

**A STUDY OF GROUNDWATER QUALITY IN TSUNAMI
AFFECTED AREAS OF SIRKAZHI TALUK, NAGAPATTINAM
DISTRICT, TAMILNADU, INDIA**

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ABSTRACT

The 26, December 2004 tsunami had major impact on the quality of groundwater along the south-east coast of India, but especially in the tsunami-affected areas of the Nagapattinam district of Tamilnadu. Major pollution resulted primarily from increases in the salinity of groundwater. The post-tsunami water quality posed problems to general health and contributed significantly to agricultural and environmental degradation in the Sirkazhi taluk and Nagapattinam districts. The adverse impact was particularly significant in the areas of Pazaiyar, Madavaimedu, Thirumullaivasal, Thoduvai, Koozaiyar, Puthupattinam, Kizhamoovarkarai, Pombhukar and Vanagiri. The present study assesses the source, degree, extent and nature of groundwater contamination in the Sirkazhi coastal region. Samples of groundwater were collected from 11 wells in this area and analyzed chemically to determine the extent of contamination. The results showed significant variations in water quality parameters in the study area and helped understand the longer-term adverse impacts that tsunami inundation can have upon groundwater resources.

Keywords: Tsunami, Coastal areas, Groundwater quality.

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1. INTRODUCTION

The 26, December 2004 tsunami flooded large coastal areas of the Nagapattinam district in Tamilnadu, destroyed vegetation along the coastal belt, and caused significant shoreline erosion. Also, the tsunami inundation affected greatly the groundwater supply. Since the quality of public health for the people in this coastal region depends to a great extent on the quality of drinking water, it was imperative to determine the effects of the tsunami.

2. STUDY AREA

The study area is the Sirkazhi taluk coastal region, in the southern Tamilnadu State located in the east coastal region of the Bay of Bengal between $11^{\circ} 6' 00''$ N and $11^{\circ} 27' 00''$ N and $79^{\circ} 36' 00''$ E and $79^{\circ} 54' 00''$ E. Figure 1 shows the study area and sample locations.



Figure. 1: Study area with sample locations (After Tsunami)

3. MATERIALS AND METHODS

Groundwater samples were collected during the month of January 2005 (beginning 13 days after the impact of the tsunami) from 11 wells in the study area for detailed quality analysis (figure 1). The names of the sampling locations at Pazhyar (two sample locations), Dharkaz, Madavaimedu, Puthupattinam, Puthupattinam (two sample locations), Kotiyamedu, Thandavankulam, Thirumullaivasal, Thoduvai and Koozhaiyar.

The samples were analyzed in the laboratory for pH, electrical conductivity, chlorides, sodium, hardness, dissolved oxygen, percentage salinity and turbidity. The concentrations of the various chemical parameters are expressed in mg/liter. The results of the water quality parameters for the 11 samples location areas are shown in Table 1 and compared with standards of the World Health Organization (WHO) and the Bureau of Indian Standards (BIS).

4. RESULTS AND DISCUSSION

The findings are summarized in Table 1. Sample parameter variations are presented in Figure 2(a) to 2(h). The results show that the pH, one of the primary parameters in the assessment of water quality was well within the prescribed norms in all the locations and in all the samples. It ranged from 6.5 to 7.07, and it was neither sharply acidic nor alkaline in nature. Hardness is defined as the sum of the polyvalent cations present in the water, notably calcium and magnesium. In the present study, the hardness varied between 264 – 2000 mg/lit.

WHO has fixed 150 mg/lit as the standard value while BSI has fixed 300 mg/lit as the limit. Puthupattinam 1, Puthupattinam 2 and Thandavankulam are the places where hardness values were below 300 mg/lit. All other remaining places had high values in hardness. According to Durfor Beckers, water with 180 mg/lit or more hardness is very hard. Almost all the samples exceeded 180 mg/lit. Excess hardness may cause health hazards like kidney stones and other ailments (Jain 1996).

Table 1: Groundwater quality parameters of study area.

