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An extensive study on physico-chemical parameters of bay of bengal and central indian ocean basin

Abstract

The analyses of selected Physico-chemical parameters, such as sea surface temperature, sea atmospheric temperature, barometric pressure, pH, relative humidity, sea surface salinity, water salinity, precipitation, wind speed, dissolved oxygen, was conducted at 101 stations situated between 81o30'04"E and 13o10'59"N to 79 o27'53"E and 5o57'07"N, located in the Bay of Bengal (BOB) and Central Indian Ocean Basin (CIOB). The results obtained indicate that both BOB and CIOB are congenial for growth, sustenance, development and distribution of biota.

Keywords: Physico chemical parameters, Bay of Bengal, Central Indian Ocean Basin

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Abbrevations: SAT, Surface Air Temperature; SSS, Sea Surface Salinity; SST, Sea surface temperature; RH, Relative Humidity; DO, Dissolved Oxygen; BOB, Bay of Bengal; IO, Indian Ocean

Introduction

The aquatic bodies in general and marine waters in particular, are the largest repository of biota, in our living world. As this biota is always surrounded by aquatic media, the physico-chemical parameters of the surrounding waters play an important role on their life processes. The biota adapts to such variations in physico-chemical parameters, which tend to have impact on diversity and distribution of the biota too. Some of the important physico-chemical parameters such as, Surface Air Temperature (SAT), which is the temperature just above the sea surface is generally slightly higher temperature than sea surface temperature. The Sea Surface Salinity (SSS), known to be the salinity in the ocean, is considered as conceptually simple, but technically challenging to define and measure precisely. By and large, the salinity is recognized as, the quantity of dissolved salt like sodium chloride, magnesium sulfate, potassium nitrate, and sodium bicarbonate, dissolved into ions in the water. The Sea surface temperature (SST) is the water temperature close to the ocean's surface between 1mm and 20m, below the sea surface. Atmospheric pressure or barometric pressure is the pressure, exerted by the weight of air, in the atmosphere of the Earth. Low-pressure areas have less atmospheric mass, above their location and high-pressure areas have more atmospheric mass above their location. Barometric pressure has substantive effect on cloud formation, rail fall, as well on biota. The Precipitation is any product of the condensation of atmospheric water vapor that falls under gravity. It forms as smaller droplets coalesce via collision, with other rain drops. The Relative Humidity (RH) is an air-water mixture and is defined as the ratio of the partial pressure of water vapor in the mixture, to the equilibrium vapor pressure of water, over a flat surface of pure water, at a given temperature. The pH of seawater is generally of the range between 7.5 and 8.4. As it is evident that, ongoing ocean acidification caused by carbon dioxide emissions of the world, pH plays an important role in the ocean's carbon cycle. Further, pH is known to exert an important role in physiological processes in the biota.

The Dissolved Oxygen (DO) referred to the level of free and non-compound oxygen presents in water or other liquids. It has profound influence on the organisms living within a body of water. Too high or too low dissolved oxygen, will affect the water quality and can harm many forms of life, including fish, invertebrates and bacteria, which need oxygen for their respiration, or to decompose organic material at the bottom of a body of water, which is an important contributor to nutrient recycling. The Wind speed, which is also known as wind flow velocity, is a fundamental atmospheric quantity. Wind speed is caused by the air moving from high pressure to low pressure, usually due to change in temperature and has countless other implications. Winds help in creating waves, which in turn help in mixing of the salts and other ions in the sea. Thus, it is beyond doubt that above mentioned parameters are of paramount importance for the biota in the marine waters.

The Bay of Bengal (BOB) is the world's largest bay. In the west, it is surrounded by India and Sri Lanka; Bangladesh to the west; Mynamar and Andaman Nicobar Islands to the east. The BOB occupies an area of 2,172,000 KM2. This water body is unique, as it is surrounded by land, on its three sides and opens to southern side to give rise to Central Indian Ocean Basin. To this bay, mighty He river Bramhaputra, `life line of north India Ganges and several other rivers such as Meghna, Padma, Godavari, Mahanadi, Krishna, Kavery flow into it. Thus, the physico-chemical parameters in general and pH and salinity in particular vary widely from almost freshwater condition, where these rivers enter into the BOB, to marine conditions at deep BOB locations. On the contrary, The Indian Ocean (IO), which extends over 30% of the global ocean area and is rimmed by 36 littoral and 11 hinterland nations sustaining about 30% of the world's population, generally maintains it pH and salinity. IO is located to the south of the Adam's bridge and from southern extreme of Dondra Head (south point of Sri Lanka) to the North point of Poeloe Bras (5o44'N, 95o 04'E). Though there are reports of recording physico-chemical parameters at BOB[1-5] and CIOB,[6-12] they are scanty, scattered, sometimes in estuaries, tidal creeks or near shore, apart from limited number of sampling sites etc., To overcome this lacunae of information, the present investigations were carried out.

