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Research Paper

Impact of *Gangasagar Mela* on Sustainability of *Sagar Island*, West Bengal, India

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Abstract *- Sagar Island, the largest delta of Sundarbans island complex with an area of nearly 240 sq. km. and with 1.60 lakh population, defines the south-west boundary of Sundarbans. Due to the complex interplay of natural dynamics and human intervention, the sustainability of the island is under threat. Sagardwip, a densely populated island, always faces impacts of adverse anthropogenic activities and socio-ecological practices. A balancing mechanism of environmental management of the coastal zone is therefore an important issue for its sustainability. In reality, the annual gathering in Gangasagar Mela (GSM) – a famous religious Hindu festival, one of the major income generating activities of the island dwellers frequently imposes public health problem in form of organic pollution of the water bodies. Sometimes it leads to socio-economic instability also. In this present work a pilot study has been carried out to estimate the pollution potential of the annual gathering on water bodies in and around Sagar Island including Bay of Bengal. Comparison of pre- and post- gathering water samples shows a tendency of tremendous water quality degradation, especially in respect to the organic pollution, which can be easily accounted by total and fecal coliform bacteria count. One to one interview of local residents and health workers too confirmed the public health problems subjectively. The site specific nature of degradation has clearly indicated that the worst source of pollution is the festival ground itself. However, a thorough environmental impact assessment of the area is needed to make a judgment on the effects of such religious gathering to maintain an overall sustainability of the coastal zone.*

Keywords: Gangasagar mela, Religious gathering, Water pollution, Coastal sustainability.

Introduction

Sagar Island is the largest island among the whole Sundarban island system and situated under the administrative jurisdiction of the district South 24 Parganas of West Bengal. It is also the most inhabited island of the state and is on the verge of vulnerability due to enhancing population pressure and environmental degradations like erosion etc. The net land loss of the island due to erosion is nearly 30 sq. kms. in last 30 years[1,2]. However, besides agriculture and fishing – the two major sources of income of the local people, the other economic backbone of the area is yearly *'Gangasagar Mela'*(GSM). In the winter, pilgrims from all over India celebrate the holy dip at the confluence of the River Ganges at Bay of Bengal near *Kapil Muni Ashrama* on the dawn of the last day of month of *Poush* (*Makar* sankranti) as per Bengali date system (Second week of January). Over a few lakhs of pilgrims from all over the India visit the place every year and nearly 2, 00,000 of them prefer staying there for 2 to 5 days [3]. Consequently, the soiling of GSM ground pollutes adjacent streams, rivers and coastal sea. Besides different well-discussed sources of water pollution, such yearly religious occasion also is very much responsible for the same.

Mark Twain, who traveled the Ganges in 1896, found the water at the city of Varanasi (Benares) "nasty" on account of the "foul gush" of its sewers. Even a century later, by 1990, 450 million people lived in the basin — and some 70 million discharged their wastes into the Ganges. Almost all the sewage reaching the Ganges, in 1990 as in 1900, went untreated. Decay of waste materials robbed the river water of oxygen, degrading fishery resources through suffocation. The menace continues to grow even after discharge into the sea water [4].

In the field of organic pollution in rivers, India has one of the worst scenarios. As per the *Cleanganga* website report (2002)[5] organic pollution in Indian rivers is 1.4 times the world average, partly because of excessive levels of human waste, which are three times larger than elsewhere and 50 times the standards set by the World Health

Organization. Government clean-up efforts started in the 1960s and coordinated into the 'Ganga Action Plan' in 1985 had little discernible effect [6].

However, in case of Sagar, the problem is recurrent but for very short duration. It is worth mentioning that one of the most major sources of income of this locality comes from this yearly 'Gangasagar mela'. Annual monetary involvement during the GSM is about Rupees Rs 20 millions of which only 20% is spent on permanent assets. And the rest roll over within the local, as well as regional economy. An estimated 67500 man-days' of jobs are created in the informal sector during the occasion of GSM [7]. The local people get themselves involved directly or indirectly with the 'GSM' through various types of business such as transport, marketing, food & lodging etc. of huge pilgrims gathered from all over the India. Thus during this GSM the economy of Sagar island boosts up. Income of the local people increases to a great extent and consequently the purchasing capacity of local people increases. They can easily meet up their liabilities and debt, if any, from the profit. Since millions of pilgrims of different socio-cultural status are crowded in this GSM, several types of culture are mixed and developed here resulting to a betterment of socio-cultural scenario of the region.

