



## Review Paper

# Environmental Degradation – A Major Problem in Flourishing Coastal Tourism at Ganga Sagar Beach, West Bengal, India

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## Abstract

*In the extreme south of West Bengal, on the island of Ganga Sagar, in the lap of the Bay of Bengal, the world-famous Ganga Sagar is visited by pilgrims every day, but tourists are not seen. In such a holy place where there are countless guesthouses for pilgrims to stay and eat, there are only 20 hotels for tourists. Among the many reasons why tourists do not come to Ganges Sagar, some of the main reasons is that although Ganges Sagar is located along the coastline, its present beach width is narrow, the presence of ditches and channels in various parts of the beach, steep beach slope from the high tide line to the low tide line, turbulent coastal waters, strong movement of waves and tides etc. Currently, this beach is suffering from chronic erosion and so even though the devotees come here, the number of tourists has decreased.*

**Keywords:** Coastal tourism, Beach profile, Sediment transport, TSS, Wave velocity, Soil texture, Coastal erosion, Environmental audit.

## Introduction

**Origin of Coastal Tourism:** The Industrial Revolution of the 18th century essentially introduced a concept of tourism although in the twentieth century coastal tourism was considered for local economic development<sup>1</sup>. At that time, the British government was ruling India. In parallel with various European countries, in this country too, the British rulers took initiatives for various industries and transportation systems in the 18th century through which tourism began.

The work on the construction of the railway line started at that time. Most of the officials involved in those activities used this opportunity to travel and spend their weekends away. For their entertainment, the British government then built tourist centers in various places, especially in the mountains, rivers, forests, and on the seashore. Seeing them, Indians also go out for a trip with their family or friends at least once or twice a year. As the number of domestic tourists began to increase, local people also began to build hotels and restaurants.

Although the beginning of the tourism industry in India was largely a product of the European Industrial Revolution, it was also a factor in the love of nature of various writers and poets like Shelly, Kits, Byran, Wordsworth, Rabindranath etc. in the 19th century which can be expressed as romanticism. People flock to various natural elements and parts of literary creation, such as mountains, rivers, forests, seas, the movement of clouds, and the presence of rain by distancing themselves from the harsh realities of everyday life. The result of all this is tourism.

Bengalis are primarily inspired by the nature, worship and love themes of Rabindranath Tagore's literature and songs.

The tourism industry took a hit after the end of World War II when tourism flooded into the lives of busy people at the end of the week. Just by laughing and loving, it revives people's minds and souls. In a word, tourism was reintroduced after 1945, and the definition of tourism is being redefined from this time. A few years later, ecotourism was added to the nomenclature of tourism based on the diversity and importance of the environment. Then, marine drive, museums, aquariums, and coastal flora are added to coastal tourism. Since the mid-20th century, various factors of coastal tourism have been considered as a combined effort. Financial indicators, stock markets, or financial transactions between different neighboring countries are carried out through the coastal tourism industry. Currently, the IMF and the World Bank have taken on the responsibility of overseeing the well-being of the coastal tourism industry in various developing countries.