Materials and methods

101 stations located between 81o30'04"E 13o10'59"N to 79 o27'53"E 5o57'07"N located in Bay of Bengal and Central Indian Ocean Basin have been analyzed for important physico-chemical parameters such as sea surface temperature, sea atmospheric temperature (by using digital thermometer, Make: Mextech, Model:Dt-8811 Digital)

barometric pressure (by using barometer, Make: HTC, Model: AL-7010), pH (by using digital pH meter, Make: Lutron, Model: 0-14.00 pH Meter PH-201), relative humidity (by using hygrometer, Make: HTC: Model: 288Cth Thermo Hygrometer) sea surface salinity, water salinity (by using salinometer, Make: Autosal, Model:8400B Laboratory Salinometer), precipitation (by using hydrometer, Make Amber Hydrometers, Model: Twaddle Hydrometers), wind speed (by using anemometer, Make: HTC, Model: AVM-06 Digital Anemometer with Temperature and Humidity), dissolved oxygen (by using DO meter Make: Lutron Model: DO-5510 Oxygen Meter with 0.4 mg/L Do Accuracy with electrochemical sensors). Further, all the readings were confirmed with Sutron Automatic weather station on board ORV Sagar Kanya. All experiments were conducted on board ORV Sagar Kanya during its cruise No SK-330 (May-June 2016), which had pre determined area of operation at BOB and CIOB.

Results

(Table 1) provides data on all the parameters analyzed in the present study. 101 sites selected for recording the data was spread across Bay of Bengal and Central Indian Ocean Basin. Surface air temperature ranged between 26.0 to 32.6oC, which is convenient for the biota for not only to sustain but also to propagate. Sea surface salinity ranged from 32.5 to 34.53ppt, which is within the range of tolerable seas surface salinity. Sea surface temperature was between 32.5 and 33.00C, proving to be suitable for marine biota for their biological activity and sustenance. Barometric pressure recorded in this study area ranged from 1004.5 to 1010.3, which is within the range of forbearance by the biota in the ocean. Precipitation recorded during the study period ranged from 0.0 to 77mm, which indicated the formation of clouds and rain thereof, thus making it as one of the important parameters for the studies. Relative humidity in the air was within the range of 62.9 and 81.2, demonstrating that, there was always humidity in the air above the study sites, which would benefit the airborne spores and other biological matters, for their sustenance. PH recorded from all the 101 sites ranged between 7.2 and 7.7, where the variation recorded was within acceptable limits. Dissolved oxygen was between 6.9 to 7.6ml/l proving to be an excellent condition for biota not only for their living, but also for maintaining healthy condition. Wind speed recorded in the present studies, was between 0.5 to 14.3M/sec shows that, at some places the water body under study was calm; while in some other places, where wind speed was high the sea was moderately rough due to windy conditions.

Table 1 Physico-chemical parameters of Bay of Bengal and Central Indian Ocean Basin