Sl No	Name of the Sampling Place	Date of Sampling	pH	EC mhos	Chlorides [mg/lit]	Na [mg/lit]	Hardness [mg/lit]	Salinity [%]	Turbidity [NTU]	DO [mg/lit]
1	Pazhyar 1	09.01.2005	6.71	10.10	3058	1300	1900	8	Nil	6.7
2	Pazhyar 2	09.01.2005	6.72	11.86	2321	1310	2000	10	Nil	6.2
3	Dharkaz	09.01.2005	6.77	2.65	1547	610	652	3	Nil	7.5
4	Madavamedu	09.01.2005	6.58	4.24	1400	840	888	3	43	7.3
5	Pudupatinam 1	09.01.2005	7.07	0.541	160	70	264	0	Nil	7.3
6	Pudupatinam 2	09.01.2005	6.69	0.781	140	180	292	0	15	7.5
7	Kotiyamedu	09.01.2005	7.03	5.45	1760	780	980	4	Nil	7.7
8	Thandavankulam	09.01.2005	6.77	0.622	160	70	272	0	Nil	7.7
9	Tirumullaivasal	09.01.2005	6.5	1.236	230	240	328	2	Nil	7
10	Thoduvai	09.01.2005	6.64	4.72	1360	590	1040	4	Nil	7.4
11	Koozhaiyar	09.01.2005	6.7	4.01	1300	560	648	3	9	7.8

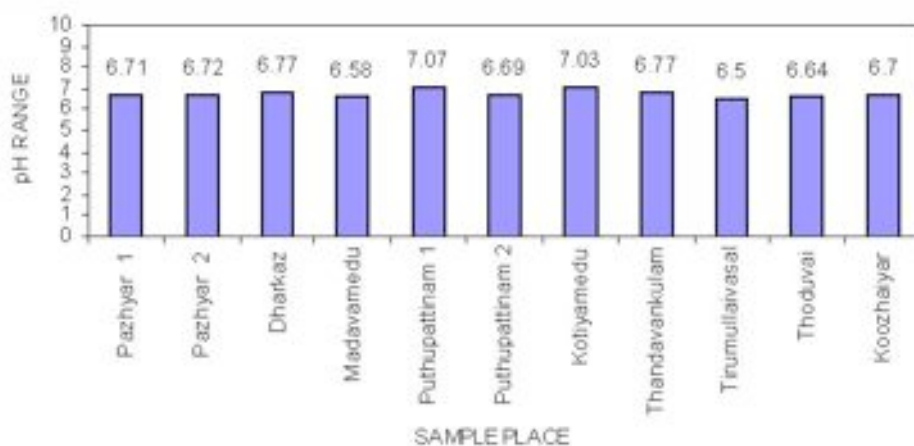


Figure. 2 (a): Water quality parameter (pH)

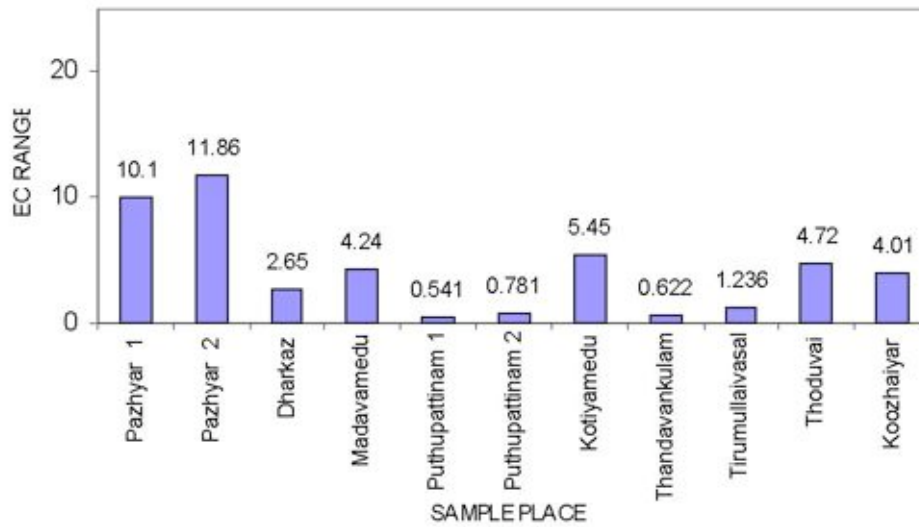


Figure. 2 (b): Water quality parameter (EC)

Natural water contains low chloride. Higher concentration of chloride in water is often found in conjunction with higher sodium concentration. WHO and BIS have prescribed 250 mg/lit as the maximum permissible value. If the chlorine value exceeds 300 mg/lit and the presence of a major cation is sodium, then the water becomes salty. The present study shows that the samples in Puthupattinam 1, Puthupattinam 2, Thandavankulam and Thirumullaivasal were well within the BIS limit while the others are higher than the norms.

