

# Winter Season Variations In Physicochemical Parameters Of Marine Water Characteristics Of Coral Reef Of The Poshitra Coast, Paga Reef And Boria Reef Of Southwest Gulf Of Kachchh, India.

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**Abstract:** Winter season variations of physicochemical parameters of water of coral reef were studied at three different sites of Poshitra cluster in the Gulf of Kachchh (GoK), India. These sites come under Marine National Park and Sanctuary and it is demarked as Marine Protected Areas (MPAs). The study sites were selected on the basis of their ecological importance. These sites are having rich marine diversity and especially good coral presence. The study was carried out on the monthly basis from Nov'11 to Feb'12. Some of the water parameters are analyzed on site and others in lab. Winter season variations of different parameters investigated were as follows: pH (8.02-9.89), Temperature (19.90-29.40 °C), Dissolve oxygen (5.20-8.60 mg/l), Turbidity (3.24-20.80 NTU), and Salinity (33.8-40.0 ppt).

**Index Terms:** Marine water, Physico-chemical parameters, Coral reef, pH, DO, Gulf of Kachchh.

## 1. INTRODUCTION

Physicochemical properties of the marine environment will play an essential role in determining the type of ecosystems. Coral reef ecosystem is unique in embracing an excess of floral and faunal species with biological productivity. The carbonate skeletal structures of coral reefs are effective barriers which dissipate wave energy and create low energy environ in the seas (Sridhar R. et al., 2008). The annual growth of the coral is very slow. Based on the environmental conditions, they may increase in size from a few mm to 5 cm every year (Karuppanapandian, et al., 2007). The physicochemical parameters of water and the dependence of all life process of these factors make it desirable to take water as an environment. Hydro biological studies are the important one associated with flora and fauna of the marine and estuarine environment. Maintenance of good water quality is essential for the survival of the aquatic habitats. The environs contain specialized habitats like salt marshes, coral reefs and mangroves and each habitat has their specific animal community (Trivedi, et al., 2012). This study includes winter season variation in physicochemical parameters coral reef of the Poshitra coast, Paga reef and Boria reef. This work includes the intertidal area of coasts and reefs.

## 2. STUDY AREA

Gulf of Kachchh, an intent to mainland of Gujarat is fourth major coral reefs areas of India. The Gulf of Kachchh is only area in Gujarat which has coral reefs and rich mangrove vegetation with creeks (Singh, 2003). The Gulf of Kachchh has total 58 % coverage of corals. Poshitra, Paga reef and Boria reef have totalled coral species reported 38, 33 and 40 respectively (The Marine National Park and Sanctuary in the Gulf of Kachchh, GEER Foundation, 2004). These three study sites lies within the southwest side of Gulf of Kachchh.

Sampling Points	Latitude N	Longitude E
Poshitra coast	22° 14' 86.6"	68° 57' 27.3"
Paga reef	22° 35' 13.3"	69° 56' 21.6"
Boria reef	22° 32' 39.6"	69° 52' 18.9"

## 3. MATERIALS AND METHODS

**Sample collection and analysis:** Water samples were collected every month from November 2011 to February 2012 (Winter Season). A clean plastic container was used for collection of water sample through grab sampling method. There were two grab samples for each site collected in the intertidal area during the high tide time. Some of the parameters measured on site such as pH, temperature, and turbidity by the Eutech Multiparameter kit and Dissolve Oxygen by Winkler's methods (APHA, 1998). The care was taken of the collected samples during the transportation to the laboratory for the further parameter analysis. Another one parameter estimated at office lab such as Salinity by Argentometric Method (APHA, 1998).

