The December 26TH (D/26), 2004 Tsunami on Kollam Coast (SW India) With Specific Reference to Management Strategies

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Abstract— The investigation attempts to provide baseline information on the environmental conditions of the D/26, 2004 Tsunami hit areas of Kollam coast, Kerala, SW India. The study includes run-up survey, analysis of water, soil, sediment and socio-economic impacts with respect to the environmental significance of Alappad sector, that lies between N latitudes 76° 27` - 76° 34` and E longitudes 9° 2` - 9° 8. A few suggestions and recommendations are also put forward for the future course of actions.

Index-terms -Tsunami,water quality,soil texture

I. Introduction

The coastal region of Kerala state, facing the Arabian sea, is 574 km long stretching from Thiruvananthapuram district in the south to Kasargod district in the north. Nine districts of the state viz., Thiruvananthapuram, Kollam, Alappuzha, Ernakulum, Thrissur, Malappuram, Kozhikode, Kannur and Kasargod have long coastal areas and the people residing there heavily depend upon the well waters for drinking and domestic needs, and also to some extent for agricultural purposes.

Considering the havoc caused by Tsunami which hit Indian coast line, the report of WHO is of significance which states that in many places around the Tsunami disaster ravaged coastlines, the water and sewage system were wrecked by the quake-driven waves, and groundwater supplies were contaminated by seawater. The Executive Director Dr. Carol bellamy of UNICEF, after a tour to the Tsunami hit areas of Indian coastline, reported that the floods have contaminated the water system leaving people with little choice but to use unclean surface water.

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The International Committee of the Red Cross (ICRC) opined that high quality potable well water is essential to avoid the propagation of water-borne diseases and Andrew Natsios the head of U.S Agency for International Development pointed out that in a Tsunami disaster, the sewer and water system get combined and as a result of that, the only water people drink is basically mixed with sewage and that means a high risk of cholera and other communicable diseases that can begin epidemics. David Nabarro, a top WHO official dealing with humanitarian crises, warned that "we could have at least as many dying from communicable diseases as we had dying from the Tsunami". In each disaster, the priority is to get safe drinking water, sanitation, food and shelter to people, and if we can do it promptly, then we will not have outbreaks of communicable diseases, (Adak and Purohit, 2003). Thus, the importance of clean potable drinking water to avoid calamities is stressed by experts working in the fields and the present study is part of and effort to achieve this goal.

II. Methodology

The Run-up survey (fig.1) carried out as per the guidelines of [1], along the 22 km coastline, also included examination of 28 water (surface as well as well water), 18 soil and 2 core sediment samples. The standard procedures followed were [2] for water; [3] and [4] for soils and [5] and [6] for core samples.

III. Results and Discussions

Run-up Survey:-Among the three tsunami waves, which hit the study area, first hit was at 9.45 am with a height of 2m, the second one (height 2.5m) after 1 hr 5 minutes and the third one (height of 4.5m) after 45m was responsible for all the damages rendered in the area. Table 1 shows the details of run-up elevation; extend of inundation and maximum sand displacement caused by the tsunami. Maximum inundations ranged between 50 and 320 m from swash zone. The gravel size clasts largely derived from tsunami damaged brick walls, foundations and roofing tiles of the region. Maximum sand transfer measured in the profile ranged between 20 to 190 m distances from swash zone. The thickness of the displaced clasts varied from a few centimeters to several tens of centimeters.

Socio-Economic Analysis: - The damages of tsunami can be classified broadly into two categories, a) impact on life b) impact on properties. The tsunami worsened the already

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fragile socio-environmental fabric of the hazard prone region. Table 2 elucidates the details of the socio- economic survey carried out in the region.

The salient observations that have contributed to the high death toll are the sheer on natural calamities, the lack of awareness, and negligence of the people. The total affected population was 24,931, among which 134 died and 5,600 rendered homeless. Among dead, 53.73% were adult and 46.27% children (55.22% females and 44.78% males). 55.97% death was occurred in ward IV (Azihkal) followed by 16.42% in ward V (Srayekkad). The age wise analysis of the dead showed that majority (35.31%) belongs to the age group 0-10 years, and the grown-up (above 45) accounted for the 29.86%. where as the productive population (19-45 years) comprised 21.64%. Among the people shifted to the 37 relief camps, 235 persons were torment from chronic illness; adults being the majority (190).

Hydrochemistry: - Fig. 2 clearly indicates a dilution effects towards the interior and seawater sustenance in the tidal mixing zone (W28). In general, the surface water characteristics of the study area may be attributed to the following reasons/hypothesis:

- From the distribution pattern of TDS, salinity, chloride, hardness, Mg and Na, it can be hypothesized that there is an influence from the growine starting from the Kayamkulam harbour that may ultimately effect an estuary formation in the Pallikkal Thodu drainage region.
- The formation of the new estuary in the drainage region may be a balancing act of the nature resulted from the collapse of Kayamkulam Pozhi which was thought to be the contributing factor, in the natural cleansing that headed up to the Kuttanadu region.

