21]. The physico-chemical parameters were not determined from the period of June to August due to the banned period of fishing activities and also the INCOIS not generating the PFZ advisories in banned and rainy seasons.

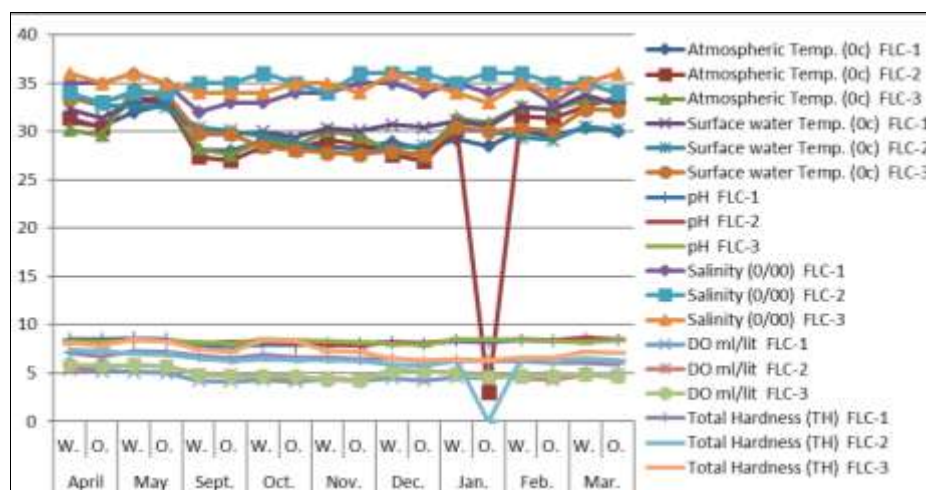
Results

For a year, from April 2018 to March 2019, three distinct sites observed monthly variations in PFZ and outside PFZ in the physico-chemical parameters of aerial and surface water temperature, pH, dissolve oxygen, salinity, and total hardness (Table 1). The seasonal fluctuations in the biochemical parameters were generally consistent across all the sites. The range of the atmospheric temperature during the study period was 28 to 33.5 degrees Celsius. Site 3 reported the minimum value in April; sites 1 and 2 both recorded the minimum value in January 2019. The greatest value was recorded at site 3 in the month of May 2019; sites 1 and 2 both displayed higher temperatures during the same period. The three sites generally had a similar seasonal trend. The surface water temperature ranged from 29 °C to 33 °C; site 1 recorded the lowest value in August 2018 (25.3 °C); sites 2 and 3 likewise displayed the lowest value in August; site 2 recorded the highest value in March (26.5 °C); and all other sites recorded the same value in May (26.5 °C). The pH ranged from 8.1 to 8.6; site 3 recorded the lowest pH value in July and the highest pH value in May. The salinity ranged from 34 0/00 to 36 0/00; the lowest salinity (33) was recorded at site 3 during the summer; sites 1 and 2 also recorded the lowest values during the same season as site 1; and the highest salinity (36) was continuously recorded at site from January until June, as well as in site 2 and site 3 during April and May. Dissolved oxygen concentrations ranged from 4.2 mg/l to 5.4 mg/l depending on activity, sea water penetration, etc.

Table 1: Seasonal variations in physic-chemical parameters of Raigad district coast during April, 2018 to March, 2019