But this temporal benefit brings in environment degradation day by day. The waste by millions of pilgrims and others causes an undesirable change in the physical, chemical and biological characteristics of the air, water and land. It harmfully affects the health, survival or activities of humans or other living organisms. Thus, the environment of the region is being polluted gradually and it poses threat to the sustenance of mankind in the long run.

Considering the contradiction in sustainability aspects of the island, with such a gathering, the present study has been designed to assess the overall effects of GSM on the local environment including socio- economic aspects.

Material and Methods

The study is a trial and done within a very short period, but with a systematic sampling procedure. Pre and post GSM samplings were done 10 days prior and a week after the actual religious event.

A total of five water-sampling sites were chosen around the main GSM ground centering the *Kapil Muni* ashram. The five sampling sites were situated in a continuous water stream, which drains the major portion of waste generated. The extreme points were situated at sea beach (Figure 1).

However, to understand the actual condition or rate of natural cleaning another sampling was done two months later and treated as baseline condition for the same five points.

The analysis of water was carried out following the standard methodologies as approved by scientific communities [8,9]. Temperature, pH, and electrical conductivity and Dissolved Oxygen were estimated at site, where as Hardness, BOD, COD and fecal coliform were estimated at laboratory.

In addition to the sampling and analytical procedures a preliminary socio-economic survey was also done for better understanding of the socio-economic dependence and impact of the GSM among local residents. 35% of the total villages of the island were chosen through systematic random sampling procedure and five households from each of the villages were surveyed. The survey design was so arranged that a very preliminary assessment of developmental parameters like Marginal Poverty Index (MPI) and Human Development Index (HDI) could be done. However, some of the methodologies were little modified from established methods, to incorporate the regional variability[10].

Results and Discussion

The comparative study of environmental parameters indicated a degradation of quality of environment basically by human waste, and it showed a persistent nature for at least one to two months (Table 1). As the sampling dates for pre and post GSM period were with an interval of nearly three weeks, the weather conditions were to some extent similar. Because of the similar weather and tidal phases during subsequent sampling, any influence of temperature and tidal conditions can easily be overruled during analysis of the changes occurred. During the sampling in the month of March (pre monsoon) the climate condition differed and was indicated through higher salinity (EC_e) and hardness values. However, the concentration goes down in Monsoon season due to huge fresh water discharge through the river and natural cleaning process remains operating [11].

As expected, the worst affected parameter of the environmental quality was found to be the bacterial count of the surface water followed by the hardness and dissolved Oxygen. While the enhancement of fecal coliform count were between 1.5 to 34 times depending upon the specific site locations during GSM period, the depletion of dissolved oxygen were at most 7 per cent, with up to 80 per cent increase in hardness. Comparatively higher degradation of seawater quality in respect to the organic pollution has been reported at the Eastern side of Sagar beach at Dhablat, where the Sagar canal meets the Bay of Bengal. The maximum organic pollution was found at Canal near Jhauban, which is nearest to the temporary toilet complex and also an area of fish drying.

However, during the sampling two months post-GSM, the coliform count found decreased significantly in canal water and sea beach where as the high count of coliform prevails in sampling point behind Kapilmuni ashram, an area with regular pilgrimage. Additionally, it is also to be noted that, in spite of significant reduction from the time of GSM, the beach water continued to have high coliform count in general. These trends seem sufficient to hold the pilgrimage activities responsible for coastal pollution especially of human origin, which get worst during the annual gathering. See Table 1.

An earlier study in 2003, by two of the authors of this paper, found similar trend for coliform count in three of the same sampling points, which in absence of a regular monitoring data for water quality, may act as a temporal evidence for validation of such quality degradation. See Table 2.

Most surprisingly, the parameters like BOD and COD showed a steep decline in post GSM period, which is in most of the cases unusual to see. A post sampling visit and dialogues with the local residents revealed that the major and unmanaged waste disposal prompted high BOD and COD loads during the preparatory phase. It is also noted

that maximum COD and BOD was reported from the central area, just behind the ashram – which tackles maximum development including painting activities during preparatory phase, and gradual decrease was found towards to the sea. It was also found that at the time of pre-GSM sampling, the area received a good number of tourists, but without any waste management drive, like that was visible after the GSM was over. Huge flashing of sea and fresh water as well in the post-GSM session may have contributed to flashing the oxygen demanding waste materials out of the area. But, all these are mere presumption on the basis of a few substantial evidences, and the trend needs a rechecking in subsequent years. However, the conditions were found prevailing over time and nearly similar values of BOD and COD had been reported in third sampling, except two sampling points at beach. This strengthens the presumption further.

