Variation in seawater quality of two intertidal zones of south Saurashtra coast, Gujarat, India

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Abstract

This study summarizes the spatio-temporal variation of the water quality of sea from the selected intertidal zone of selected sampling sites along the south Saurashtra coast of India. The outcomes suggest the ranges of analyzed water samples of collected from Navapara and Vadodara of Gir-Somnath district from the period of December-2014 to November-2015. It was recorded that temperature of water from selected area was different by season. There was less variation or no variation recorded between all selected sites as well as in season in value of pH. Month wise more or less variations was recorded in value of Total Solids and Total Dissolved Solids. During summer it was recorded that value of Salinity was increased. It was also recorded that the dissolved oxygen level decreased when value of salinity increased. The value recorded for calcium and magnesium hardness was within the range of reported value of Arabian Sea. The study findings give the existing quality status for Navapara and Vadodara as a base line reference and will be useful for other environmental monitoring of these coastal sites.

Keywords: Seawater Quality, Saurashtra coastline, Spatio-temporal variation, India.

Introduction

Gujarat has the longest shoreline of approximately 1,650 km among all the maritime states of India[1]. The Saurashtra coast can be aptly described by its rocky, sandy and muddy intertidal zones nurturing rich and varied biodiversity. This substratum is mainly formed of rocks of miliolite and laterite stones providing altogether a different habitat for the sustenance of the intertidal flora and fauna[1].

The coastal areas, owing to its large and wide scale utilization for the purpose of transportation, tourism and industrialization has resulted in the deterioration of the faunal community, and their ecological attributes with respect to varying environmental conditions[2]. It is believed that in the next two years, population residing within 100 km of the coastline would increase manifoldly, thus bringing in more pressure on these ecologically rich zones[3-5].

Such kind of anthropogenic factors influences the structure as well as the functions of the marine ecosystem by varying the species composition of the existing communities and also affects the nutrient cycle and eventually threatening the equilibrium of planet's biosphere[6].

The physicochemical parameters of these stressful coastal zones are the primary indicators of the changes due to pollution and such other anthropogenic factors. Literature is available on seawater quality for south Saurashtra regions like Veraval, Kodinar, Mangrol, Dwarka etc, but no data has been yet available for intertidal zones of Navapara and Vadodara dodiya of the south Saurashtra coast, which are the prime areas of investigation covered under present study[7]. This situation requires a systematic overall backup study to be acquainted with their present status.