Sl. No.	Date	Time (Hrs)	LocationLongitude/Latitude	SAT(oC)	SSS(ppt)	SST(oC)	Bar.Pressure (mbar/hPa)	Preci-pitation (mm)	RH(%)	pH	DO(ml/l)	Wind Speed (M/sec)
1	10-5-'16	718	81o30'04"E 13o10'59"N	31.1	32.68	31.3	1009	1	75	7.3	7.1	4.3
2	10-5-'16	1128	81o49'68"E 13o11'54"N	31.5	32.71	30.5	1008.9	2	72.2	7.4	7.1	4.4
3	10-5-'16	1548	82o14'47"E 13o13'52"N	32.1	32.72	31	1006.3	6	67.6	7.4	7.1	4
4	10-5-'16	1938	82o36'74"E 13o13'48"N	31.4	32.72	30.5	1008.6	8	69	7.3	7.2	4
5	11-5-'16	730	83o48'64"E 13o16'93"N	31.5	32.73	30.2	1009.1	1	66.2	7.3	7.1	3.7
6	11-5-'16	1130	84o15'19"N 13o18'04"N	32	32.64	30.8	1007.5	1	65.6	7.2	7.1	1
7	11-5-'16	1543	84o15'17"E 13o18'04"N	31.5	32.65	30.6	1006.8	3	64.9	7.4	7.4	2.1
8	11-5-'16	1935	85o01'11"E 13o20'57"N	31.2	32.61	30.7	1008.2	5	64.5	7.2	7	1.3
9	12-5-'16	748	86o35'16"E 13o24'08"N	31.4	33.33	30.4	1009	1	65.2	7.3	7.1	2.7
10	12-5-'16	1148	87o03'51"E 13o24'53"N	31.1	33.56	30.5	1008.1	2	65	7.3	6.9	3.2
11	12-5-'16	1608	87o35'03"E 13o24'70"N	31.2	32.85	30.6	1004.5	7	64.9	7.3	6.9	1.9
12	12-5-'16	1948	87o58'91"E 13o27'36"N	30.8	32.52	30.5	1005.6	10	67.5	7.4	7.4	1.5
13	13-5-'16	728	88o59'38"E 13o29'70"N	32.2	32.92	31	1007.6	0	63.6	7.3	7.6	0.5
14	13-5-'16	1140	89o00'61"E 13o29'89"N	31.9	32.77	31.5	1006.6	4	62.9	7.4	6.9	2.2
15	13-5-'16	1538	89o00'12"E 13o29'16"N	32.6	32.78	33	1004.2	9	64.9	7.4	7	2.8
16	13-5-'16	1948	88o58'79"E 13o31'25"N	31.6	32.69	32	1006.3	12	64.7	7.2	6.8	3
17	14-5-'16	830	80o90'37"E 13o25'45"N	31.8	32.8	31.5	1008.8	1	66.7	7.4	7	1.9

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Table Continued...

Sl. No.	Date	Time (Hrs)	LocationLongitude/Latitude	SAT(oC)	SSS(ppt)	SST(oC)	Bar.Pressure (mbar/hPa)	Preci-pitation (mm)	RH(%)	pH	DO(ml/l)	Wind Speed (M/sec)
18	14-5-'16	1148	88o58'53"E 13o10'28"N	31.5	32.52	31.5	1008.1	5	70	7.4	7	1.5
19	14-5-'16	1536	88o54'89"E 12o51'00"N	31.9	32.66	32	1006	11	68.3	7.4	7.1	2.8
20	14-5-'16	1958	88o50'36"E 12o17'00"N	31.2	32.5	31.5	1008	14	71.6	7.3	7.2	3.3
21	15-5-'16	758	88o42'80"E 11o25'90"N	31.7	33.05	31.5	1008.1	5	63.4	7.5	7.2	5.9
22	15-5-'16	1138	88o39'70"E 11o07'95"N	31.6	32.94	31.5	1007.6	9	71.4	7.4	7	6.3
23	15-5-'16	1528	88o37'06"E 10o47'32"N	30.5	32.92	31.5	1003.7	18	73.5	7.4	7.3	5.9
24	15-5-'16	1938	88o34'53"E 10o29'42"N	29.5	33.08	31.5	1006.9	28	79	7.4	7.2	4.6
25	16-5-'16	818	89o13'09"E 10o31'88"N	28.1	32.7	31	1007.6	2	81.2	7.4	7.4	10.4
26	16-5-'16	1148	88o58'28"E 10o21'09"N	29.5	32.64	31	1005.3	5	77.6	7.5	7.3	10.2
27	16-5-'16	1528	88o42'46"E 10o09'16"N	29.2	32.63	30.5	1002.6	7	79.7	7.5	7.1	10.9
28	16-5-'16	1948	88o29'95"E 10o00'22"N	30	32.53	30.5	1004.3	12	73.7	7.2	7.4	13.5
29	17-5-'16	748	88o30'28"E 9o59'72"N	31.2	32.82	31	1004.7	16	72.4	7.4	7.3	11.1
30	17-5-'16	1138	88o30'43"E 10o00'64"N	30.8	32.53	31	1004.7	25	74.2	7.3	7.3	8.6
31	17-5-'16	1528	88o30'28"E 10o03'61"N	31.6	32.88	31	1002.2	33	71.1	7.3	7.4	8.5
32	17-5-'16	1928	88o29'82"E 9059'85"N	31.4	32.9	30.5	1004.5	38	71.5	7.5	7.5	11
33	18-5-'16	808	88 o33'79"E 9 o17'19N	31	32.76	31.3	1005.1	6	73.1	7.3	7.3	9
34	18-5-'16	1148	88 o35'69"E 8 o5 8'12"N	31	32.66	30.5	1005.3	11	78.6	7.3	7.5	9.3
35	18-5-'16	1548	88 o37'24"E 8 o3 6'69"N	31	32.63	30	1003.7	27	77.1	7.4	7.3	10.6
36	18-5-'16	1938	88o38'80"E 8 o1 5'85"N	30	32.76	31	1005.2	35	74.8	7.4	7.4	12
37	19-5-'16	758	88o43'65"E 8 o11'39"N	30	33.17	31	1007.1	5	73.3	7.5	7.5	11.9
38	19-5-'16	1209	88o45'51"E 6 o48'84"N	30	33.88	31	1006.1	8	74.5	7.4	7.2	9.1
39	19-5-'16	1521	88o 46'23"E 5 o 89'33"N	30.5	33.4	31	1006.2	12	76.5	7.4	7.4	10
40	19-5-'16	1951	88o 43'62"E 5o 97'40"N	30	33.31	31	1006.4	16	77.1	7.4	7.2	11.5
41	20-5-'16	748	88o 43'58"E 6o14'96"N	30.5	33.51	30.7	1007.7	3	73.7	7.4	7.3	12.7
42	20-5-'16	1138	88o41'94"E 6o15'04"N	30.5	33.42	30.6	1007.4	20	72.6	7.4	7.2	9.1
43	20-5-'16	1558	88o43'89"E 6o15'82"N	30.5	33.48	30.9	1005.1	37	71.8	7.4	7.3	8.7
44	20-5-'16	1948	88o45'45"E 6o16'96"N	30.5	33.49	31	1007.5	55	69.6	7.4	7.4	9.7
45	21-5-'16	748	89o24'30"E 5o38'74"N	30	33.26	30.8	1008.1	1	72.1	7.5	7.5	13.2
46	21-5-'16	1128	89o42'01"E 5o24'30"N	30	33.33	30.9	1008.4	26	70.5	7.5	7.4	13.7