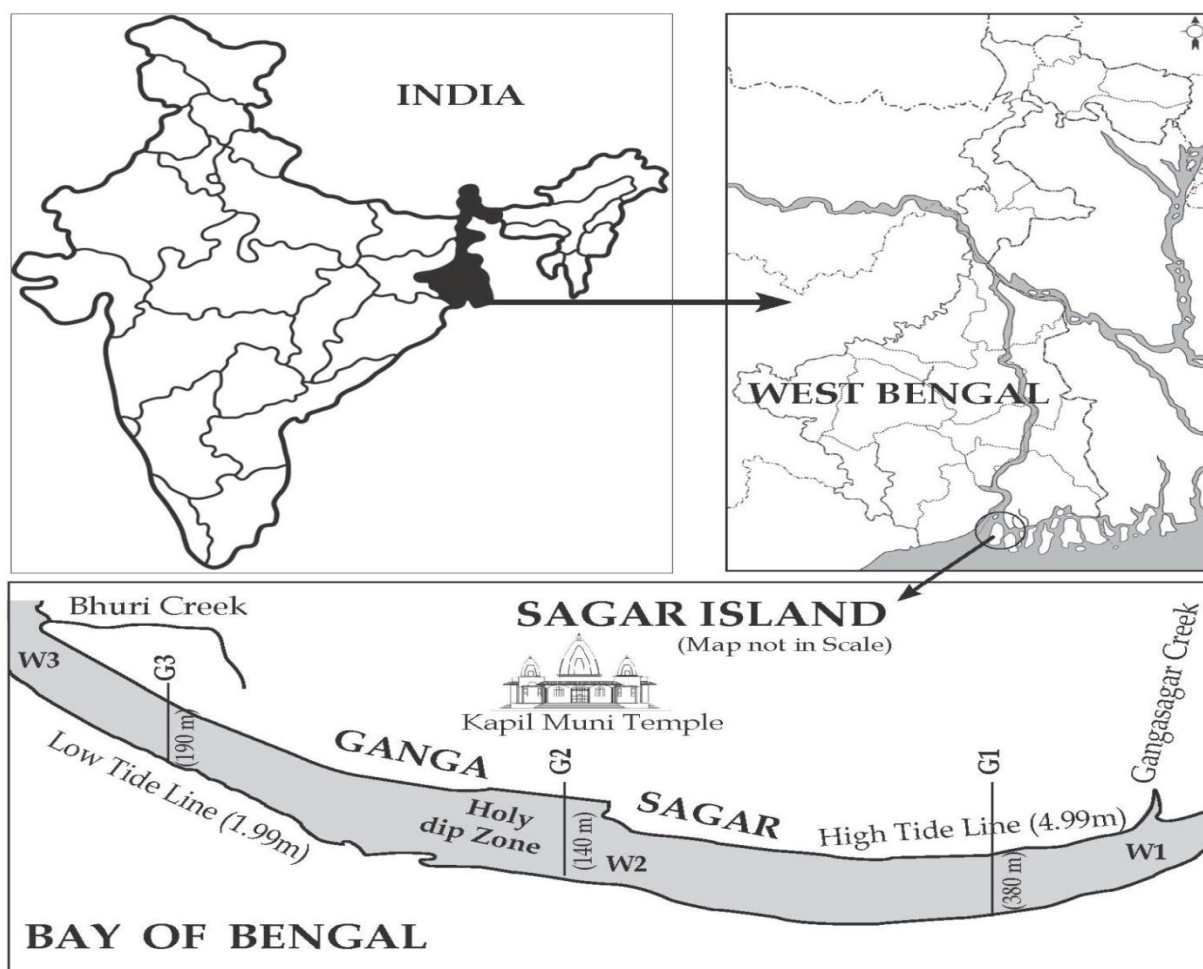
## Coastal Tourism at Ganga Sagar

Although the history of tourism in different places is different, one of the main reasons seems to be that pilgrimages were developed for the purpose of attaining virtue by devotees at holy places. Ganga Sagar, located on the Sagar Island of West Bengal, is a holy place for millions of people to attain virtue (Figure-1). Every year, millions of people gather here to bathe in the estuarine water at the confluence of the Bay of Bengal and the Ganges River on the auspicious day of Makar Sankranti<sup>2</sup>. On this day, devotees from almost all states of India and abroad can be seen. Moreover, on other days of the year, thousands of

people come on an average every day for pilgrimage and after taking a holy bath, they worship Kapil Muni with offerings at the temple located at the end of the beach. However, in nature, they are almost all pilgrims, among whom it is difficult to find tourists. They are never seen spending hours on the waves in the coastal waters like tourists or they are not seen roaming on the shores of the Ganga Sagar. In short, even if millions of people visit Ganga Sagar, it should not be called a tourist center. This place is a pilgrimage site. Tourists generally don't want to come here due to transportation problems and the current beach conditions. Despite all these practical problems, one of the reasons why pilgrims continue to come for their belief is that without suffering, one cannot attain virtue at a pilgrimage site or the blessings of the gods. However, even 40 years ago, this beach was a beautiful natural sand dune that stretched from east to west separating the coastline from the mainland, there was an intertidal zone of about 500m width, and a beautiful natural landscape of casuarina trees beyond the sand dunes<sup>3</sup>.

## Results and Discussion

Although Bakkhali and Digha are popular tourist centers on the east and west sides of the Ganga Sagar, there are several reasons why the Ganga Sagar is not a tourist center like excessive land erosion in coastal areas, steep slopes of coastal areas, lack of coastal vegetation, turbid coastal waters, comparatively higher TSS values, lack of easy access, difficulty in crossing rivers at the right time, emergence of submerged tidal shoal in the river bed etc. There are about 855 hotels in Digha for tourists to stay in, with about 25,000 rooms available. Digha Tourist Center is located on the shores of the Bay of Bengal, just a few kilometers west of the Ganga Sagar. On the east side of the Ganga Sagar beach, Bakkhali and Fraserganj together have about 200 hotels, holiday homes, and numerous government dormitories providing services to tourists. Due to various coastal conditions, the environmental degradation of Ganga Sagar has kept this beach behind Digha and Bakkhali Beach tourism<sup>4,5</sup>.



