

ANALYSIS OF CHANGES IN WATER QUALITY PARAMETERS IN COSTAL REGION OF GHOGHA TALUKA, BHAVNAGAR

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Abstract: This study was aimed to analysis of changes in last 10 year status of Physico-chemical characteristic of pre-monsoon and post-monsoon 2005 to 2014 at Ghogha taluka costal region Bhavnagar district, Gujarat, India. In this present study various seasonal groundwater quality data were collected from different agencies like WASMO and GWRDC for some consecutive years and the respective physicochemical characteristics was observed for particularly eight parameters pH, Calcium, Chloride , fluoride , Total hardness, Magnesium, Nitrate and total dissolve solids which are essentially responsible for groundwater quality degradation in the said area. It is observed that all physio-chemical parameters are within the permissible limit as per the BIS standard in all wells except in well no 14, Ghogha village and in well no 49, Padva village. It is observed that during year 2013-2014 concentration of NO₃ increased substantially in Chhaya, Lakhanka, Padva, Kareda, Odarka and Tansa Village.

Keywords- groundwater quality, Ca, Cl, Mg, NO₃, TDS, TH, and Fluoride

INTRODUCTION

Groundwater plays a vital role as important source of drinking water in rural and urban areas of India. According to some estimates, it accounts for nearly 80 per cent of the rural domestic water needs, and 50 per cent of the urban water needs in India. Naturally surface water bodies' are highly subject to contamination and pollution whereas groundwater is less susceptible. Over exploitation of groundwater is causing pollution of this priceless resource. Groundwater pollution is a challenging global problem. Particularly people, who are living near to coastal areas, are facing a struggle to have safe drinking water. Nearly 25% of the population of India lives along the coastal zones. Coastal regions are having both spatial and temporal variations in the groundwater characteristics. In these regions, the groundwater system is influenced by many factors in a particular site. Rainfall, landform, soil, seawater intrusion and other anthropogenic activity are some of the factors determining the ground water quality in coastal region. The quality of ground water has become weak in coastal areas mainly due to salt water intrusion. This is because of rigorous pumping of fresh ground water.

In India, sea water intrusion is observed along the coastal areas of Gujarat. The Stalinization processes in coastal area is very complex which may be due to multitude of factors viz., seawater intrusion, prawn culturing and pollution phenomena

STUDY AREA

The state of Gujarat has the longest 1600 km length coastal, which is 1/3rd of the total coastal length of Indian sub-continent. Out of 1600 kms long Coastal of Gujarat, Saurashtra and Kachchh cover a coastal length of about 1125 km. The Ghogha is a census town in Bhavnagar district in the state of Gujarat, India. Ghogha is located in Ghogha tehsil and located in Bhavnagar district of Gujarat, latitude 21.6848795 and longitude 72.2748686. Ghogha consist of 48 villages having population of 85624 as per 2011 census, is situated on the mid-western bank of the Gulf and about 15 km south of the present port town of Bhavnagar. It is in the 12 m elevation (altitude). It is near to Arabian Sea. The climate of this area is temperate to humid. The minimum temperature is 10°C in the month of December, whereas maximum temperature is 40°C in the month of May. Mainly there are three seasons in the area i.e. summer from February to mid June, Followed by monsoon which lasts up to middle of October and the winter from mid October to February. Soils of the coastal areas are clayey to sandy loam, which are formed due to weathering of trap rock and windblown sands in this study area. Scarcity of drinking water is a long-time problem in the Ghogha region. This region is characterized by hot summers and erratic rainfall. Being a coastal region, salinity ingress into groundwater is high. Wells in the region have either dried up or turned saline due to depleting water tables Every year, drinking water had to be supplied by tankers for a couple of months.(wasmo)