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47	21-5-'16	1528	90o00'95"E 5 o09'32"N	30.2	33.78	30.8	1006.6	38	71.3	7.5	7.3	12.5
48	21-5-'16	1928	90o17'93"E 4o55'37"N	30.1	34.06	30.8	1009.2	53	69.9	7.4	7.3	12.4
49	22-5-'16	748	91o11'02"E 4o12'89"N	30	34.03	30.7	1010.3	6	70.1	7.5	7.4	9.6
50	22-5-'16	1148	91o2627"E 4o00'42"N	30.1	33.84	30.6	1010.3	14	70.6	7.5	7.3	9.9
51	22-5-'16	1548	91o41'65"E 3 o48'27"N	30.2	33.89	30.3	1007.2	24	71.9	7.5	7.2	9.6
52	22-5-'16	1948	91o42'87"E 3 o48'64"N	30	33.89	30.6	1010.2	40	72.2	7.5	7.3	8.5
53	23-5-'16	748	91o41'79"E 3o48'10"N	30	34.08	30.8	1010	9	68.1	7.5	7.2	6.9
54	23-5-'16	1158	91o42'34"E 3 o47'50"N	30	33.99	30.9	1010.1	17	71	7.6	7.2	10.7
55	23-5-'16	1538	91o41'80"E 3 o50'40"N	30.1	34.04	28.3	1008.3	33	78.6	7.6	7.1	10.2
56	23-5-'16	1948	91o42'58"E 3 o47'68"N	30.1	34.02	30.6	1009.9	55	75.6	7.6	7.1	10.3
57	24-5-'16	748	91o23'58"E 4o13'99"N	30.1	34.21	30.3	1010.2	8	75	7.6	7.1	10.1
58	24-5-'16	1148	91o07'87"E 4o26'27"N	30.2	34.48	30.6	1008.8	14	71.5	7.6	7.1	10.9
59	24-5-'16	1558	90 o53'66"E 4o37'52"N	30.2	34.53	28.5	1007.2	31	72.8	7.5	7.1	11.4
60	24-5-'16	1948	90o41'41"E 4o46'62"N	30.2	34.33	30	1008.4	34	73.3	7.6	7.1	22.4
61	25-5-'16	748	90o06'89"E 5o14'11"N	30	33.95	30.6	1008.5	8	71.4	7.5	7.1	11.5
62	25-5-'16	1158	89o56'58"E 5o21'91"N	30.1	33.85	30.7	1007.1	24	72.4	7.5	7.3	14.3
63	25-5-'16	1838	89o48'69"E 5o29'02"N	30.1	33.87	30.5	1005	36	72.2	7.5	7.2	11.7
64	25-5-'16	1948	89o38'25"E 5o35'84"N	30.1	33.37	30.6	1007.7	51	73.7	7.5	6.9	11.4
65	26-5-'16	748	89o04'24"E 6o01'88"N	30.1	33.43	30.6	1008.1	8	73.7	7.6	7.3	11.2
66	26-5-'16	1158	88o50'82"E 6o12'81"N	30.1	33.31	30.1	1007.3	19	76.2	7.6	7.3	12.2
67	26-5-'16	1548	88o49'09"E 6o15'08"N	30.1	33.56	30.1	1005.8	33	76.2	7.6	7.3	7.4
68	26-5-'16	1958	88o53'66"E 6o17'52"N	30.1	33.59	30.1	1008.1	48	76.3	7.6	7.4	11.5
69	27-5-'16	738	88o46'74"E 6o14'51"N	30.1	33.24	30.1	1008.5	7	72.8	7.7	7.3	12.2
70	27-5-'16	1148	88o49'24"E 6o15'38"N	30.1	33.21	30.1	1008.4	17	72.5	7.6	7.5	6.7
71	27-5-'16	1548	88o49'62"E 6o16'26"N	30.1	33.4	30.1	1006.3	33	74.2	7.6	7.4	13.8
72	27-5-'16	1928	88o54'27"E 6o17'12"N	30.1	33.35	30.1	1008.4	45	74.3	7.6	7.3	8.5
73	28-5-'16	758	88o51'97"E 6o16'00"N	30	33.58	30.0.	1008.4	6	73.9	7.6	7.3	14.3
74	28-5-'16	1148	88o50'20"E 6 o17'20"N	30	33.34	30	1007.6	14	73.9	7.6	7.4	8.7
75	28-5-'16	1558	88o48'76"E 6o17'07"N	30	33.39	30	1008.2	27	74.2	7.6	7.3	11.4

