



RAPID GROWTH OF COASTAL TOURISM IN DIGHA AND ADJACENT AREA OF COASTAL MEDINIPUR AND ITS IMPACT ON ENVIRONMENT

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Abstract

The ecological destruction due human intervention has set the popular paradigms in environmental and social sciences. Ecological aspect and its related dynamics in spatial context are analysed in Biogeography, while spatial perspective human intervention on ecology and environment occupies the domain of environmental geography; on the other hand, human activities and its impact on economy and culture is highlight in social geography. The foregoing investigation is therefore an attempt to glean out the social perspective and ecological backlash of due to rapid growth of coastal tourism along the Medinipur coast. Present investigation crops up all those under the tune environmental and social impact assessment of tourism Therefore, study of coastal ecosystem and its change due to rapid intervention in some pockets of the study area is the major consideration and protection and conservation of fragile ecosystem is the goal points.

Key Words: Ecology, Popular Tourism, Eco-Tourism, Coastal Ecosystem

I. INTRODUCTION

Ecology and economy are the two side of the same coin i.e.; they are the most important integral part of human civilization. Due to continuous promotion of urban- industrial civilization economy is continuously experiencing fashionable growth with a recent transformation through tourism industry in different parts of the world and also in India. Tourism though popular mode and even eco-tourism are gradually or sometimes rapidly dethroning the ecological balance which may cause instability to both economy and ecology of sensible natural spots like forest area, wildlife sanctuary, estuarine ecosystem, coastal area in near future.

Tourism is now recognised as a major industry. Recently tourism along with popular ecotourism and homestay tourism with a perspective of nature's beauty have become more attractive to the tourists. Today's life is become full of hustle and bustle; so urban people being frustrated in hasty life frequently visit to the natural sites to avoid monotony. This gathering of tourist and their activities has popularised the tourism in such places. Tourism activity in Digha and also in other points of coastal areas of East

Medinipur, West Bengal is experiencing stupendous growth for the last thirty years that has dethroned the ecological rhythm of the dune based coastal tract. In 1990-95 onwards this activity invariably leads to accelerated urbanisation, road construction, hotel industry and small shop keepers encroached upon the coastal area illegally. These activities create direct impact upon environment. Whereas some other areas are experiencing eco-tourist spot. Therefore, this presentation attempts to unfold the pros and cons of environment impact of popular and eco-tourism in the coastal areas of East Midnapore.

II. CONCEPTUAL FRAMEWORK

Popular tourism is associated with problems due to increasing human activities in the natural sites. In the present context rapid growth of popular coastal tourism has developed rural economy at the cost of coastal ecology. In a whole it initially focusses on natural fragile ecosystem and its interaction with human ecosystem resulting into some change that is putting questions on the sustainability of coastal ecosystem and its related ecology. Therefore, it involves an understanding of the: facets of the coastal ecosystem, its components, principle and interactive interaction with human ecosystem which is adversely affected by the development of popular tourism with successive changes in ecology (ecosystem changes - availability of different faunal species, floral or vegetation cover, physical property, CRZ violation) and its backlash (due to tourism and human interventions).

III. LOCATION OF THE STUDY AREA

The study area not the coastal zone of East-Medinipur of West Bengal but the different points of coastal stretch along the coastal beach where the human intervention of coastal ecology is more pronounced by tourism.



Figure 1. Location of the Study area

The coastal areas East Medinipur in general and of Digha in particular have a fascinating environment with sand dune, natural vegetation, sea waves and most prominently the sea beach (Fig. 1). View of sun rise and sun set and the sea breeze are important features which attract the tourist. This is a transitional zone in between land and sea where 'the forest are whispering, sea is roaring, the flora and fauna are blooming and where visitors can rejuvenate themselves in the company of sand dunes, sea beaches and sun in the pristine open air' (Mondal et al., 2013).

IV. OBJECTIVES

Interactive interaction with human ecosystem and its impact with the complex interaction is a burning issue of recent time. So, to assess the Impact of Tourism related hyper economic growth and its impact on coastal ecology and society.