Materials and methods

Study area: This study was performed during December-2014 to November-2015 at two different selected sites i.e. Navapara (20°56'26.7"N 70°18'23.3"E) and Vadodara (20°58'47"N 70°15'07"E) of the south Saurashtra coast along Arabian Sea. Both sites are in Gir-Somnath district of Gujarat State, India. These sites were located between Veraval and Mangrol fishing centers.
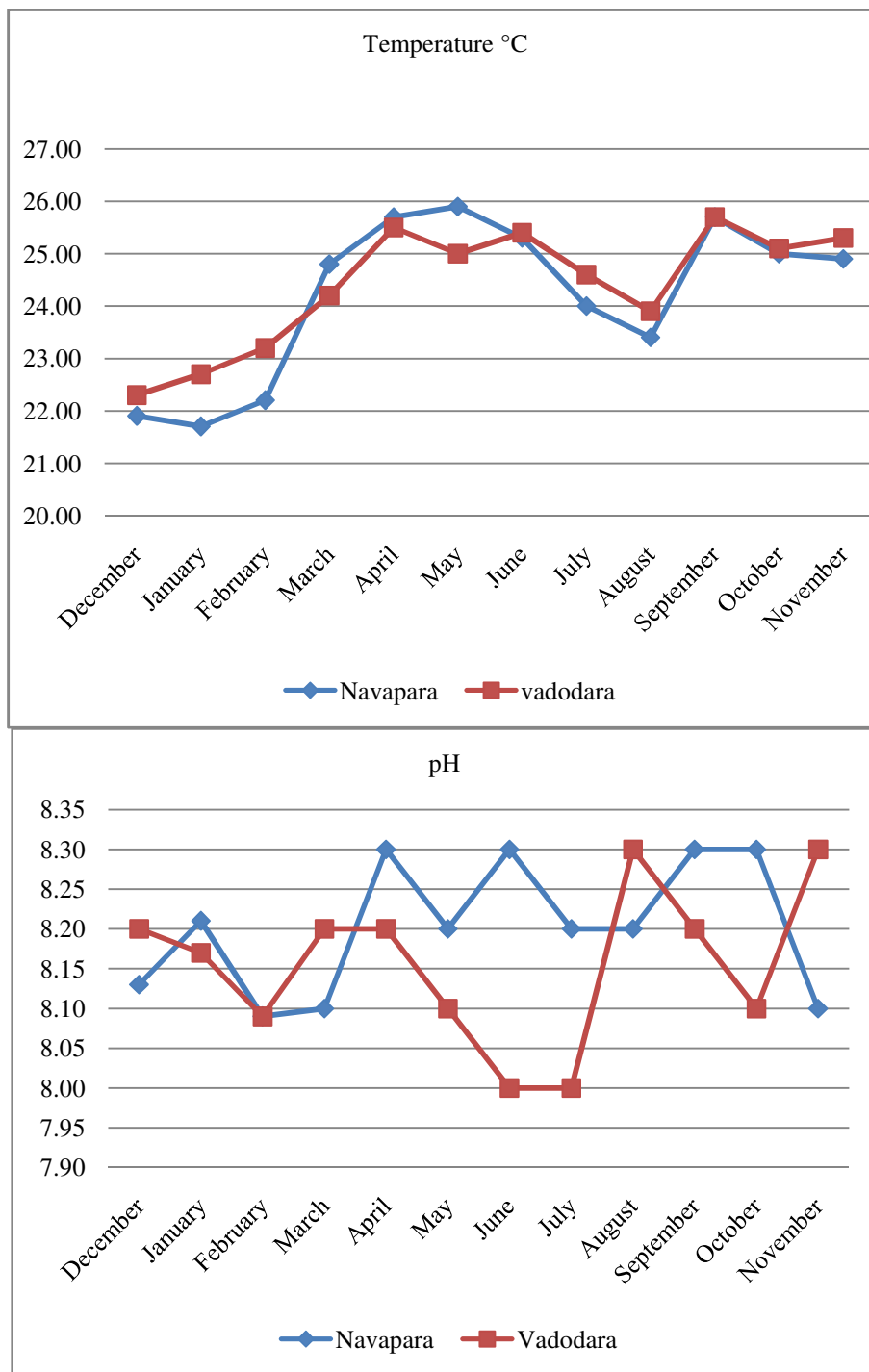
Sample collection: From the selected sampling sites water samples were collected once in a month. Collected water samples were analyzed using standard methods[8,9]. Some physical parameters like temperature