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76	28-5-'16	1958	88o47'78"E 6o16'13"N	30	33.41	30	1007.1	39	73.2	7.7	7.2	12.5
77	29-5-'16	748	88o10'94"E 6o12'27"N	29.6	33.46	29.6	1006.7	9	72.2	7.6	7.1	9.4
78	29-5-'16	1158	87o58'25"E 6o11'03"N	29.5	33.57	29.5	1006.1	28	70.2	7.5	7.1	8.9
79	29-5-'16	1528	87o44'04"E 6o07'55"N	29.5	33.59	29,5	1006.2	46	70.8	7.4	7.2	7.1
80	29-5-'16	1948	87o31'45"E 6o07'56"N	29.4	33.58	29.4	1008.2	55	74.8	7.4	7.4	9.4
81	30-5-'16	748	86o43'47"E 6o02'29"N	29.3	34.02	29.3	1007.9	13	72.1	7.5	7.5	7.3
82	30-5-'16	1158	86o28'01"E 6o00'71"N	29.5	33.84	29.5	1008	31	72.2	7.7	7.5	7.2
83	30-5-'16	1548	86 o13'72"E 5o58'13"N	29.5	33.91	29.5	1006.1	46	69.9	7.8	7.5	7.1
84	30-5-'16	1958	85o55'93"E 5 o56'95"N	29.4	33.92	29.4	1007.6	67	75	7.8	7.5	9,2
85	31-5-'16	758	85o06'80"E 5o51'25"N	29.3	33.79	29.3	1008.7	13	72.5	7.8	7.4	8
86	31-5-'16	1148	84o53'95"E 5o51'65"N	29.4	33.82	29.4	1008.3	31	78.1	7.8	7.5	9.8
87	31-5-'16	1548	84o40'57"E 5o52'35"N	29.4	33.76	29.4	1006.3	53	75.4	7.7	7.5	11
88	31-5-'16	1958	84o28'49"E 5o51'51"N	29.2	33.7	29.2	1008.6	72	76.2	7.6	7.6	8.5
89	1-6-'16	738	83o 53'7"5E 5o48'79"N	29.5	33.77	29.1	1008.6	11	74.5	7.6	7.7	8.3
90	1-6-'16	1158	83o4098"E 5o48'50"N	29.3	33.61	29.2	1008.6	31	73.3	7.6	7.8	8.2
91	1-6-'16	1558	83o30'07"E 5o47'63"N	29.6	33.52	29.5	1006.7	52	72.2	7.6	7.7	8.5
92	1-6-'16	1948	83o19'13"E 5o46'92"N	29.5	33.5	29.3	1008.4	72	74.3	7.6	7.6	11.4
93	2-6-'16	748	83 o41'30"E 5o44'88"N	29	33.5	29.6	1008.4	15	73.2	7.6	7.5	11
94	2-6-'16	1158	82o27'85"E 5o44'87"N	28.9	33.51	29.5	1008.5	38	73.5	7.6	7.6	11.5
95	2-6-'16	1548	82o14'93E 5o41'44N	28	33.41	29	1005.9	57	76.5	7.6	7.5	4.6
96	2-6-'16	1958	81o59'23E 5o35'39"N	28.9	33.45	28.9	1008.1	77	79.1	7.6	7.6	11.9
97	3-6-'16	758	81 o05'68"E 5o40'71"N	28	34.22	28	1008.6	9	79.1	7.5	7.5	8.2
98	3-6-'16	1158	80o48'58"E 5o40'91"N	28.9	34.24	28.9	1008.9	15	78.3	7.5	7.4	5
99	3-6-'16	1548	80o32'71"E 5o34'59"N	28.6	34.2	28.6	1005.9	23	79.5	7.5	7.5	7.6
100	3-6-'16	1938	80o11'91"E 5o34'52"N	28.5	34.2	28.5	1008	33	78.7	7.5	7.4	6.1
101	4-6-'16	758	79o27'53"E 5o57'07"N	29	34.22	29	1008.1	2	78.9	7.4	7.6	8.7