Therefore, the following are the points to curve out the scenario:

- i) To figure out the growth of tourism and economy of this area and
- ii) To find out the impact of tourism on ecology

V. METHODS AND TECHNIQUES

As the Study tries to find out the impact of tourism on environment and society some field based measurement, simple statistical techniques and land use analysis by soft wares are used. Time series analysis is used to depict the growth of the tourists over time whereas NDVI is used to changed detection of vegetation. Simple cartographic techniques are used for data representation.

GROWTH OF TOURISM AND RELATED ECONOMY

The impact of tourism by increasing tourist flow in Digha and other areas close to it not only affects the terrestrial ecosystem but the marine also. On the other hand, pollution by throwing garbage, degradation of habitat using recreational transport, threatening biota by trampling on the Beach area, bathing etc. are continuously affecting terrestrial and marine ecosystem (Davenport, 2006).

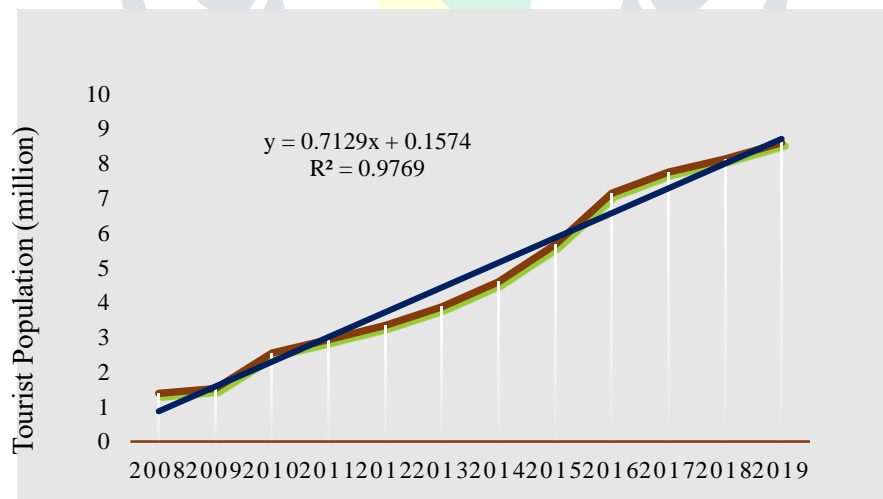
The Digha area of Purba Medinipur was communicated with the Kolkata metropolis with the introduction of Matangani Setu over Haldi river in 1978; tourism before it was almost in dormant condition. Direct transport link gave the initial thrust which was propelled to mass tourism from 1990s. The temporally increase in tourist have been noticed though there is no concrete evidence of tourist footfall in beach area, still it is the conception of the authority (DSDA) that increasing tourist, their voluptuous recreational activities and constructional activity along and away from coastline wreckage the natural flow of ecosystem. Tourist flow is the main driving force in this regard. Therefore, increasing tourist flow (fig. 2) is depicted here (Table 1) is consider as the root of all shots of ecological backlash.

Table 1. Annual Tourist Flow in the Area (in Million)

Year	Total(mil.)
2008	1.39
2009	1.525
2010	2.544
2011	2.935
2012	3.345
2013	3.876
2014	4.597
2015	5.6571
2016	7.1476
2017	7.7521
2018	8.1273
2019	8.5983

Source: (DSDA) Government of West Bengal

In the past years, not more than 1-1.5 lakh came in 2020 and 2021 each, the official said only the people (domestic. The regression line shows a rapid increase of tourist from 2008) with an average growth of 71 lakh per year which is highly significant ($R^2=0.98$). With improvement in the Covid situation, tourists are flocking in high numbers to the coastal town in recent months, and the DSDA is expecting Turn around this year. Recently this area has modified with the religious institution. Once the Jagannath temple is completed and opens for devotees, the annual tourist footfall is expected to exceed 45 lakhs, and again it will turn around like pre-covid year. That increasing tourist make large turnout economically recent years the official added.¹