Fig. 3 a & b show the well water quality that infers a transition zone of nearly 1.3 km .The tsunami effects is clear from the abandoned (W12) and/or the mixed (W9,10&11) wells showing higher range in the salinity parameters. The observations cope up well with the results of run-up survey.

The study points out the importance of detailed research on the anthropogenic effects and salt water intrusion along the coastal belt of Alappad. It also categorically emphasizes on the necessity of remedial measures needed for a sustainable living of the fisherman folk of the area.

Soil analysis: - The soil types can be categorised as sand, loamy sand, sandy clay loam and clay. The values of soil pH were almost equivalent to the buffering capacity of carbonates and generally fall under the categories of saline sodic soil and saline soil. The transition of many normal regions along the coast into sodic saline and saline categories might be an indication seawater invasion or anthropogenic impacts. The tsunami-affected area can be specifically noted for the presence of saline sodic soils. Further research on the changing soil patterns along the coastal belt is needed. Also a desalination programme for sustainable agriculture in the coastal belt is highly on demand.

Sedimentological analysis of core samples: - The main core sediment types are sand, clayey sand, silty sand, clayey mud, silty mud, sandy clay and sandy mud pointing out the diversity in the hydrodynamic condition prevalent in the area that varied under the calm to turbulent past. Fig.6. shows depositional environment pattern for core I &II. This suggests the need of high resolution stable isotopic studies to understand the paleo imprints of tsunami and its relationship to various geo-environmental factors.

IV. RECOMMENDATIONS: -

The large-scale devastation caused by the D/26, 2004 tsunami, realised that present disaster management system is very weak. The major recommendations drawn from the study are

- ❖ A scientific linkage between the environment and developmental needs to be clearly established to forecast and mitigate disasters and to improve our environment of the state.
- ❖ Minimum standards should specify the levels of availability of services in the disaster prone area such as coastal belt
- ❖ There is an urgent need to set up a separate wing under Department of Environment in the State to look into the various environmental issues generated by natural hazards by involving experts from related disciplines. The formation of a Natural Hazard Management Commission (NHMC) with full autonomy in line with the Central Election Commission must empower the efforts in this front.
- ❖ Coastal afforestation schemes such as bio shield development to protect the coastal area must be implemented with out delay.
- ❖ Contour mapping of coastal areas from 10 to 20 km at a half meter interval should be taken up for the purpose of evacuation and the association of micro level preparedness planning in case of emergency.
- ❖ Education/extension programmes related to the coastal calamities, warning systems and preparedness activities connected to disaster mitigation measures should be charted out for government officials, NGOs, primary curriculum as well as the general public.

ACKNOWLEDGMENT

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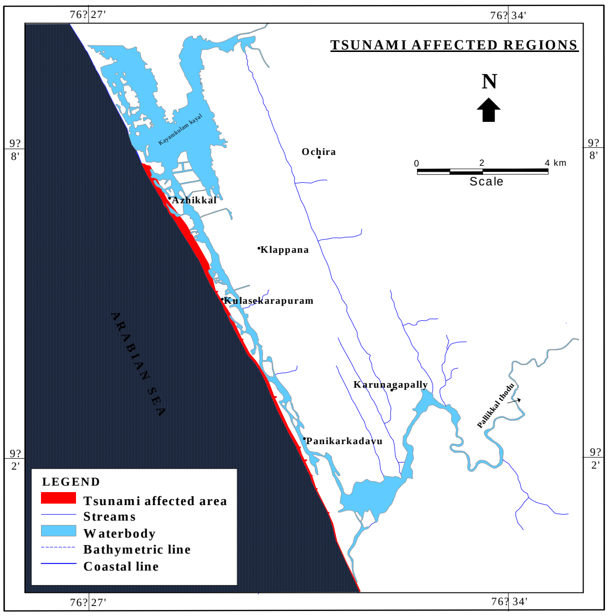

