Seasonal Changes in Water Quality Parameters of Bhatye Estuary (Ratnagiri) West Coast of Maharashtra, India

Dr. Budharatna Bhaware[1] and Dr. Lawate Digvijay[2]

Department of Zoology, G. M. Vedak College of Science, Tala, Raigad, India[1]

Department of Zoology, Arts, Commerce and Science College, Lanja, Ratnagiri, M. S., India[2]

bgbhaware.pfz@gmail.com and digvijaylawate@gmail.com

Abstract: *The seasonal changes in water quality parameters on the coast of Bhatye estuary from January 2020 to December 2020 the investigation was conducted in Bhatye estuary. Transparency values ranged from 0.58±0.16 to 0.92±0.23. Mean values of pH was varied from 7.5 ± 0.24 to 8.5 ± 0.43. Atmospheric temperature varied from 27.3 ± 1.06 °C to 33.5 ± 1.02 °C. Surface water values ranged from 25.4 ± 1.02 °C to 30.7 ± 0.62 °C. Salinity of Bhatye estuary varied from 19.22 ± 0.45 to 35.34 ± 102 (‰). Dissolved oxygen was ranged from 32.22 ± 0.24 to 7.62 ± 0.52 mg/l. The rainfall was varied between 0.34 ± 0.01 to 133.3 ± 0.34 mm.*

Keywords: Environmental parameters, Bhatye estuary, Site selection, Low tide & High tide, Fishing Boat, Research Laboratory

I. 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. Rapid industrialization and fast-growing aquaculture sector leads to variations in the physico-chemical parameters of estuarine water body. Industries which are located nearby water stream released their wastes (effluents) without treatment or partial treatment, this eventually enter into the estuarine water. Hence continuous monitoring is required to assess the quality of estuarine water body. 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. 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 sea coast is a complex environment that plays a key role in biodiversity and in transfer of dissolved and particulate trace metals to the coastal boundary zone worldwide Valença and Santos (2012) habitats like mangrove zones, salt marshes, mudflats, sea grass, seaward beds are highly productive and play an important role 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). The sea coast of within PFZ and outside PFZ water exhibit seasonal variations in its physicochemical characteristics and nutrients content depending of physical and biological processes (Subramanian and Mahadevan et al. 1999, Telesh 2004, Shridhar et al. 2006, Sarvankumar et al. 2008, Nirmal et al. 2009, Soundarapandian et al. 2009, Babu et al. 2010, Sivadas et al. 2011) In addition, it is well known that human activities like industrialization, urbanization, tourism and domestic waste are affecting to the water quality (Ananthan et al. 2005, 2006, Valença and Santos 2012, Jin et al. 2012) Numerous contamination inputs have been described in relation with the temporal and spatial variations in physico-chemical parameters in several sea coasts from Indian coast (Balasubramanian et. al. 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) Actually, the water quality of the sea 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). Therefore, the study assumption is that to assess the changes of physico-chemical parameters and nutrients in the water of the sea from the Bhatye estuary west coast of Ratnagiri Maharashtra, India. Several workers reported water quality parameters of estuarine environment in different parts the India (Gadhia *et al.* 2012, Pravat Ranjan Dixit *et al.* 2013, Uma Maheswara Rao *et al.* 2015, Sreenivasulu *et al.* 2015, Vijaya Pratap and Ramesh Babu 2015, Sobha Rani 2016) The aim of the present investigation is to provide basic data on physic-chemical parameters in Bhatye estuary (Kajali river) which is located at Ratnagiri Maharashtra.

II. MATERIAL AND METHODS

Sampling was practiced for twelve months (January to December 2020 in Bhatye estuary to identify the water quality parameters. Water was collected in 5 litres polythene containers and transported to the laboratory of CCMB, Bhatye, Ratnagiri nearby estuaries for further analysis. Dissolved oxygen (DO) and salinity were estimated as per standard procedures mentioned in Strickland and Parsons (1972). Calibrated pH meter was used for pH analysis (digital) (DH-2, Atago Company Pvt. Ltd, Japan). Water temperature was estimated by using thermometer (Testo, 104 IR).

Results

Transparency, pH, salinity, temperature (atmospheric as well as surface water), Dissolved oxygen and Rainfall content of estuarine water was studied from January 2020 to December 2020.

Transparency

The water transparency values ranged from 0.58±0.16 to 0.92±0.23. Our observations showed that, transparency in the month of May was maximum whereas lower transparency was recorded in September. Transparency showed positive relation with atmospheric (r=0.3298) and water temperatures (r=0.5736) (Table 1, 2).

pH

pH of water fluctuated between 7.5 ± 0.24 to 8.7±0.62 Maximum and minimum pH values were noticed during June and November months respectively (Table 1, 2). Positive correlation was observed with temperature of water (r=0.8824), salinity (r=0.5443). Indirect relationship with Dissolved oxygen was noticed (r= -0.3784) (Table 1, 2).