and salinity were measured using standard centigrade digital thermometer and refractometer respectively. pH was recorded using digital pH meter. Samples were collected in one liter plastic bottles for all the other parameters, and for dissolved oxygen water sample was collected in BOD bottles directly from the source and processed as per Alkaline Azide method.
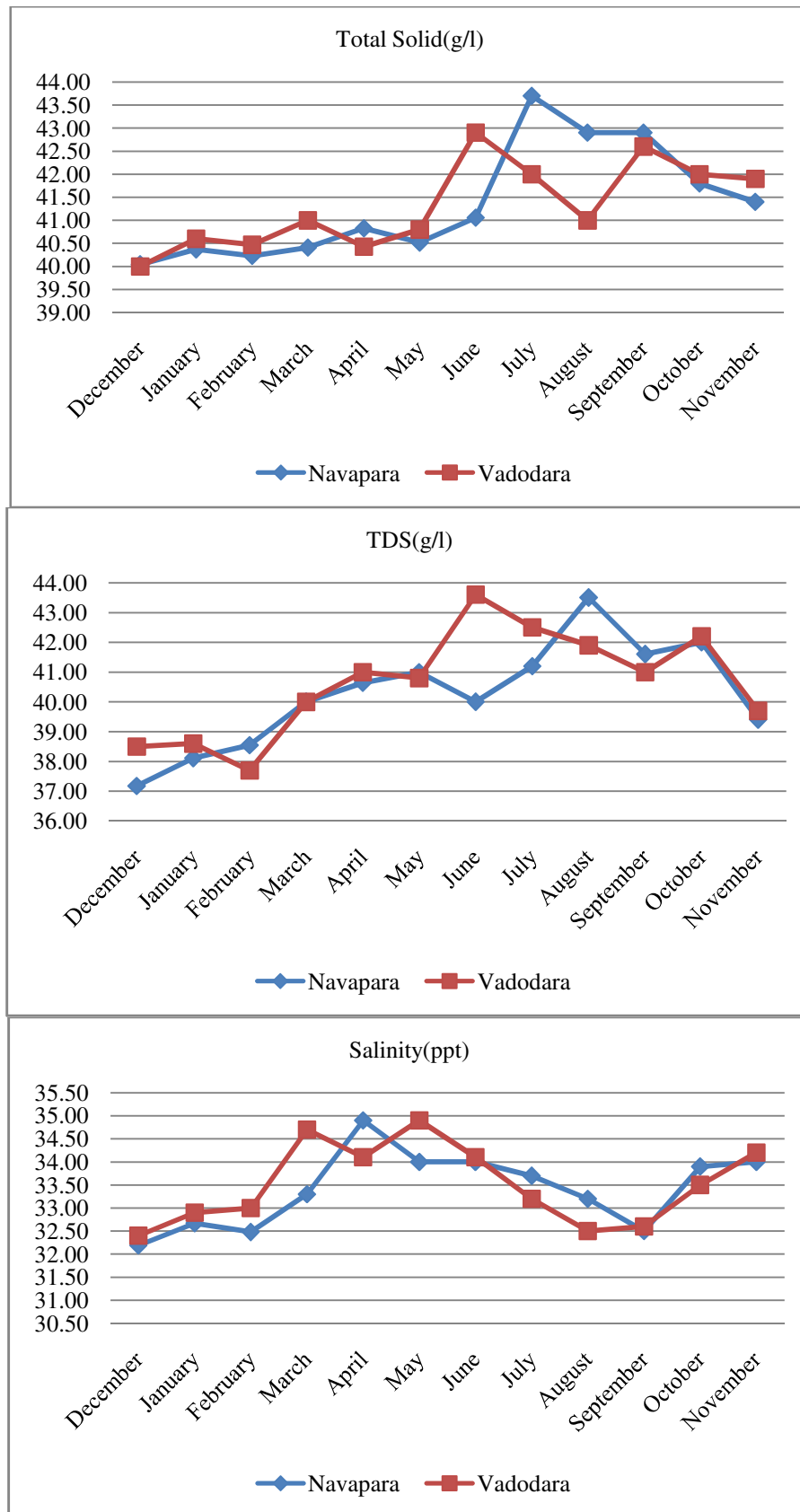
Values recorded for all the parameters were statistical analyzed using mean, standard deviation and student's T test to understand the differences between the selected sampling sites. Sigma plot software was used for statistical analysis.