**Figure-1:** Location map of Ganga Sagar, located south of Sagar Island in West Bengal, showing beach profiling (G1 – G3) and water collection points (W1 – W3).

**Beach Profile:** The coastal region of West Bengal is studded with islands, tidal shoal, series of estuaries, sand dunes, and beaches parallel to the land surface<sup>6-8</sup>. Due to the presence of numerous estuaries, the hydrodynamics here are always active<sup>9,10</sup>. The sedimentary environment of this coastal region formed during the Quaternary age with the sediments supplied by the Ganges, Brahmaputra and Meghna River systems<sup>11-13</sup>. In this geomorphic situation, Sagar Island is located in a vibrant coastal area, with Ganga Sagar Beach on its southernmost side<sup>14</sup>. The length of the Ganga Sagar coastline from Ganga Sagar Creek in the east to Bhuri Creek in the west is about 2.3 km. The Kapil Muni temple is located on the landward side along the middle stretch of this beach. Pilgrims who come to the Kapil Muni temple bathe in the sea water, cross the beach stretch of about 140m, and then offer worship at the temple while soaking wet. The width of the beach stretches adjacent to the Ganga Sagar Creek and the Bhuri Creek are 380m and 190m respectively. The present location of Kapil Muni temple is situated about 5m altitude from the sealevel. During the survey of the coastal profile, the altitudes of beaches at high water lines near Ganga Sagar Creek and Bhuri Creek were observed to be 6m and 5.4m respectively (Figure-2). The beach-width facing the Kapil Muni temple is so short that even a casual visitor stroll here will not be enjoyable. Not only is the width of the beach here short, but the slope of the beach towards the sea is very steep, more than about 4 degrees, which is in no way comfortable for tourists who come here for leisure in the vacation and holidays. Moreover, along the width of the beach, there are some troughs, runnels, or rough surfaces that hinder

the leisurely walk of the tourists<sup>15</sup>. But the runnel or trough located in the beach does not cause any problem to the devotees because they know very well that without suffering, one cannot attain the blessings of the gods.

### Total Suspended Solids (TSS)

Surface water samples collected and tested during monsoon and post-monsoon periods from three locations (W1 – W2) have shown that the amount of TSS is much higher during monsoon than during post-monsoon periods. The Ganga Sagar Mela is usually held on January 14 or 15 every year during the post-monsoon season. TSS of coastal water samples collected near the Bhuri Creek varies from 173 to 410 mg/L at high tide and 220 to 446 mg/L at low tide respectively during monsoon and post-monsoon periods. At the holy dip zone across the Kapil Muni temple, TSS varies from 78 to 282 mg/L at high tide and 147 to 422 mg/L at low tide, and near Ganga Sagar Creek it varies from 45 to 145 mg/L at high tide and 68 to 159 mg/L at low tide respectively (Figures-3 & 4). The TSS level at the coastal waters along Kapil Muni temple is much higher than the permissible limit which is unsuitable for bathing<sup>16</sup>. Tourists visiting the Ganga Sagar beach dislike bathing in this turbid seawater. Rather, tourists like to bathe in the sea near the Ganga Sagar Creek, as the TSS level in the coastal waters is relatively low. However, despite the TSS level being much higher than the permissible limit, devotees take a holy bath in the hope of regaining their sanctity at the coastal waters across the Kapil Muni temple.