Atmospheric and surface temperatures

Atmospheric temperature varied from 27.3 ± 1.06 °C to 33.5 ± 1.02 °C. In November and December months the observed atmospheric temperature was minimum whereas maximum temperature was recorded in the month of May. It exhibited positive relation with surface water temperature (r= 0. 82012) (Table 1, 2). In perspective of surface water, it ranged from 23.6±2.01 °C to 31.8 ±0.73 °C. The higher and lower temperatures were noticed in the month of December and June respectively. It exhibited a positive relation for salinity (r=0.5991), pH (r=0.8824) and an indirect relation was seen in case of dissolved oxygen (r= -0.4201) (Table 1, 2).

Salinity

Salinity of Bhatye estuary varied from 19.22 ± 0.45 to 35.62 ± 1.00 (‰). The observed salinity was lower during October (18.45 ± 0.94) and August (19.22 ± 0.45), Whereas maximum was noticed in the month of May (34.68 ‰). Salinity exhibited a positive relation with temperature (r=0.5991), pH (r=0.5443) whereas it exhibited an indirect relation for dissolved oxygen (r= -0.4201) (Table 1, 2).

Dissolved oxygen

Dissolved oxygen was varied between 3.31±0.26 to 8.22±0.17. In May (3.31±0.26) lower DO was observed whereas maximum (8.22±0.17) was observed in the month of August. Dissolved oxygen exhibited an indirect correlation (negative) (r= -0.5201), (r= -0.6291), (r= -0.3754) with water temperature, salinity and pH respectively (Table 1, 2).
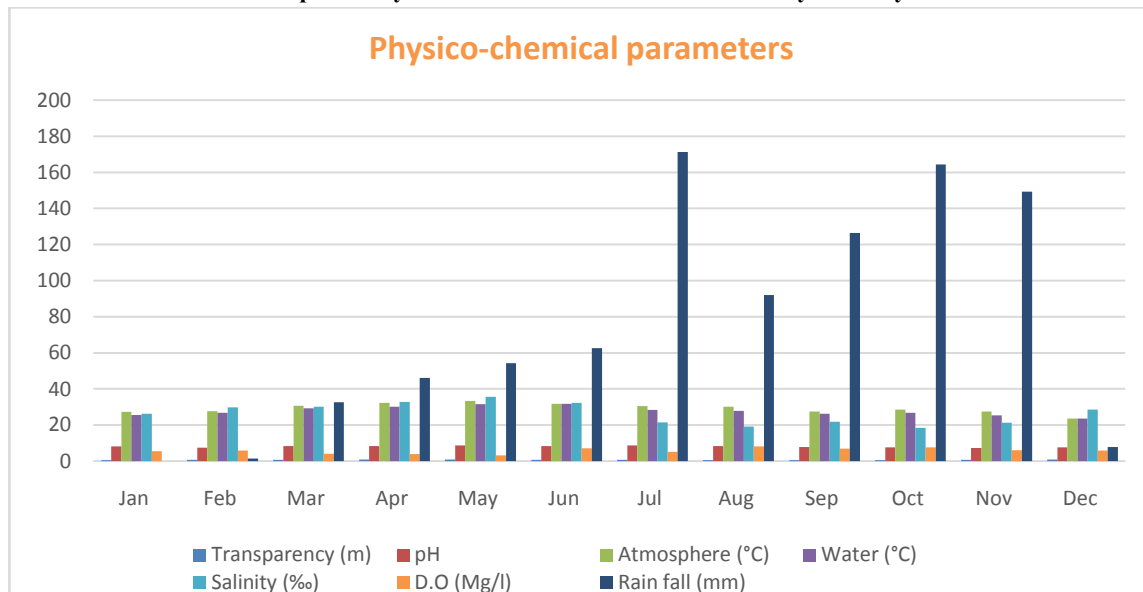
Rainfall

The rainfall was varied between 0.21±0.01 to 171.47±1.15 mm. The lower and higher rainfall data was observed during the months of January (0.21±0.01 mm) and July (171.47±1.15 mm) respectively. Rainfall exhibited a direct relation (positive correlation) with Dissolved oxygen (r=0.5379) (Table 1, 2).