The people of the villages situated at the northern part of the fairground complained of obnoxious smell and attacks of a few communicable diseases like dysentery, amoeboisis etc. in post-GSM season, provided the breeze occur from sea to land, which generally does not take place in winter. This year, in absence of such breeze, the problem was minimized.

During the same sampling, water was also sampled from either banks of the river Muriganga, which is the only gateway of the island and bear heavy vessel movement during the time. Although being a flowing system any definite quality change is unexpected, but increase in oil and grease was reported.

From this short term trial study at the Gangasagar mela ground at the south of Sagar island near estuary of River Ganges, it seems that the annual fair at the last date of month of *Poush* (as per Bengali calendar) or in the middle of January commit a lot of pollution at the locality and adjacent Bay of Bengal coast as well. In present situation when the island along its coastal stretch is facing the verge of erosion and is getting vulnerable day by day, such ill managed repetitive religious pollution may intensify the destruction of local environment. Though this festival is a part and parcel of living of the local inhabitants in respect of economic, social and cultural development, there is a need to check the growing pollution to save the environment on the part of the State Govt. as well as the local people. However, some sorts of effort to restrict the prolonged stay at the fairground and cleaning of the environment had already been taken by the authority.

Also the authority needs to set the limit of gatherings according to the carrying capacity of the GSM ground which depends on proper infrastructure such as housing, latrine, toilet, bathing ghat etc. to minimize the pollution. A thorough study with more extensive environmental quality monitoring of the area is to be done to make a proper assessment of the effects of such religious gathering on a vulnerable coastal zone.

The simultaneous socio-economic survey with a few sampled villages and subsequent calculation of HDI and MPI presented some unique trends. Higher HDI was reported at areas alongside the arterial road of the island. Interestingly, MPI of those areas too showed lower value, which is indicative of a better economic stability correlated with infrastructure development. In fact, improvement in infrastructural facilities in the GSM ground along with a control over the stay of pilgrims during the gathering showed significant betterment in the environmental conditions in recent years. Additionally the island has high potential of ecotourism development [3], which may strengthen the economic background of the local inhabitant throughout the year.

Conclusion

Sustainability depends on linkages among several components, and it remains hard to identify any particular responsible factor, which reduces or enhances the same. This year, while some efforts, like restricting the pilgrims' stay, shifting of temporary structures etc. were found promoting better environmental condition during and post GSM period, on the other hand, these restrictions reportedly led to a cut in profit levels of the local people damaging economic sustainability. On the contrary, the preliminary assessment of HDI & MPI too is indicative of inequality in resource distribution. Hence, the central question of the study that relates to the systems sustainability related to the GSM needs further detailed studies and formulation of an integrated management covering all these issues.