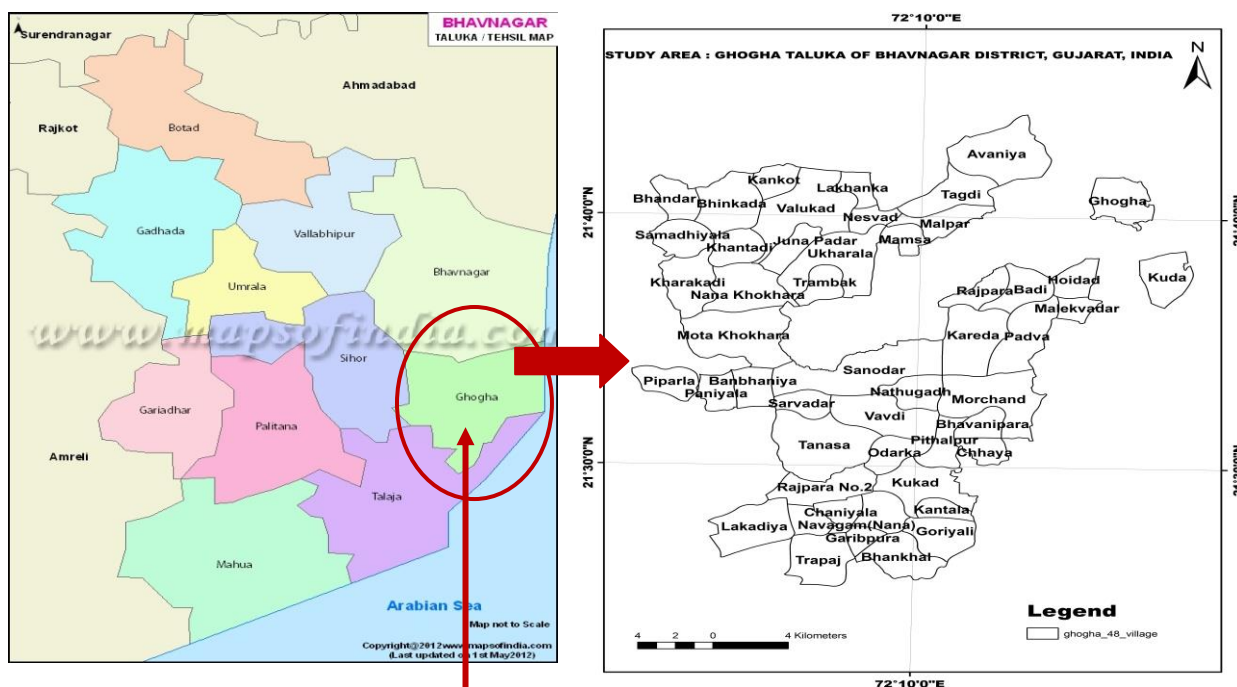




Fig.1 LOCATION MAP OF STUDY AREA GHOGHA TALUKA IN BHAVNAGAR DISTRICT, GUJARAT, INDIA.