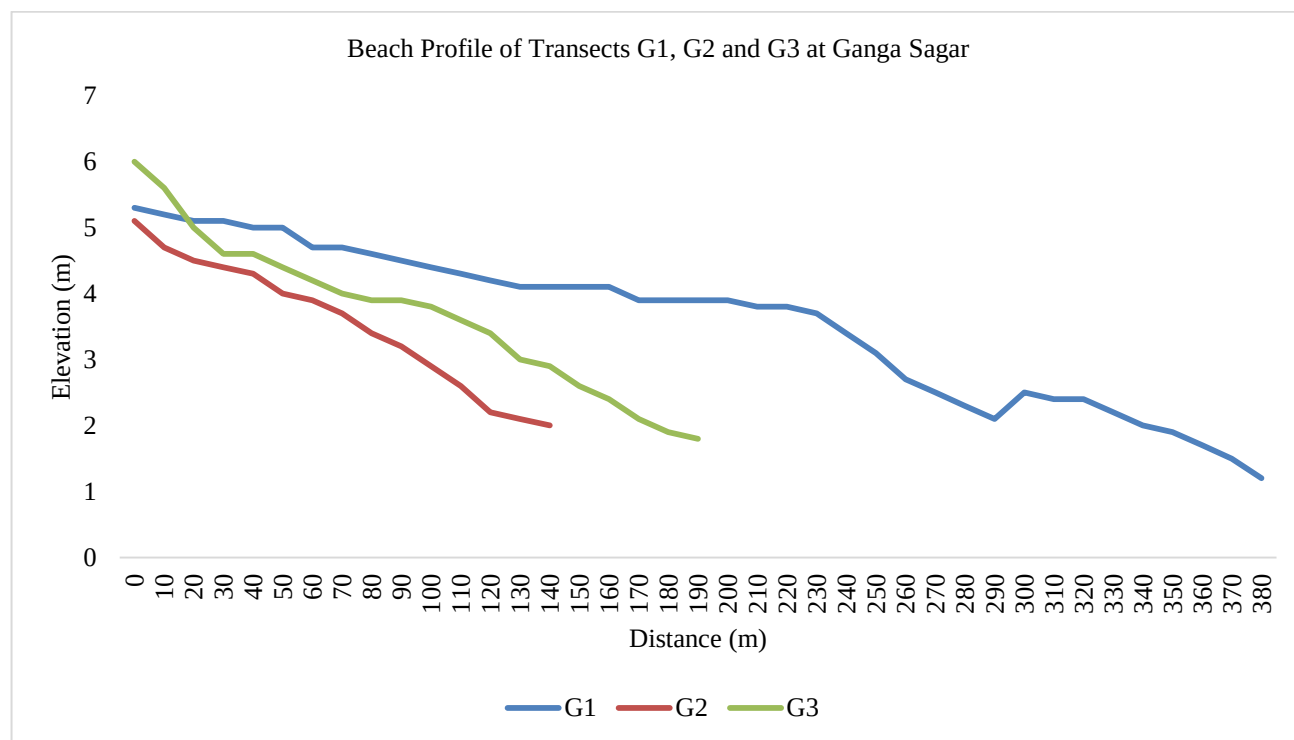
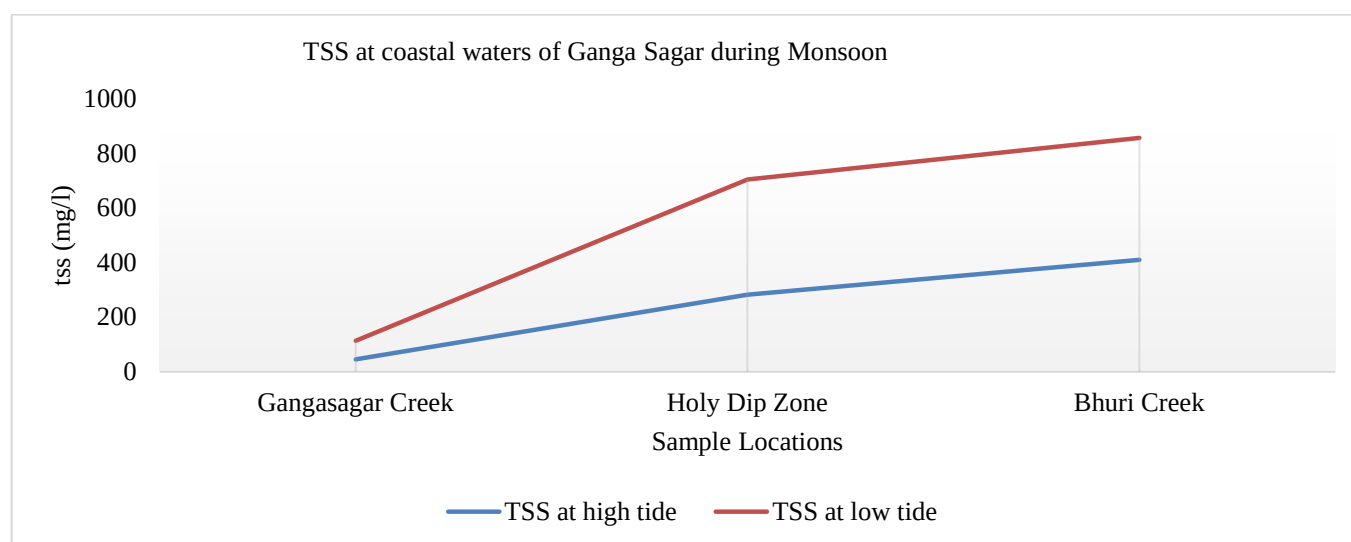


Figure-2: Beach profile of Ganga Sagar beach located at south of Sagar Island.