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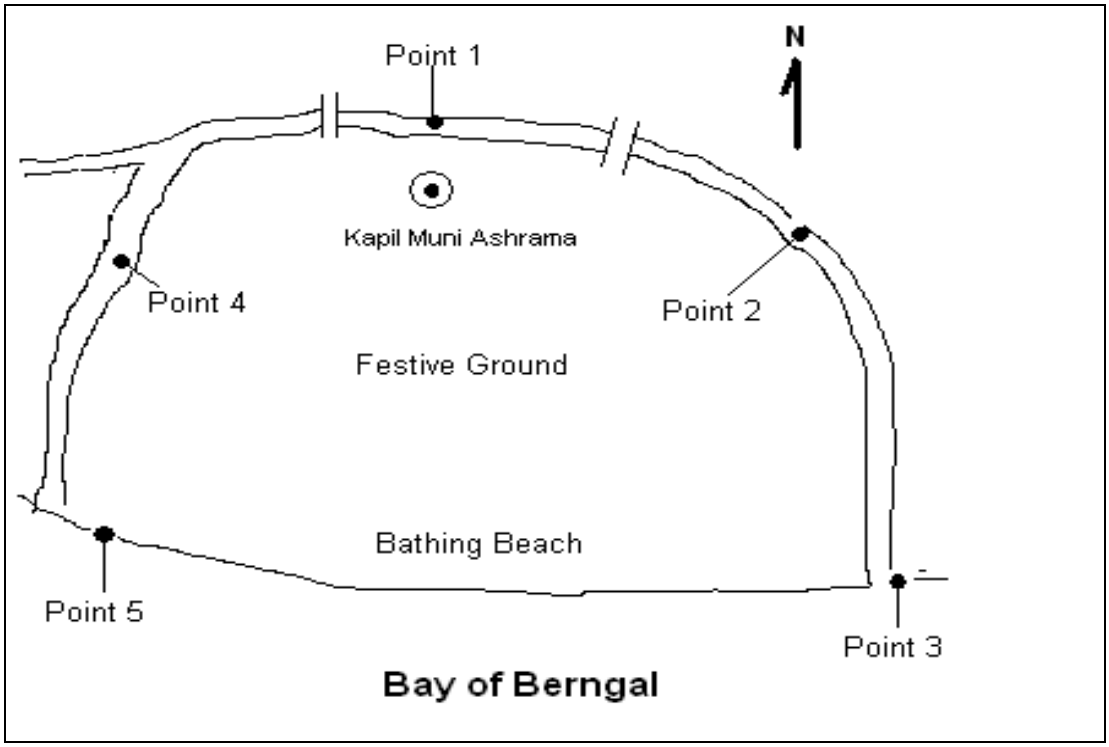

Figure 1: Schematic Diagram showing placement of five sampling points at the festive ground

Table 1: **Water quality in five different points of Sagar Island in Pre and Post-GSM periods**

Site and Period ***Pre GSM (Pre)*** ***Post GSM (Post)*** ***Pre Monsoon (PM)***		**Temp. [°C]**	**pH**	**E.C [dS/m]**	**TSS [mg/l]**	**Hardness [mg/l]**	**D.O. [mg/l]**	**COD [mg/l]**	**BOD_3 [mg/l]**	**Fecal coli [MPN/ 100ml]**
Sagar canal Point – 1	*Pre*	24	8.2	29.39	54	3044	8.6	102	21	1770
	Post	21.5	8.0	34.12	25	4400	8.3	14.3	2.9	5836
	PM	28	8.3	40.78	364	4299	7.1	16	BDL	5882
Dhablat Khal Point – 2	*Pre*	22	7.5	22.44	51	2076	8.0	32	3.8	3800
	Post	22	8.5	35.5	62	3739	8.3	17.9	3.0	5836
	PM	28	8.2	41.99	346	4397	7.4	17	2.2	1256
Dhablat beach Point – 3	*Pre*	18	7.9	30.99	38	2920	8.7	16	2	220
	Post	21	8.5	36.46	42	3855	8.3	19.4	2.6	7353
	PM	30	8.6	42.46	615	4006	7.1	36	3.6	2269
Jhau ban Khal Point – 4	*Pre*	22	7.5	30.20	24	2795	8.7	25	3.0	2590
	Post	21.5	8.5	36.46	52	4295	8.1	17.5	2.4	14857
	PM	30	8.4	42.36	90	4494	7.6	15	BDL	353
Jhauban beach Point – 5	*Pre*	21	7.2	32.01	31	2671	8.4	47	8.5	1600
	Post	21	8.5	36.5	77	4295	8.4	5.7	<2.0	4746
	PM	29	8.5	42.64	145	4592	7.6	18	BDL	1004

Table 2: Water quality in three different points of Sagar Island in Pre and Post-GSM periods in 2003

Site and Period		**Temp.** [^{o}C]	**pH**	**E.C** [dS/m]	**Hardness** [mg/l]	**D.O.** [mg/l]	**Fecal coli** [MPN/ 100ml]
Sagar canal **Point – 1**	*Pre*	26.4	8.00	232.0	3120	8.10	5.0
	Post	29.1	8.32	306.0	3680	5.47	170
Dhablat beach **Point –2**	*Pre*	22.5	7.88	289.0	4160	4.86	9.2
	Post	25.1	7.93	342.0	4600	4.67	200
Jhauban beach **Point – 3**	*Pre*	21.7	7.88	233.2	3440	5.06	16.0
	Post	26.2	8.13	340.0	4680	4.18	190