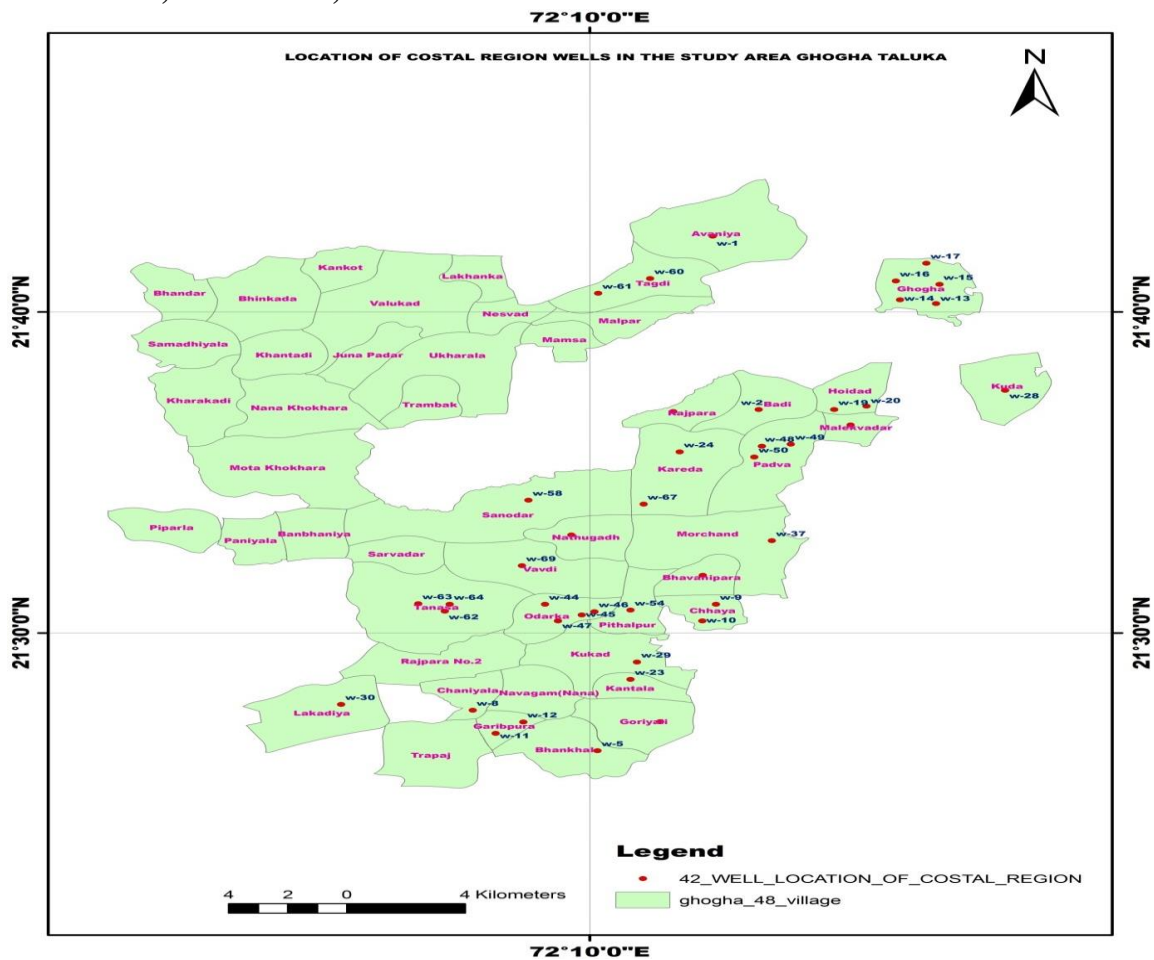


Fig.1.1 Location of observation wells in study area

METHODOLOGY

Observation of seasonal variation of water quality parameter in 42 wells at Ghogha taluka for pre-monsoon and post-monsoon period from the year 2005 to 2014 has been carried out for eight parameters pH, Calcium, Chloride, Fluoride, Total hardness, Magnesium, Nitrate and Total Hardness. Each of the groundwater quality parameters are compared with the standard specified according to BIS. The results indicated that Physico-chemical parameters of the water were within the permissible limit with reference to BIS standard and can be used for domestic and irrigation.

1. **pH** – The acceptable limit range is 6.5-8.5 in BIS. Beyond this range the water will affect the mucous membrane and/or water supply system.
2. **Calcium (ppm)** - The acceptable limit is 75ppm and permissible limit is 200 ppm in BIS.
3. **Chloride (ppm)**-The Acceptable limit is 250 ppm and the permissible limit 1000 ppm with reference to BIS. Beyond this limit taste corrosion and palatability are affected.
4. **Fluoride (ppm)**- The acceptable limit of fluoride 1.5 ppm and permissible limit is 3 ppm with reference to BIS. Fluoride may be kept as low as possible. High fluoride may cause fluoridise.
5. **Total hardness**- The acceptable limit 300 and permissible limit is 600 with reference to BIS.
6. **Magnesium (ppm)** - The acceptable limit 30ppm and permissible limit 100 ppm with reference to BIS.
7. **Nitrate (ppm)** - The acceptable limit 45 ppm. Beyond this range may be indicative of pollution.
8. **Total dissolved solid**- The acceptable limit 500ppm and permissible 2000 ppm with reference to BIS. Beyond this palatability decreases and may cause gastrointestinal irritation.

TABLE-1 GROUNDWATER QUALITY PARAMETERS

GROUNDWATER QUALITY PARAMETERS	BIS -10500 STANDERDS	
	DESIRABLE	PERMISIBLE LIMIT
PH	6.5 TO 8.5	
Calcium (ppm)	75	200
Chloride (ppm)	250	1000
Fluoride (ppm)	1.5	3
Total hardness	300	600
Magnesium (ppm)	30	100
Nitrate (ppm)	45	
Total dissolved solids (ppm)	500	2000