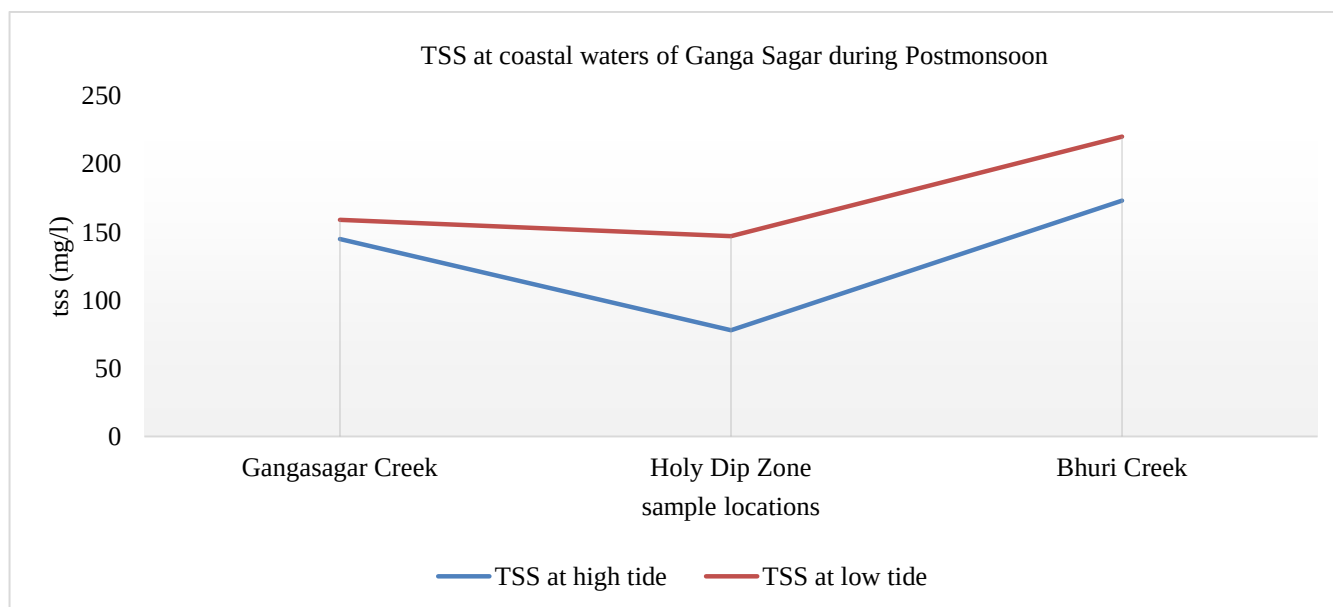
## Sediment Transport

The highest tidal water level that reaches the Ganges Sagar beach, i.e. the high tide line, extending from Ganga Sagar Creek to Bhuri Creek, is 4.99m and the lowest point at which the water drops at full tide i.e. low tide line is 1.99m. The area between this high tide line and the low tide line is the intertidal zone of the Ganga Sagar beach from where 18 sediment samples were collected for sediment texture analysis. Texture analysis has shown that the Ganga Sagar beach sediment is composed of about 97% sand and 3% silt and there is no presence of clay content in the sediment samples. From the cumulative curves drawn on the arithmetic probability chart from the data obtained from the sediment samples, it can be concluded that 25% sediment has been transported through rolling, 75% through

saltation, and the rest through suspension mode of sediment transport<sup>17</sup>. The reason for the sediment transport in the rolling and saltation processes is for the relatively higher velocity of the water in the strong tides in the coastal zone<sup>18</sup>. The residual velocity measured in the coastal zone of Ganga Sagar is 99 cm/s. Due to such intense velocity, the quantity of sediment transported in the 2.3 km stretch coastal area of the Ganges Sagar is  $24.6\text{m}^3/\text{s}$ <sup>19</sup>. Due to the high amount of sediment transport in the Ganga Sagar beach of only 2.3 km in length and 300 m wide, erosion is increasing faster than accretion. The width of the Ganga Sagar beach is decreasing every year due to sediment loss in the beach. The beach is getting smaller, and the number of tourists here is gradually decreasing, although the number of pilgrims is increasing every year.