Results and discussion

This study point out that selected sampling sites were not considerably influenced by the anthropogenic movements as the performed water quality parameters were recorded within the standard range for an open sea coastline[10]. The selected

sampling sites were open and constant without any barriers so normal tidal activities followed all along the coastline. The values recorded for the water quality parameters for both the sampling sites are presented in Table-1, 2 and Figure-1.
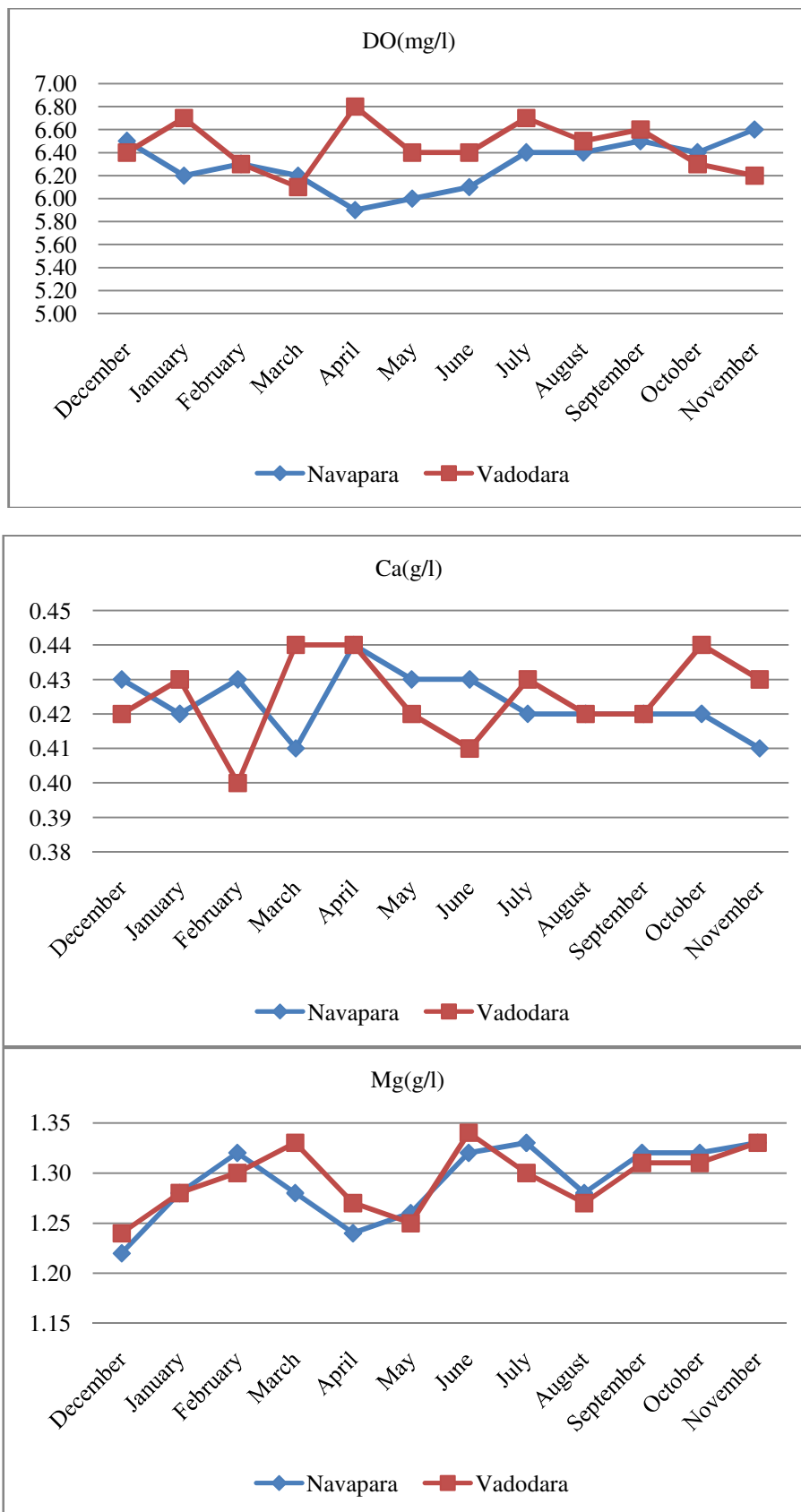
Total Solid(g/l)

Navapara — Vadodara

TDS(g/l)

Navapara — Vadodara

Salinity(ppt)

Navapara — Vadodara

Figure-1: Water quality parameters at both the sampling stations.

Table-1: Sea water parameter observed from Navapara. Values expressed as mean and SD.

Parameter	Season(Month)			
	Winter (December to February)	Summer (March to May)	Monsoon (June to August)	Post Monsoon (September-November)
Temprature (^{O}C)	21.93±0.25	25.47±0.59	24.23±0.97	25.20±0.45
pH	8.14± 0.06	8.20±0.10	8.23±0.06	8.23±0.12
Total Solids (g/l)	40.2±10.17	40.59±0.22	42.55±1.35	42.03±0.78
TDS (g/l)	37.95±0.70	40.55±0.51	41.57±1.78	41.00±.40
Salinity($^o/_{oo}$)	32.45±0.24	34.07±0.80	33.63±0.40	33.47±0.84
DO (mg/l)	6.33±0.15	5.90±0.36	6.30±0.17	6.50±0.10
Ca (g/l)	0.43±0.01	0.43±0.02	0.42±0.01	0.42±0.01
Mg (g/l)	1.27±0.05	1.26±0.02	1.31±0.03	1.32±0.01

Table-2: Sea water parameter observed from Vadodara. Values expressed as mean and SD.

