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Post - Tsunamic changes observed in Colachel estuary Kanyakumari District, Tamil Nadu.

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Abstract

Tsunami, the killer wave which occurred 26, December, 2004 in the south – east coastal areas of Tamil Nadu, India, has caused high disaster in most of the coastal belts of south India. This natural calamity has changed the geographical profile of the coastal areas and nearby places. Physico – chemical parameters of Colachel estuary studied from March 2009 to October 2009 were compared with the data collected during October 2003 to May 2004 to know the pre - and post - Tsunamic status of temperature, pH, Biological Oxygen Demand, salinity, alkalinity and Dissolved Oxygen with the Colachel estuary, South India. The analysis of the two sets of data showed clear evidence that there were remarkable changes in the water temperature, pH, dissolved oxygen, salinity, alkalinity and the Biological Oxygen Demand was lower in the period subsequent to the tsunami.

Keywords: alkalinity, disaster, salinity, tsunami and water quality

INTRODUCTION

Tsunami, the killer wave which occurred on 26th December 2004, in the South - East coastal areas of Tamil Nadu, India has changed the geographical profile of the coastal areas and nearby places. The tidal waves caused opening up the mouth of estuaries, so to a greater extent seawater got landwards (Murugaesan *et al.*, 2006).

The word estuary refers to a semi enclosed body of water, such as a river mouth or coastal bay where the salinity is intermediate between the sea and fresh water and where tidal action is an important physical regulator and energy subsidity (Odum, 1971). Estuarine ecosystem is unique in embracing a plethora of microbial populations, especially the heterotrophic and coliform groups of micro organisms. The immense numbers of these small organisms play a major role in the decomposition of organic matter, dissolution of inorganic insoluble salts and in the regeneration of nutrients. (Pomeroy *et al*., 1965).

The changes caused by the Tsunami along the Tamil Nadu coast was discussed by Jayakumar *et al.*, (2005). The increase in the suspended sediment concentration along the South, West, East coast is shown by remote sensing data by Ramachandran (2006) and it is reported that Tsunami churns the shallow water sediments and increases the sediment load in coastal waters suggesting strong turbulence and mixing in near shore water. Further, the Department of Ocean Development, Government of India (2005) has published a preliminary report on Tsunami from affected areas of Tamil Nadu and Kerala coast and discussed the change in chemical and biological properties.

The force of the tsunami destroys all structures that it comes in contact with and thus results in excessive debris. These debris are then dumped on the coast by the action of the waves and such coastal dumpings pollute the coastal waters (Rosamma *et al.*, 2005). The run up waves flushed out many inland water, creeks, estuaries and lagoons. During this process, changes in the water quality are due to flushing of a lot of contaminated sediments and water into coastal area occur resulting in the depletion of oxygen and increase in salinity.

The p^{H}, dissolved oxygen, alkalinity and the dissolved nutrients are important for the phytoplankton production. Temperature, pH and dissolved oxygen are the important factors which control the exchange of nutrients between the sediment and water (Basis and Agarwal, 1990). Changes in water quality such as temperature, salinity, oxygen, nutrients might affect the migration of fishes and their distribution domain, this will in turn affect the survival of young ones especially the larval forms, finally the bio-diversity will be affected (Pauly, 1980). The present study was undertaken as a first step towards monitoring some selected basic environmental characteristics in the Colachel estuary, South India after Tsunami and the study was carried out from March 2009 to October 2009.

MATERIALS AND METHODS

Description of the study area

The present study was carried out in Colachel estuary, located in Kanyakumari district of Tamil Nadu state.

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The estuary is formed by the confluence of river *Kothaiyar* with the Arabian Sea. The estuary is bound by *Kothaiyar* river basin in the east and flows through *Mulagumoodu*, *Thickanamcode* and Colachel villages and discharges into the Arabian Sea. The catchment area is 89.75 Km^2. It is a bar built estuary containing a chain of sand bars along the shore between the sea and the estuary. The estuary is having a length of 9.1 km and a width of 75-325 meters. This estuary receives the *Pampoori Vaikal* at *Kurumbani* about 0.5 Kms ahead of the mouth. Intensive coir retting is carried out along the banks of the *Vaikal*.

Description of sampling stations

For the present study, three stations were selected in the estuary.

Station I :- Bar mouth region

Station II :- 100 meters away from barmouth

Station III :- 300 meters away from station I and station II.

The water samples were colleted at monthly intervals from March 2009 to October 2009. Samples were collected periodically every month morning hours between 6.00 and 9.00 A.M with the help of sterilized wide mouth screw capped bottles. Temperature was recorded on the spot using centigrade thermometer. The parameters like p^H, alkalinity, dissolved oxygen, Biological Oxygen Demand and salinity were estimated according to standard methods (APHA, 1995).