## 4. RESULTS AND DISCUSSION:

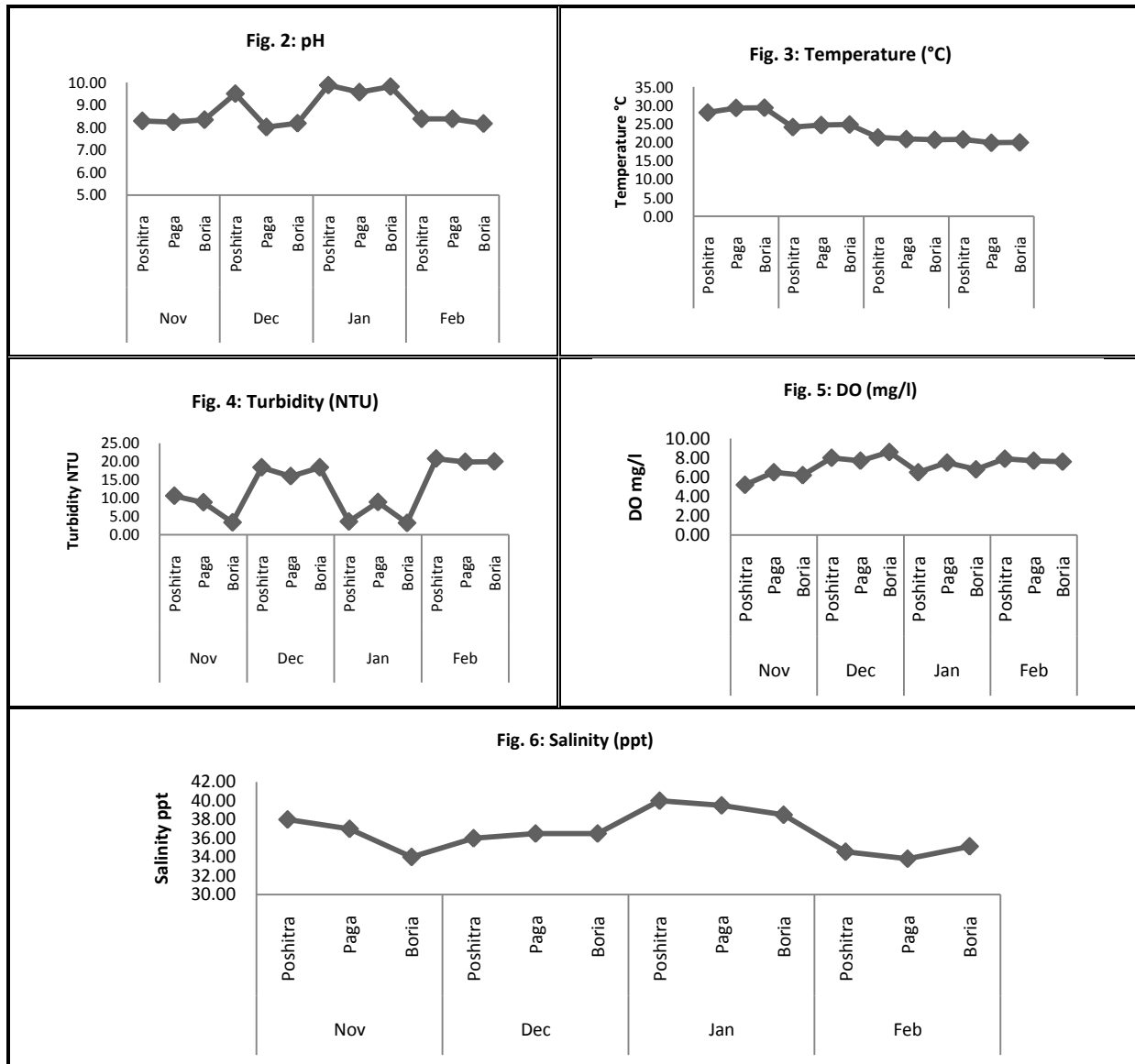
### 4.1 pH

In the present study, water pH varied from 8.02 to 9.89 (Fig. 2). The pH remains alkaline of natural waters due to the presence of sufficient amount of carbonates (Trivedi and Goel, 1984). The high buffering activity of sea water often checks wide range variations of pH in coastal water (Martin, 1970). Fluctuations of dissolved oxygen and CO<sub>2</sub> often influence the variation in pH in coastal water (Nair et al., 1983). The higher pH recorded in the present study due to the removal of CO<sub>2</sub> by the photosynthesizing coral community. Lower pH in water would help in the precipitation of calcium carbonate which in turn would help in the formation of interstitial lime paste, most useful for the coral development (Vaclcet, 1984).

**4.2 Temperature**

The coral reefs thrive at water temperature ranging from 17°C to 30°C (Gulich, 1988) (Fig. 3). The present range of water temperature recorded between 19.90°C to 29.40°C with the optimum growth occurring between 25°C to 30 °C (Clansen and Roth, 1975, Glynn, 1991). The temperature exceeding up to 36.4°C, it will cause the coral death or physiological stress (Mayer, 1914). Similar observations have been reported by Manikannan, et al., 2011, Kannapiran et al., 2008, Kumar and Geetha, 2012. Turbidity In the present study, water turbidity varied from 3.24 NTU to 20.80 NTU (Fig. 4). Turbidity is the amount of particulate matter that is suspended in water. Turbidity measures the scattering effect that suspended solids have on light: the higher the intensity of scattered light,

the higher the turbidity (Yap, et al., 2011). Corals is assumed to depend primarily on light availability for their symbiotic unicellular algae (zooxanthellae, reviewed by Buddemeier and Kinzie, 1976; Barnes and Chalker, 1990; Muscatine, 1990). Anthony and Larcombe, 2000 reported that, during 50- 100 NTU turbidity, the predicted light levels in water are reduced which shows the negative effect on coral reefs. The present study shows comparatively less turbidity which has no negative effect on the coral growth (Anthony and Larcombe, 2000). Mohanty et al., (2010) have reported turbidity value 4 NTU to 14 NTU during winter season in the Kalpakkam coastal water. When compared to the above finding the values were more or less similar to this.