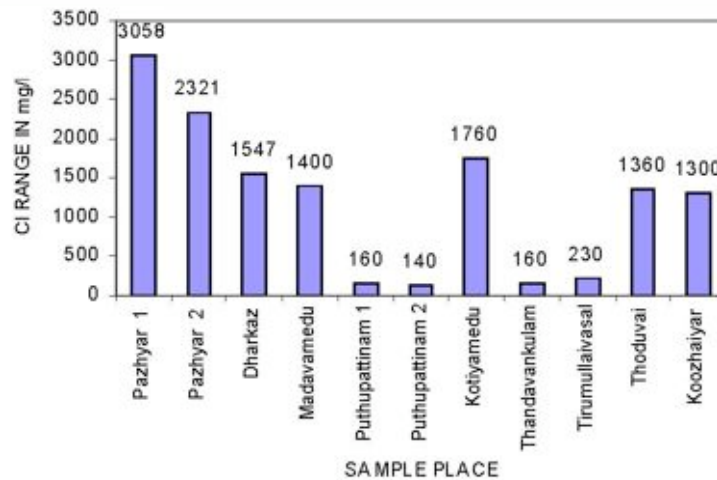


Figure. 2 (c): Water quality parameter (Cl)

Dissolved oxygen (DO), a vital parameter in the stability of the aquatic eco-system, was within the prescribed norms (6.2 – 7.8 mg/lit). The electrical conductivity (EC) is the parameter, which influences agricultural crops. The present study shows that the EC ranged from 0.571mhos to 11.16 mhos. Puthupattinam 1, Puthupattinam 2, and Thandavankulam showed lesser concentrations but other location had high concentrations. Sodium concentration is an important factor in classifying irrigation water. High level of sodium inhibits soil permeability.

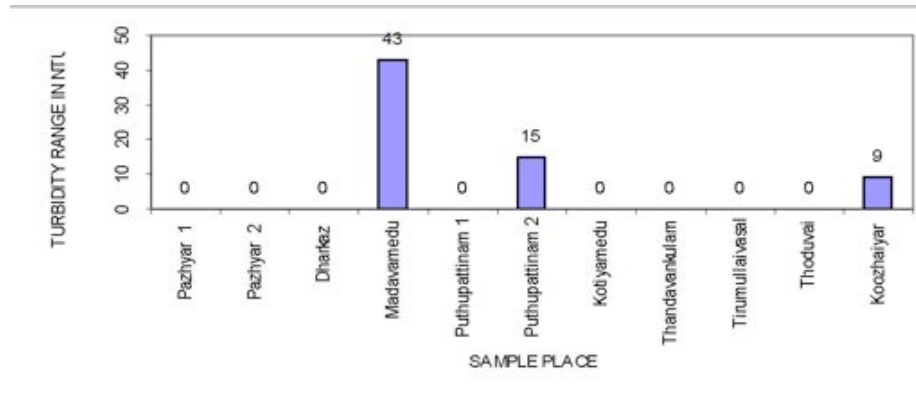


Figure. 2 (d): Water quality parameter (Turbidity)