RESULTS AND DISCUSSION

The physico-chemical characteristics of water (Before and after Tsunami) during the eight months study are as given in Table 1. The water temperature data showed a wider range after the tsunami varying between 28^{0}C and 34^{0}C compared to the pre-tsunami condition of 26^{0}C and 31^{0}C. An increase of 2^{0}Cand 3^{0}C is observed in the post-tsunami period. This change is significant since temperature is an important factor which regulates the biogeochemical activities in the aquatic environment (Sondergaard and Sand - Jenson, 1979). Water temperature influences aquatic weeds, algal blooms (Zafer,1968) and surrounding air temperature (Gupta and Sharma, 1993). Further more, all metabolic and physiological activity and life process such as feeding, reproduction, movements and distribution of aquatic organisms are greatly influenced by water temperature (Spencer and King, 1989).

p^H varied between 7.5 – 8.9 before tsunami and 8 – 9 after tsunami. The p^H was the in alkaline range with a maximum after tsunami. p^H values above 8 in natural waters are produced by increased photosynthetic rates that demands more CO_2 than quantities furnished by respiration and decomposition. The p^H of the water also depends on the relative quantities of calcium, carbonate and bicarbonate (Subala and Wani, 1990).

The dissolved oxygen values were higher after tsunami (2.01 - 3 ml / l) than before tsunami (1.5 – 3.9 ml / l). The salinity values were also higher after tsunami (12.9 – 18 ppt) when compared to the values before tsunami (11.5 – 17 ppt). Salinity was found to be the most fluctuating parameter with a wide range of variations due to tsunami. The alkalinity values were higher after tsunami (118.2 – 160.2 mg/l) when compared to the values before tsunami (101.7 – 165 mg / l). The alkalinity of water depends on the carbonate and bicarbonate ions solely and to lesser degree on magnesium, sodium and potassium. Some amount of them is used by phytoplankton as carbon source (Ahmad and Singh, 1993). The present results support the statement of Mohapatra (1987).

Marked reduction (2.1 – 5.1 mg / l) is noted in the Biological Oxygen Demand values after tsunami, as prior to the tsunami, the Biological Oxygen Demand values ranged between 3.49 mg / l – 5.50 mg / l. Biological Oxygen Demand is governed by the photosynthetic activity and aeration rate (Gautam *et al.*, 1993). The distribution of Biological oxygen demand in the estuary water is governed by a balance between

Table 1. Water Physico-chemical characteristics at Colachel Estuary before (October 2003 to May 2004) and (March 2009 to October 2009) after Tsunami

Parameter	Period	Pre Monsoon		Monsoon		Post Monsoon		Summer	
		Min	Max	Min	Max	Min	Max	Min	Max
Temperature (^{0}C)	Before	26	30	27	28	26.51	27	29.61	31
	After	29.54	31	28	30	28	30	32	34
P^H	Before	7.98	8.5	7.97	8	7.98	8.5	7.5	8.9
	After	8.5	9	8.2	8.5	8	8.5	8.5	9
Dissolved Oxygen (ml/l)	Before	2.01	2.5	2.13	2.9	2.36	2.9	2.41	3
	After	3	3.5	2.90	3.2	1.5	3	3.9	4
Salinity (ppt)	Before	16.56	17	12.08	14	12.5	13	11.5	14
	After	15.3	14	15.3	16	17.3	18	12.9	14.5
Alkalinity (mg/l)	Before	161.71	165	135.31	140.5	105.4	111.4	101.7	105.2
	After	150.4	155.2	154.01	160.2	130.2	134	118.2	120.2
Biological Oxygen Demand (ml/l)	Before	3.49	4.5	4.51	5.1	4.74	5.50	4.13	5
	After	2.51	3.1	2.11	3	4.01	4.5	4.21	5.1

input from the atmosphere, rainfall and photosynthesis and losses by the chemical and biotoxic oxidation. This is in support of the findings of Moss and Balls (1989).

The present study elucidates the effects of tsunami on some physico – chemical parameters of an estuary. The direct environmental impacts of the tsunami might be due to various factors notably the bathymetry and geomorphology of the coastline. Changes in the coastal geomorphology after tsunami were recorded by the National Department of Ocean Development and also reported by local fishermen.

The changes noted may be due to the churning of the bottom and vertical elevation of waterbody to the surface caused an increase in the suspended load as a result of turbulence caused by the tsunami (Ramanamurthy *et al.*, 2005)

The results of the present study show that after tsunami considerable changes have occurred in the physico – chemical characteristics. These changes will have telling effects on fisheries both in the short term and long term (Ross and Thenmozhi, 2005).

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