**4.3 Dissolved Oxygen**

In the present study, water Dissolved Oxygen (DO) level varies from 5.20 mg/l to 8.60 mg/l (Fig.5). The DO in water is a very important parameter in water analysis as it serves as an indicator of the physical, chemical and biological

activities of the water body. Two main sources of DO are photosynthetic activity and air. Oxygen is considered to be the major limiting factor in water bodies with high concentration of organic materials. It is well known that the temperature and salinity affects the dissolution of oxygen

(Vijayakumar et al., 2000). Kumar and Geetha reported DO content ranged between 4.1 to 6.7 mg/l of the coral reef island of Gulf of Mannar. Sridhar et al., reported DO content ranged between 3.15 to 6.68 mg/l. In present study DO value is high due to winter cooling and higher photosynthetic activities (Prasanna and Ranjan, 2010).

#### 4.4 Salinity

Natural reef community seems to do well within a salinity range from 25 - 40 ppt (Fig. 6). Sridhar et al., 2008 were recorded salinity from 28 - 35 ppt for coral reef environment. In the present study, water salinity varied from 33.8 - 40.0 ppt was well within the optimum range. The salinity increases in summer where temperature is high (Satheeshkumar and Khan, 2009). The fluctuations in salinity, affect the biological characteristics of the marine environment (Sithik et al., 2009). In the present study temperature was recorded lower so salinity was recorded higher. Similar observations reported by Kannapiran et al., and Sridhar et al., of different coral reef areas. Salinity

fluctuations and factors that increase or decrease salinity levels can have harmful impacts on the benthic reef building corals (Kumar and Geetha, 2012).

#### 4 CORRELATIONS WITH THE PARAMETERS:

Fig. 7 shows the correlation between temperature and DO is inversely proportional to temperature i.e. DO decrease with increase in the temperature. The variation in the DO concentration is due to many factors such as photosynthesis and respiration (Soundarapandian et al., 2009). In the uppermost waters, however, where the temperature rises above 25<sup>o</sup> C, oxygen concentrations may decrease as a result of the lower solubility of oxygen in warmer seawater, (Manasrah et al., 2006). High temperature causes the oxygen to be relatively low (Bardran, 2001). Similar type of correlation is observed between pH and temperature as pH decrease with increase in the temperature Fig. 8.