SAT: Surface Air temperature

SST: Sea Surface Temperature

SSS: Sea Surface Salinity (Average of three readings was taken and then calculated SSS).

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Discussion

As 101 sites were studied in the present studies, one can say that the study is of extensive nature. As the sampling size was large, the results obtained will give fairly correct report and thus provide near truth results. AS BOB as it is surrounded by land mass on three sides the SST is greatly influenced[13] and remains warm (>28oC),[14] in the present studies, which was conducted during summer, that too mostly southern part of BOB, a large number of sites in BOB and northern part of CIOB showed a relatively higher temperature (28.0 to 33oC). Similarly, the SAT ranged from 28oC to 32.6oC. SAT and SST recorded in the present studies indicates that, it is quite favorable for the tropical biota for their natural biological activities.

Similarly, salinity range (32.5 -34.53ppt) is known to be congenial for physiological activities of the biota living in marine waters. Barometric pressure recorded, shows that, there no additional or extra pressure on the biota like the biota, living at abyssal depths, where coping up with the pressure is one of the major problems faced by them. As the cruise was undertaken during late summer, just before onset of monsoon, precipitation of 0-77mm indicates that, the weather conditions prevailing over the BOB and CIOB during summer, which was quite common. Whenever the precipitation increases, the size of the water molecule will also increase and later it falls on the ocean surface as rain. Humidity in the air is an important criterion, as it helps the airborne spores to be active. The pH recorded was between 7.2 and 7.7 shows that there is not much influence of the freshwater rivers decanting into the BOB at the study sites as those sites were mostly located in the southern part of BOB and northern part of CIOB, where there is least impact of freshwater rivers flowing into the Bay. PH is an important parameters for all aquatic biota for their survival. In the present studies the pH ranged within the permissible level, mostly alkaline ranging from 7.2 to 7.7pH in the water column, very much suitable for living organisms. One of the best ecological conditions encountered in the present studies was Dissolved Oxygen. In all 101 sites the DO was between 6.9 and 7.6ml/l providing congenial environment for the biota's aerobic respiration process. Winds bring turbulence on the surface of the water, which will help mixing of the water column. This in turn will not only bring the nutrients from one place to another, but also helps in mixing of the nutrients. It also helps in the dispersal of plankton, thus providing food for zooplankton which consumer phytoplankton in the first instance and later zooplankton as food for fishes. The negative point is these winds and rough sea is detrimental for fish eggs. Apart from the above, winds above the water surface, helps in dispersal of clouds, which will result in spreading of rains to a larger area. In Toto, the present studies indicated that, physico-chemical parameters analyzed at BOB and CIOB in the present studies are very much congenial for growth and sustenance of biota in BOB and CIOB.

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Conflicts of interest

None.

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