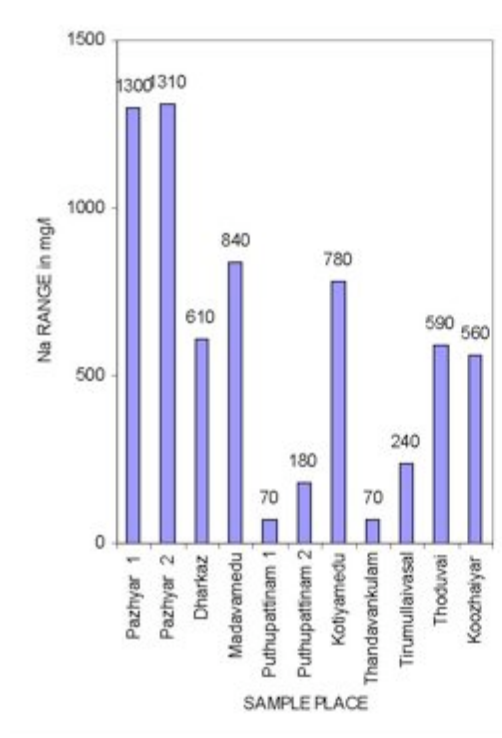


Figure. 2 (e): Water quality parameter

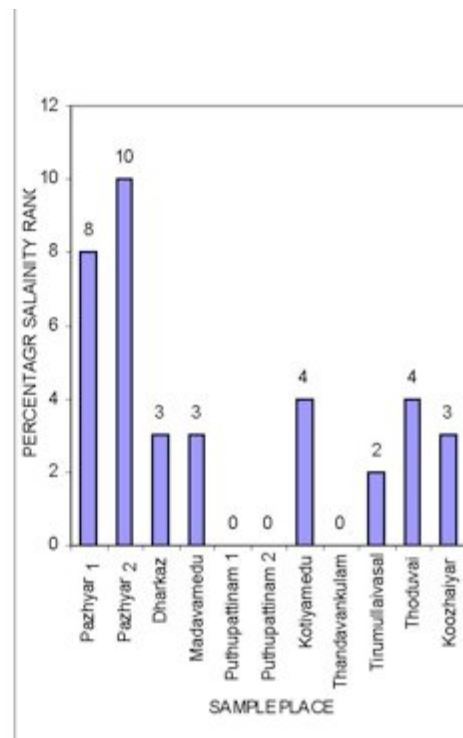


Figure. 2 (f): Water quality parameter (Na) (% Salinity)

Comparison of water samples collected from hand pumps, in general, indicated higher concentration of parameters. Water quality modeling in the study area using GIS & RS software (ILWIS) were also prepared to identify the polluted areas and these are shown in figures 3(a) and 3(b). Table 1 above and the additional figures below outline the results.

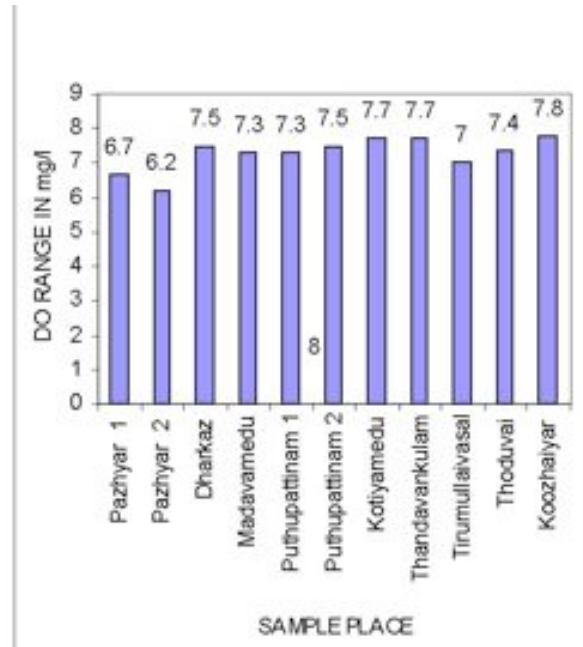
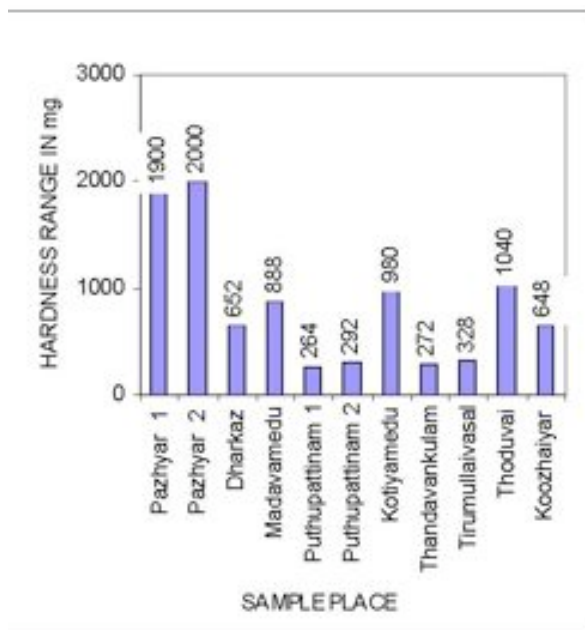


Figure. 2 (g): Water quality parameter (Hardness)

Figure. 2(h): Water quality parameter (DO)

5. CONCLUSIONS

The December 26, 2004 tsunami had a devastating effect on most of the sectors of the Tamilnadu coast, but notably in the Sirkazhi Taluck area of the Nagapatinam District. The tsunami impact changed entirely the coastal geomorphology along this region. The inland inundation of the tsunami affected the quality of groundwater. The saline intrusion contaminated and affected significantly the quality drinking water supply and affected significantly its quality parameters show very significant change due to recent Tsunami.