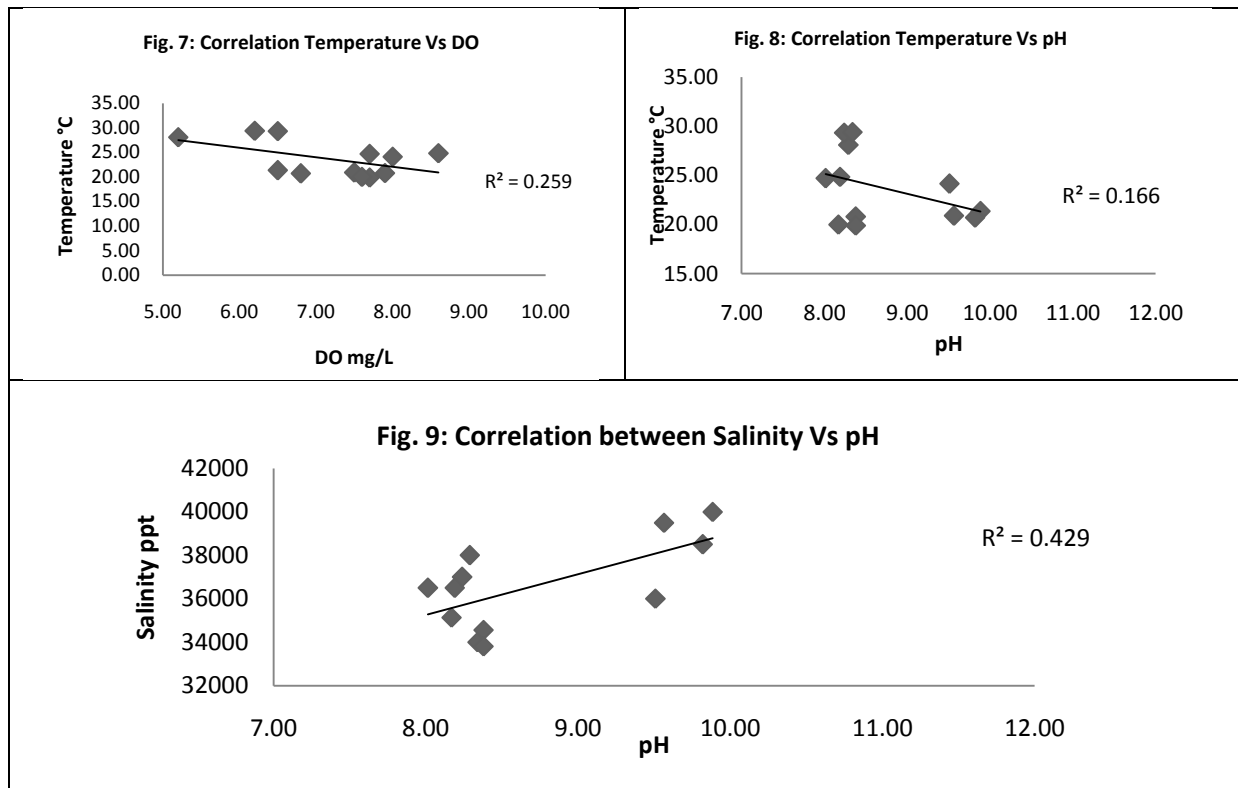


Fig. 9 shows the salinity and pH shows good positive correlation, salinity increase with increase in the pH, the reason may be the influence of salinity, salinity increase the basicity of the water. Salinity is the one of the important key factor in the marine. The fluctuations in salinity, affect the biological characteristics of the marine environment (Sithik et al., 2009)

#### CONCLUSION:

The present baseline information of the physicochemical characteristics of water would be a useful tool for coral reefs area and it shows the optimum environmental conditions for the coral growth. The pH and DO results are quite higher than the optimum range which may causes the threat for coral growth.

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**REFERENCES**

- [1]. APHA (2005). Standard methods for examination of water and wastewater. 21st Edition., Washington D.C.
- [2]. Manikannan R, Asokan S, Ali A (2011). Seasonal variations of physicochemical properties of the great vedaranyan swamp, point calimere wildlife sanctuary, south-east coast of india. *Africal Journal of Environmental Science and Technology*. 5(9): 673-681.
- [3]. Prasanna M, Ranjan PC (2010). Physico chemical properties of water collected from Dhamra estuary. *International Journal of Environmental Sciences*. 1 (3): 334-342.
- [4]. Karuppanapandian T, Karuppudurai T, Kumaraguru A.K (2007). A preliminary study on the environmental condition of the coral reef habitat. *International Journal of Environmental Sciences*. 4(3): 371-378.
- [5]. Singh H S (2003). Sea mammals in marine protected area in the Gulf of Kachchh, Gujarat State, India. *Indian Journal of Marine Sciences*. 32(3): 258-262.
- [6]. Yap C K, Chee M W, Shamarina S, Edward F B, Chew W, Tan S G (2011). Assessment of surface water quality in the Malasian coastal waters by using Multivariate analysis. *SainsMalaysiana.*, 40(10): 1053-1064.
- [7]. Trivedi J N, Gadhavi M K, Vachhrajani K D (2012). Diversity and habitat preference of brachuran crabs in Gulf of Kachchh, Gujarat, India. *Arthropods*. 1(1): 13-23.
- [8]. Satheeshkumar P, Khan B A (2009). Seasonal variation in physicochemical parameters of water and sediment characteristics of Pondicherry Mangroves. *African Journal of Basic & Applied Sciences*. 1(1-2): 36-43.
- [9]. Mohanty A K, GouriShau, Biswas S, Natesan U, Prasad M V R, Satpathy K K (2010). Spatio temporal variation in physicochemical properties of coastal waters of Kalpakkam, southeast coast of India. *J. Mar. Biol. Ass. India*. 52(1): 75-84.
- [10]. ManasrahR, Raheed M, Badran M I (2006). Relationships between water temperature, nutrients and dissolved oxygen in the northern Gulf of Aqaba, Red Sea. *Oceanologia*. 48 (2): 237-253.
- [11]. SithikM A, Thirumaran G, Arumugam R, Ragupathi Raja Kannan R, Anantharaman P (2009). Physico-Chemical Parameters of Holy Places Agnitheertham and Kothandaramar Temple; Southeast Coast of India. *American-Eurasian Journal of Scientific Research*. 4 (2): 108-116.
- [12]. Soundarapandian P., Premkumar T., Dinakaran G. K. (2009). Studies on the Physico-chemical Characteristic and Nutrients in the Uppanar Estuary of Cuddalore, South East Coast of India. *Current Research Journal of Biological Sciences*. 1(3): 102-105.
- [13]. Kumar Y., Geetha S. (2012). Seasonal changes of hydrographic properties in sea water of coral rees islands of Gulf of Mannar, India. *Int. Jrl. Of plant and animal and env. sci*. 2(2): 135-157.
- [14]. Kannapiran E., Kannan L., Purushothaman A., Thangarajdou T. (2008). Physicochemical and microbial characteristics of the coral reef environment of the Gulf of Mannar marine biosphere reserve, India. *Journal of Environmental Biology*. 29(2): 215-222.