Fig. 1 The Tsunami affected area with its lateral extension in red line

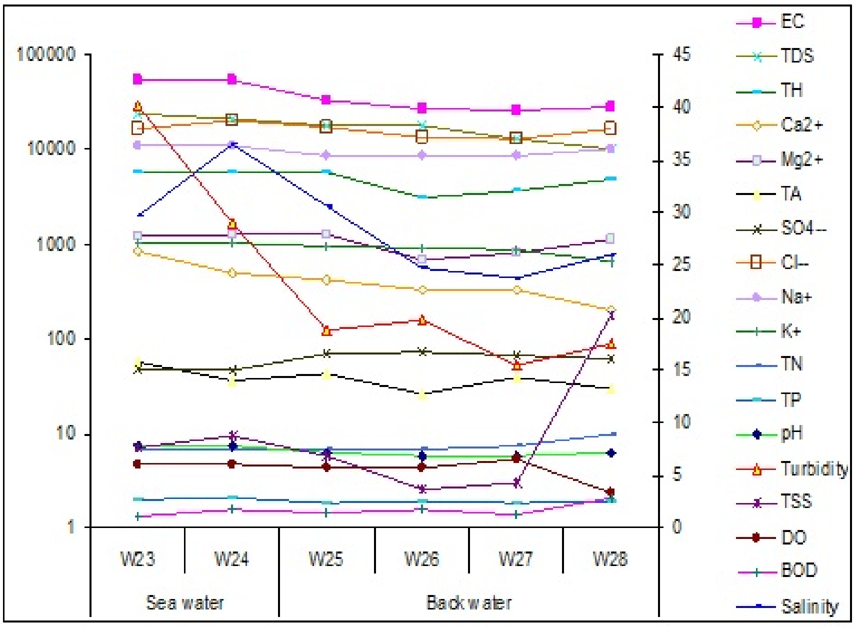

Fig 2. Surface Water Quality

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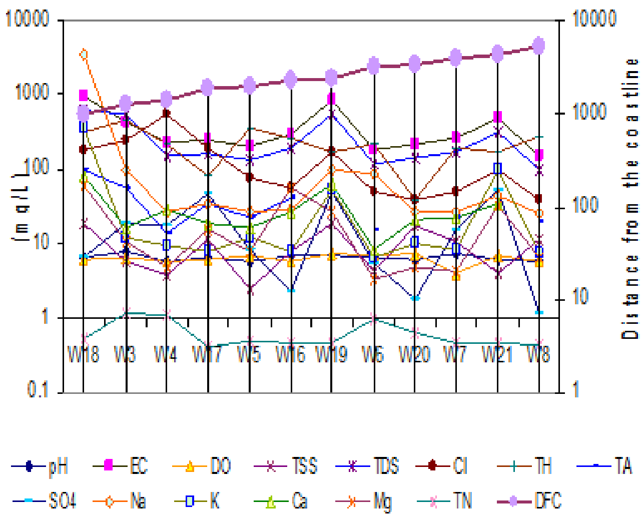

Figure 3. Well Water Quality (<500m from coastline)

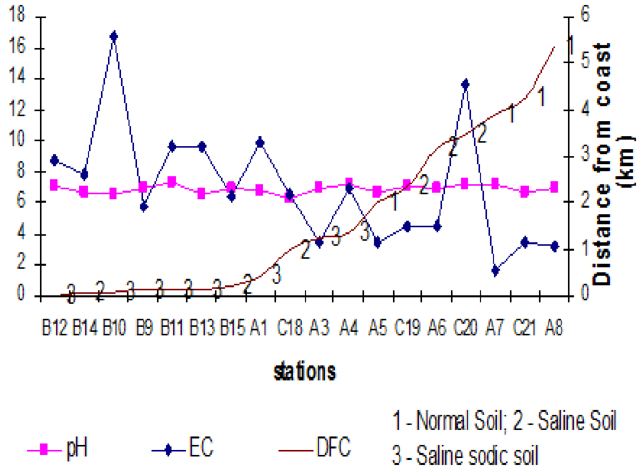

Figure 4. pH & EC association with soil types

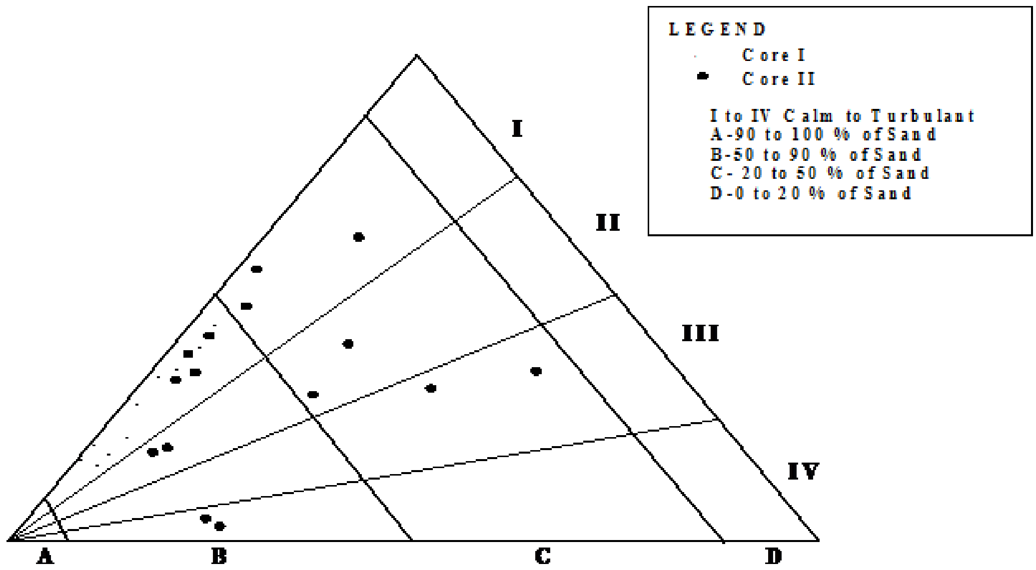

Fig. 5 Ternary diagram showing depositional environment for core I &II.

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