**Figure-3:** Total Suspended Solids in the coastal waters at Ganga Sagar during the monsoon period



**Figure-4:** Total Suspended Solids in the coastal waters at Ganga Sagar during the post monsoon period.



## Coastal Erosion

Coastal erosion is one of the main reasons for the decline in tourist arrivals along the Ganga Sagar coast due to which the width of the beach is decreasing (Figure-5). The Ganga Sagar coastline, located on the southernmost tip of West Bengal, on the shores of the Bay of Bengal, has been suffering from chronic erosion for many years. Even just forty years ago, a continuous 4-6 m high sand dune stretched from the Ganga Sagar Creek in the east to the Bhuri Creek in the west in the supratidal zone along the Ganga Sagar coastline. That sand dune completely disappeared about 20 years ago. If a coastline is characteristically stable and a natural disaster such as a cyclonic storm causes erosion occasionally, then that erosion is called acute erosion. But Ganga Sagar Beach is not included in the acute erosion because this erosion process is ongoing. So, the erosion of the Ganga Sagar coastline cannot be called acute erosion, but rather this type of erosion is chronic erosion<sup>20</sup>. Due to land erosion along this stretch, the sea has advanced about 77m towards the land in the last five decades with the average rate of erosion 1.54m per year. Coastal erosion is occurring due to the characteristics of hydrodynamics in this particular situation. The Hooghly River and its tributary Muriganga prevent from supplying sediment to the coastal areas of Sagar Island. Almost no amount of the sediment carried by the Hooghly River into the Bay of Bengal returns to the coastal areas due to the winnowing action. Therefore, under the influence of tidal currents, the intensity of waves, and the

occasional fierce cyclonic storms that rise from the Bay of Bengal, the Ganga Sagar coastal zone is constantly eroding along the southern tip of Sagar Island<sup>21</sup>. Even about four decades ago, there was a lower intertidal zone of about 300m width with various types of sedimentary structures<sup>22</sup>. As a result of chronic erosion, the zone has now become a subtidal zone that is no longer visible when the tide recedes.

## Environmental Impact on Coastal Tourism

The coastal tourism industry has had quite both positive and negative impact on the environment<sup>23</sup>. Around 13% of total carbon emissions worldwide are due to transportation, with tourism contributing to some extent because tourism is inextricably linked to transportation. Moreover, due to tourism, hotels keep lights on all night, use and waste a lot of water, throw away half-eaten food, and leave food or drinks unattended. No member of the tourist community usually forgets to throw away or waste all these things while sitting at home. Yet tourists refrain from wasting food, water, or electricity in their own home environment. The most environmentally damaging aspect of the tourism industry is the indiscriminate use of land to build hotels or restaurants. Illegal construction on the coastline within the coastal regulatory zone, disregarding government regulations, is very harmful to the coastal ecosystem. And if that coastal area is located near a pilgrimage site, then finding a solution to the problem becomes difficult.



**Figure-5:** Due to strong tidal currents and devastating waves, the width of the Ganga Sagar beach is decreasing every year because of chronic erosion.

## Conclusion

The area of the Ganga Sagar coastal plain is gradually shrinking due to the strong velocity of tides and waves, and the chronic erosion of the coastal plain. The beach slope has become relatively steep, causing the current to flow erratically. Tourists who come to visit Ganga Sagar beach are afraid to go into the sea and play water games here. There is currently no lower intertidal zone at the southern end of the beach where tourists can enjoy sea bathing. Moreover, the main destination of Ganga Sagar tourist spot cannot be reached in less time because of the difficulty of reaching Ganga Sagar by road. Once the tide recedes, the vessel ferry service to Sagar Island is suspended. The riverbed of the Muriganga River has been filled with sediment and formed a huge submerged tidal shoal in the thalweg of the river. With all these conditions, turbid coastal waters are detrimental to the health of coastal ecosystems<sup>24</sup>. Moreover, land erosion at Ganga Sagar beach cannot be solved in any way due to changes in the sedimentary transport channel and lack of sediment supply. Despite so many problems, the Ganga Sagar beach can be the socio-economic foundation for local people<sup>25</sup>.

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