**Figure 2:** Annual Tourist Flow (DSDA) 2008 - 2019

VI. IMPACT OF TOURISM

Digha is the most popular tourist spot of Midnapore coastal belt. Shankarpur, Tajpur, Udaypur and Mandermoni are the other tourism centres on this coast that have successively developed from late 1990s onwards due to the huge demand of coastal tourism and also as a spillover effect of Digha centre. The

¹ <https://travel.economicstimes.indiatimes.com/news/destination/states/west-bengal-government-sets-up-tourist-circuit-connecting-seaside-resorts/94447968#:~:text=To%20a%20question%2C%20another%20DSDA,2021%20each%2C%20the%20official%20said.>

pressure of tourist aggravates the destruction on the coastal ecosystem. The study can be dividing the aspects in two ways -**direct** impact of tourists and **indirect** impact. Thus promotion of tourism activities leads to the modification, alteration and constructions activities in the sensitive coastal area. **Field Observation has been carried out to find out the biotic diversity of beach and coastal ecosystem and also habitat ecology and at the same time it also endeavours how these affected by the anthropogenic activity.** Despite a long history of setting up appropriate measures to protect the sensitive coastal ecosystems, some attempts have been made by the State Government to conserve the neo dune fields by plantation rounded bamboo and wire fencing, the bulk of embankment boulders act as hard substrates for profuse settlement of barnacles and oysters and endanger recreational activities on the beach (Bhattacharya et al., 2003). Human interference in these areas often destroy the whole arrangement. Imprudent behaviour of many people on sand-dunes, cliffs etc. are not only through the excessive interference of human activities and the like, (Gormsen, 1997) but simply by trampling off the sandy beaches as all the beach areas.

A. ANTHROPOGENIC DISTURBANCES ON DUNE ECOSYSTEM

The dune ecosystem of the study area is developed by the dumping of sandy soil carried by longshore wind of the sea. The coastal terrestrial ecosystem starts from the dune area which is facing the interaction of the land and sea air mass. The dunes of the study area are mainly covered with Casuarina, Screw-pine, Datura etc. The Casuarina Forest along the coastal dune is the beautifying aspect of coastal tourism. It also plays a great role for the protection of dunes from the on shore wind.

The top of the dunes is generally flattened for the construction of series of hotels without considering much about the Coastal Zone Regulation Act (1986). Sand dunes are ideal places for building hotels simply because they offer an open sea view (Bhattacharya et al., 2003). The immediate impact of tourism due to construction of hotels is the loss of the vegetation (Fig. 3), As a result, the present condition of casuarina forest at New Digha area has decreased to a great extent. Dune area is now widely used as a parking zone by the Tourist



Figure 3. Construction of Hotels and the Loss of the Vegetation



Figure 4. Dune Used as Parking Zone

(Fig. 4), and the base of the forest becomes clear and no such new vegetation or natural plants are found to grow. The ecological stability is weakened because of poorer succession of natural growth of vegetation; ultimately the ground is almost species free. This is significant to develop climax community (Das & Das, 2014). Some patches have been damaged to clear the road for parking in dune areas. The natural floral components of some parts are so destroyed which can ruin the coastal Phyto-diversity and subsequently it will damage the habitat of avian fauna of the coastal area to a great extent.

In that case the dune ecosystem is affected by the tourism, because the dune area is used by the tourist as the parking zone, horse keeper uses dune area as a stable. Among the respondents there were 79 people who had vehicle to park; 61% of them parked their vehicle on the dune area, 21% use parking zone, and 16% use hotel campus as a parking zone (Fig. 5).

The older trees are frequently affected by the cyclones from Bay of Bengal almost in every year. Recently **Bulbul**² **Amphaan**³ has damaged the forest; those are heated by the cyclone no one cares about them; in fact, younger local people have cleared the broken Casuarina trees to extend their playground.

² Bulbul was a strong tropical cyclone, which struck the Indian state of West Bengal as well as Bangladesh in November 2019 originated over the southern Bay of Bengal.