Parameter	Season(Month)			
	Winter (December to February)	Summer (March to May)	Monsoon (Juneto August)	Post Monsoon (September-November)
Temperature (^{O}C)	22.73 ± 0.45	24.90 ± 0.66	24.63 ± 0.75	25.37 ± 0.306
pH	8.15 ± 0.06	8.17 ± 0.06	8.10 ± 0.17	8.20 ± 0.100
Total Solids (g/l)	40.36 ± 0.32	40.74 ± 0.29	41.97 ± 0.95	42.17 ± 0.379
TDS (g/l)	38.27 ± 0.49	40.60 ± 0.53	42.67 ± 0.86	40.97 ± 1.250
Salinity($^o/_{oo}$)	32.77 ± 0.32	34.57 ± 0.42	33.27 ± 0.80	33.43 ± 0.802
DO (mg/l)	6.47 ± 0.21	6.43 ± 0.35	6.53 ± 0.15	6.57 ± 0.252
Ca (g/l)	0.42 ± 0.02	0.43 ± 0.01	0.42 ± 0.01	0.43 ± 0.010
Mg (g/l)	1.27 ± 0.03	1.28 ± 0.04	1.30 ± 0.04	1.32 ± 0.012

One of the most key factors of the coastal ecosystem is temperature, which stimuli the physicochemical characters of coastal waters[11], and even in the study, the seasonal variation of the sea water temperature showed similar patterns at both sites. At both the stations minimum temperature noted in winter was 21.70°C and thereafter increased in summer up to 25.90 °C. The values of pH showed very less variation between the selected sampling sites as well as different months. Values of pH were recorded in between 8.00 to 8.30 during the course of study period and found to be in their usual range[12]. It was observed that the values of Total solids were much higher in monsoons compared to summer and winter seasons. It was in the range of 40.00 – 41.00 g/l during December to May (winter and summer) and 41.00 to 43.70 g/l during June to November (Monsoon and post monsoon).

Less or no variation was observed between both stations during study period for values of Total Solids (TS). The values of total dissolved solids (TDS) were slightlyincreased during the study period but there was novariation between both stations. Lower values observed 37.18 g/l during winter and higher value observed 43.60 g/l during Monsoon. Values observed for TS and TDS were within the normal ranges of the coastal seawater[10]. Salinity is another important factor which influences the distribution of organisms. The salinity at any point will be dependent on the rain fall and extent of fresh water

inflow[13]. The salinity values obtained showed minor variation over the months as compared to other conditions. The range of salinity was observed between 32.19$^o/_{oo}$ to 34.90$^o/_{oo}$ however, there was no difference observed at different stations, may be due to topography of sampling sites (open shore). Calcium (Ca^{++}) and Magnesium (Mg^{++}) hardness showed irregular pattern at both the stations throughout the study period, but it was not statistically significant. Values of Calcium were between 0.40 to 0.44 g/l and Magnesium ware 1.22 to 1.34 g/l.

Dissolved oxygen (DO) of water is also a key parameter which supports the aquatic life[14]. It is most significant parameter affecting the productivity of aquatic system. The main sources of DO in seawater are diffusion of oxygen from atmosphere and photosynthetic activity of aquatic flora. The dissolved oxygen values varied between 5.50 to 6.80 mg/l at both the stations. It was observed that value of DO was slightly decreased from December to May during the study period. It was observed that with increase in salinity the DO level decreased[15].

Conclusion

Result of this study indicated that there was no major variation between both the selected sampling sites. Normal tidal activities were observed possibly because of the nature of the open sites. The quality of water for these coastal regimes of Navapara and Vadodara were nearly to the ideal situations due to absence or very less anthropogenic impacts on this coast. This finding gives the insight into the current day position of the water quality parameters of selected coastal areas which can be used as a reference for further ecological and environmental studies.

Acknowledgement

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