Table 1. Physico-chemical characteristics of Bhatye estuary

Months	Transpar-ency (m)	pH	Temperature		Salinity (‰)	D.O (Mg/l)	Rain fall (mm)
			Atmosphere (°C)	Water (°C)			
Jan	0.65±0.06	8.2±0.43	27.3±1,06	25.6±0.87	26.32±0.49	5.54±0.11	0.21±0.01
Feb	0.73±0.02	7.5±0.24	27.8±1.21	26.8±1.07	29.84±0.12	5.96±0.38	1.37±0.02
Mar	0.76±0.04	8.5±0.53	30.8±1.01	29.4±1.21	30.12±0.58	4.16±0.27	32.66±1.27
Apr	0.87±0.12	8.5±0.43	32.4±1.32	30.1±1.34	32.87±1.09	3.95±0.58	46.24±2.42
May	0.92±0.23	8.7±0.62	33.5±1.02	31.7±0.89	35.62±1.00	3.31±0.26	54.32±1.97
Jun	0.82±0.01	8.4±0.33	31.9±1.05	31.8±0.73	32.35±1.27	7.13±0.05	62.71±1.71
Jul	0.74±0.25	8.7±0.41	30.6±1.12	28.4±0.87	21.41±0.94	5.24±0.10	171.47±1.15
Aug	0.63±0.15	8.5±0.53	30.1±1.05	27.9±1.03	19.33±0.76	8.22±0.17	92.15±0.78
Sep	0.58±0.16	7.9±0.35	27.4±1.34	26.3±0.91	21.74±1.09	6.91±0.13	126.5±2.12
Oct	0.62±0.15	7.6±0.42	28.7±1.07	26.8±1.08	18.45±0.94	7.62±0.11	164.4±0.86
Nov	0.72±0.23	7.2±0.20	27.5±1.13	25.4±1.22	21.29±0.48	6.14±0.37	149.4±1.87
Dec	0.85±0.02	7.6±0.57	23.7±1.16	23.6±2.01	28.64±0.75	5.89±0.41	08.02±0.78

Graph. 1. Physico-chemical characteristics of Bhatye estuary

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Table 2. Correlation co-efficient matrix (r) for physico-chemical parameters of Bhatye estuary

Sr. No.	Transpa-rency	pH	Atmospheric temperature	Water temperature	Salinity	Dissolved oxygen	Rainfall
Transparency	1						
pH	0.2367	1					
Atmospheric temperature	0.3241	0.76937	1				
Water temperature	0.530848	0.882436	0.920123	1			
Salinity	0.855434	0.544331	0.490374	0.599154	1		
Dissolved oxygen	-0.72438	-0.37841	-0.43749	-0.42012	-0.7292	1	
Rainfall	-0.51881	-0.38954	-0.09226	-0.11844	-0.67523	0.537969	1

III. DISCUSSION AND CONCLUSION

Turbidity of water prevents the proper penetration of light into water body and this leads to minimize the growth of plants and oxygen production. Suspended particles in estuarine water body leads to enhance the water temperature as they have capacity to absorb heat.

Higher pH values were recorded in summer season where as the low pH values were recorded during monsoon. The observations of the current work correlate with the findings of previous reports Thangaraj 1984, Hemalatha 1996, Sreenivasan 1998, Santhanam and Perumal 2003, Palpandi 2011, from the Vellar estuarine system. Ravaniah*et al.* 2010 from pennar estuary Nellore. The reported pH values in the current study following the trends of results reported by Ragothaman et al. 1995 and Upadhyaya 1998).

Temperature is a universal factor which may influence the physico-chemical parameters of an aquatic ecosystem and also on the distribution of organisms. Higher temperature in summer months was due to the meteorological characteristics, shallowness of the estuary and its proximity to land, which resulting in rapid changes in temperature with reference to changes in atmospheric temperature Karunagaran (1990). The observations of the present study results were in agreement with previous reports (Thangaraj 1984, 1985, Gothandaraman 1993, Sreenivasan 1998, Senthilnathan 1990, Mani 1981, Vasantha 1989, Kaliyaperumal 1992, Karuppusamy 1997, Saraswati 1993, Ravaniah*et al.* 2010 and Palpandi 2011).

Salinity is key abiotic factor which control the distribution of the living organisms(Chandramohan et al. 1998) The findings of present study following the trends in salinity values from different estuarine environment (Singbal 1973, 1976, Chandran et al. 1984, Murugan et al. 1991, Palpandi 2011, Budharatna Bhaware *et al.* 2013). DO concentration in any water body due to rate of photosynthesis process and respiration of plants as well as animalsSoundarapandian*et al.* (2009). Temperature, photosynthesis, salinity, respiration process will influence the DO levels in the water body of any environment Budharatna Bhaware *et al.* (2013). In Bhatye estuary the dissolved oxygen values were reported high during monsoon months. This process is aided due to the freshwater influx and rainfall Saravankuamr*et al.*(2008) Recorded high rainfall data in the present study was attributed due to Northeast monsoon. The minimum rainfall was notice during post monsoon and summer months. The rainfall data obtained in the present investigation following similar trends of previous reports from different estuaries, Vellar estuary Nedumaran *et al.* 2001, Parangipettai coast Santhanam et al. 2003, Sundaramanickam*et al.,* 2008, Muttukadu backwaters (Prema et al. 2003)

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