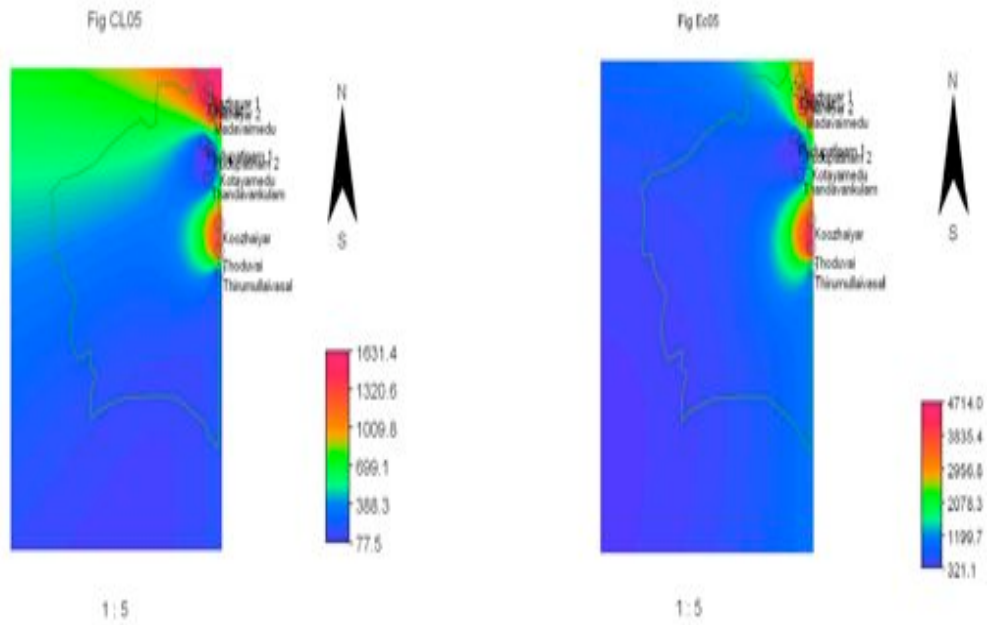


Figure. 3 (a): Water quality Modeling (Cl and EC)

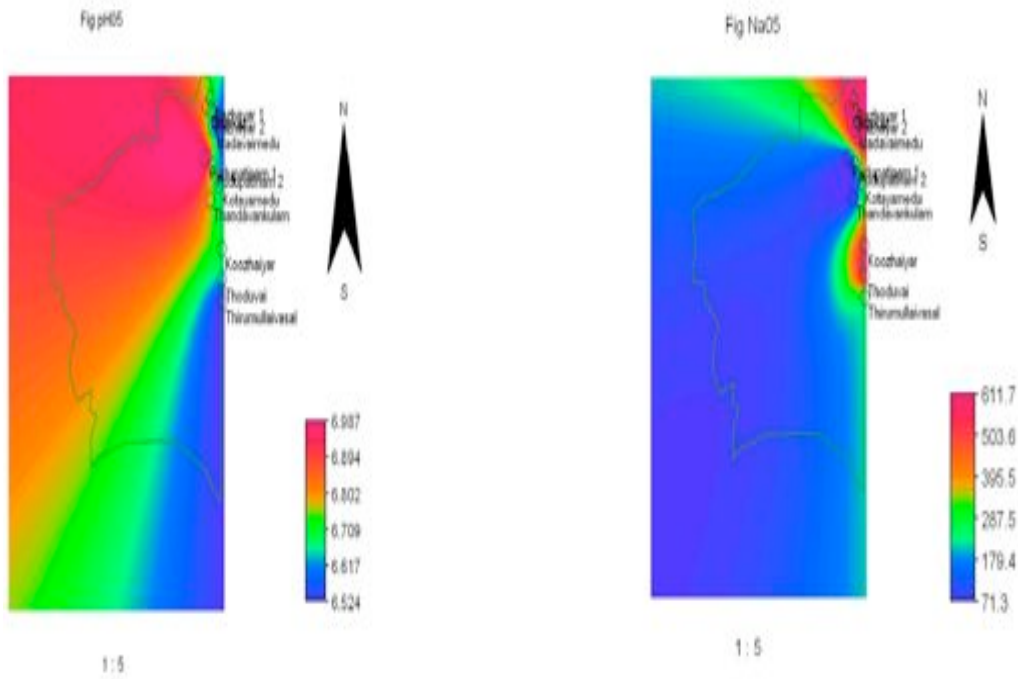


Figure. 3 (b): Water quality Modeling (pH and Na)

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