TABLE-2 PRE-MONSOON DATA ANALYSIS

Parameters	year	Ph	Ca (ppm)	Cl (ppm)	F (ppm)	Total Hardness	Mg (ppm)	NO ₃ (ppm)	TDS (ppm)
	2005	8.1	0	3000	1.56	0	0	52.04	6780
	2006	8.0	0	2840	1.53	0	0	51.46	5760
	2007	8.6	505	2840	1.56	2500	390	51.42	7590
	2008	8.3	510	1600	1.53	2288	243	55.4	6250
MAXIMUM	2009	8.6	495	2200	1.77	2313	258	53.36	6490
	2010	8.8	500	3200	1.52	2213	360	49.16	6150
	2011	8.5	505	1160	1.53	2500	297	0.89	3930
	2012	8.3	410	1040	1.48	2188	279	178	4580
	2013	8.7	535	1360	1.31	2525	285	165.88	6068

	2014	8.2	610	1240	0.84	2850	318	168.29	4720
	2005	7.3	0	80	0.39	0	0	0	600
	2006	5.4	0	88	0.38	0	0	0	510
	2007	7.1	20	112	0.38	225	30	0	580
	2008	6.7	25	48	0.34	138	18	0	83
MINIMUM	2009	7.0	20	80	0.32	188	30	0	580
	2010	6.9	12	40	0.2	120	5	0.89	280
	2011	7.2	16	36	0.2	80	5	0.89	212
	2012	7.1	16	28	0.19	120	15	0	242
	2013	7.1	13	40	0.03	100	8	0	266
	2014	6.3	16	20	0.03	120	18	0	225

TABLE-3 POST-MONSOON DATA ANALYSIS

Parameters	year	pH	Ca (ppm)	Cl (ppm)	F (ppm)	Total Hardness	Mg (ppm)	NO3(ppm)	TDS (ppm)
	2005	8.4	0	2200	1.22	0	0	49.95	4670
	2006	8.2	795	2240	2.65	3225	372	50.93	5940
	2007	8.3	655	2760	1.44	2538	216	52.3	4960
	2008	8.6	585	2000	1.39	2625	480	55.36	5040
MAXIMUM	2009	8.1	610	1240	7.39	2788	303	48.76	4360
	2010	8.7	670	1280	1.39	2188	177	46.5	4410
	2011	8.5	640	1000	1.32	2213	147	28.23	4290
	2012	8.8	450	1600	1.4	3063	465	158.1	5160
	2013	8	450	1000	1	2350	294	589	3620
	2014	8.2	440	1280	1.16	2000	255	184.95	2930
	2005	7.3	0	64	0	0	0	0	320
	2006	7.6	35	88	0.31	213	30	0	430
	2007	7.1	30	56	0.42	188	18	0	340
	2008	6.4	25	72	0.48	200	27	0	450
MINIMUM	2009	7	30	48	0.62	238	33	0	470
	2010	7	10	32	0.2	160	21	0.89	366
	2011	7	16	30	0.19	120	20	0.47	140
	2012	7.15	16	28	0	120	6	0.89	248
	2013	6.5	14	26	0.02	112	13	0	108
	2014	7.03	8	20	0.07	100	5	0.01	6.24

CONCLUSION

For the coastal region of study area data have been collected for the basic parameters like pH, Calcium, Chloride, Fluoride, Total hardness, Magnesium, Nitrate and Total Hardness from the different agencies like WASMO and GWRDC. In general in observation for most of years of analysis pH variation is quite negligible with variation ranging from 7 to 8.7. There are few exceptional cases where we find pH 5.4 in pre-monsoon-2006 and pH 6.3 in pre-monsoon 2014 revealing bit acidic. Variation in fluoride is very negligible; however variation in chlorides TH, TDS is found having wide variation.

It is observed that all parameters are within the permissible limits except in well no 49, Padva and in Wel no 14, Ghogha in which parameters like Ca, Cl, NO₃, Mg, exceeds the permissible limit from year 2005 to 2014 and also TDS and TH values are extremely high from year 2005 to 2014. NO₃ value exceeds the permissible limits during 2007-2008 in Chhaya, Lakhanka, Padva and Tansa Village. Very high concentration of NO₃ has been observed during year 2013-2014 in the above villages indicates over fertilization in this region. Higher concentration of nitrate may cause methemoglobinemia, an illness found in infants. It is observed that NO₃ concentration in many wells increase from year 2008 to 2014. TDS and chlorides exceed the permissible limits in Ghogha village in well no 13, 14, 15 and 16 from year 2005 to 2009. It is observed that TDS concentration in Well no 13 and in 15, Ghogha village is decreased from the year 2010 onwards. For to first two year of analysis data of TH and Mg are not available and during some period NO₃ data are not available.

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