Parameters	FLC	April		May		Sept.		Oct.		Nov.		Dec.		Jan.		Feb.		Mar.	
		W.	O.	W.	O.	W.	O.	W.	O.	W.	O.	W.	O.	W.	O.	W.	O.	W.	O.
Atmospheric Temp. (0c)	FLC-1	31.0	30.5	32.0	32.8	28.1	28.0	29.0	28.5	28.4	28.2	28.9	28.1	29.2	28.5	30.1	29.5	30.4	30.0
	FLC-2	31.4	30.4	33.5	33.2	27.4	27.0	28.5	28.2	29.1	28.7	27.6	26.9	30.2	3.0	31.6	31.4	32.6	33.5
	FLC-3	30.2	29.6	34.5	33.5	28.2	27.6	29.1	28.5	30.1	29.5	27.9	27.5	31.4	30.9	32.6	32.3	33.2	33.0
Surface water Temp. (0c)	FLC-1	32.3	31.4	33.1	33.0	29.8	29.7	30.0	29.4	30.3	30.1	30.7	30.4	31.1	30.5	32.5	32.3	33.8	32.8
	FLC-2	33.5	32.7	32.6	32.5	30.4	30.1	29.5	28.9	27.8	27.6	28.4	28.5	30.2	30.1	29.4	29.1	30.5	30.2
	FLC-3	33.4	33.0	34.2	34.0	29.8	29.7	28.4	28.1	27.8	27.6	28.0	27.6	30.5	30.0	30.3	30.1	32.3	32.2
pH	FLC-1	8.5	8.5	8.6	8.5	7.8	7.7	7.9	7.9	8.1	8.1	8.2	8.0	8.3	8.2	8.4	8.3	8.5	8.4
	FLC-2	8.4	8.3	8.5	8.4	8.1	8.2	8.3	8.0	7.9	7.8	8.2	8.1	8.4	8.4	8.5	8.4	8.7	8.5
	FLC-3	8.3	8.2	8.4	8.3	8.2	8.0	8.5	8.4	8.3	8.2	8.0	7.9	8.5	8.5	8.4	8.3	8.2	8.4
Salinity (0/00)	FLC-1	35	35	36	35	32	33	33	34	34	35	35	34	35	34	35	33	35	34
	FLC-2	34	33	34	34	35	35	36	35	34	36	36	36	35	36	36	35	35	34
	FLC-3	36	35	36	35	34	34	34	35	35	34	36	35	34	33	35	34	35	36
DO ml/lit	FLC-1	5.4	5.2	5.1	5.0	4.2	4.1	4.3	4.11	4.4	4.2	4.5	4.2	4.6	4.5	4.8	4.6	4.9	4.8
	FLC-2	5.6	5.6	5.9	5.7	4.9	4.8	4.6	4.4	4.5	4.3	5.3	5.2	5.0	4.8	4.5	4.3	4.8	4.6
	FLC-3	5.9	5.8	5.8	5.7	4.8	4.7	4.7	4.7	4.3	4.2	5.2	5.2	4.9	4.6	4.7	4.7	4.9	4.7
Total Hardness (TH)	FLC-1	7.1	6.7	7.3	7.2	6.8	6.5	6.9	6.6	6.6	6.4	6.5	6.2	6.3	6.2	6.2	6.1	6.1	5.9
	FLC-2	7.4	7.3	7.0	6.9	6.5	6.2	6.4	6.3	6.3	6.2	5.9	5.8	6.2	6.2	6.4	6.2	6.5	6.3
	FLC-3	8.1	7.8	8.5	8.3	7.5	7.2	8.4	8.3	7.3	7.2	6.5	6.3	6.4	6.3	6.6	6.6	7.2	7.1

W-Within Potential Fishing Zone, O-Outside Potential Fishing Zone FLC-Fish Landing Centres



Graph 1: Seasonal variations in physico-chemical parameters of Raigad district coast during April, 2018 to March, 2019

A minimum pH value was noted from June to November, which may have been caused by a number of variables including freshwater inflow, diluted seawater, chilly temperatures, organic matter breakdown, and decreased primary productivity. Other estuaries along the Indian coast have found similar outcomes (Bragadeeswaran *et al.*, 2007; Sankar *et al.*, 2010) [15]. One of the elements that was high from December to May was salinity. The lower salinity concentration was recorded in the months of September to November, which may be due to heavy rain fall and large quantities of fresh water inflow. The higher salinity values may be caused by low amounts of rainfall, a higher rate of evaporation, and the predominance of neritic water. Similar trends in salinity levels were seen in several estuaries around the Indian coast by Balasubramanian and Kannan (2005) [6], Solai and Diwakar (2007) [18], Soundarapandian *et al.* (2009) [19], and Sankar *et al.* (2010) [15]. Total hardness, which in this study is defined as the sum of calcium and magnesium concentration, is a measurement of the capacity of water to precipitate soap, which is primarily caused by the presence of calcium and magnesium in the water. Total hardness was comparatively higher from September to December, and minimum values were found from December to May. In the months of December to June and July to November (monsoon season), there was a greater concentration of chloride content. From November to June, the calcium concentration was at its highest, and from July to August, it was at its lowest. The west coast of India appears to have a larger calcium concentration than the east coast, in contrast (Sugandhini *et al.*, 1982) [23]. Numerous elements, including temperature, salinity, photosynthesis, and animal and plant respiration, have an impact on how easily oxygen dissolves. According to previous studies (Govindasamy *et al.*, 2000; Saravanakumar *et al.*, 2008; and Sankar *et al.*, 2010) [16, 15], higher concentrations of dissolved oxygen were found during the monsoon season (June to September) in the current inquiry. This is because of increased rainfall and freshwater inflow. From December to March, nearly all of the sites recorded the highest levels of sodium and potassium, and from June to November, the lowest. The impact of fresh water inflow and rainfall may contribute to seasonal fluctuations in total hardness as well as in the chloride, calcium, magnesium, and salt content. Overall, our findings showed that there are no changes between the physico-chemical and nutrient status of the water collected from three separate places. However, further research on the accumulation of heavy metals is

required to fully understand the quality of the seawater. Preliminary information on the physico-chemical parameters and nutrients in this region, however, would be a helpful tool for future research on the ecology, biodiversity, and culture of marine organisms. To conclude from present study the physico-chemical parameters were observed highly within PFZ than outside PFZ in Karanja, Murud and Srivardhan Sea coast. Therefore, the physico-chemical parameters were observed highly recorded within PFZ than outside PFZ areas and it get benefits for aggregation of fishes.

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