³ A severe cyclone originated on the Bay of Bengal on the period of covid 19 which destroyed the life of people on economic crisis as well as the environmental crisis.

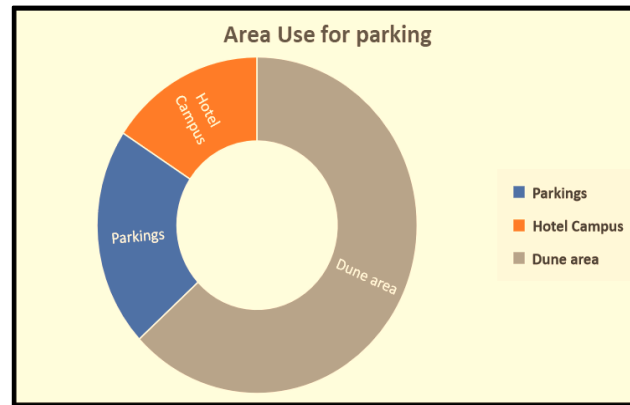


Figure 5. Dune Area Used for Tourism Purpose

Beautification Program and its impact:

The coastal Dunes of old Digha beach is totally constructed from the foreshore road to the High Tide Line (HTL) and most of them are under beautification program. The foreshore road is about 91.74 m (300 ft) away from the beach. The Biswa Bangla Park is close to the HTL and the measuring Distance is only 65 m from the HTL. The construction of sea-beach road (Saikat Sarani Project⁴) for off road vehicles along the coast has been developed ignoring the CRZ rule (1986). This road responsible for alarming interference of human being along the coastal stretch. The increasing pedestrian density and of-road vehicle movement destroys natural vegetation. In CRZ rule 1986; it is mentioned that no development be encouraged with 500 m distance of HTL but it has been relaxed and diluted by several amendments in 1991, 2001, 2002, 2003; in the said coastal area (Bera, 2013). As per present CRZ Rule no development will be allowed within 100 m from the high tide line. The levelling, breaching and destruction of dunes for construction is the violation of the coastal regulation (CRZII and CRZ III) zone (Bhattacharya et al., 2003).

Pollution

Human intervention is so important throughout the years such that the base of the forest is marked by absence of under growth due to picnic, car parking, increasing pedestrian density and of-road vehicle movement. The throwing of waste on the dune area is not enough; the workers usually gather the solid waste of the area on one place in the forest and burn them openly (Fig. 6) Burning of waste, fire from picnicking in the dune tract hampers the growth of dense casuarina forest.

⁴ Road along the coast 29km called marine drive stretch which decrease the he distances between Digha and Mandarmani by about 12 km.

Releasing toxic gases like Dioxins, Furans, Mercury and Polychlorinated Biphenyls into the



Figure 6. Solid Waste Burning and Burnt Trees in New Digha due to Garbage Burning

atmosphere are posing a threat to vegetation, human and animal health and environment as a whole; Plastic waste has the ability to attract contaminants (Verma et al., 2016). Here in the coastal area of New Digha some trees are burnt by such human activities.

Gap plantation zone under ICZMP cannot escape from this type activities. The wire fencing along the zone have been broken. In fact, these places have been spotted picnicking and parking unauthorizedly. Some of these trees have been cut down to make a picnic spot. The officials of MARC say “Earlier there were many birds in this forest, but now they are not found at all; it has converted into area for picnicking, garbage, plastic burnt etc.”. During the field visit some birds were found in Udaypur beach. Recently the Relocation of hawkers from beach to the hawkers’ centre placed on the dune area under Integrated Coastal Zone Management Plan (ICZMP) is partially able to save the coastal sea beach ecosystem; but the replacement of hawkers has altered the dune ecosystem that has led to decrease the density of dune vegetation,

Loss of Community Plant Species



Figure 7(A) Old Digha Coast in the Year 2001 (Collected)

Figure 7(B) Old Digha Coast in the Year 2019 Source: Field Survey, 2019

The linear alignment of casuarina forest along the coast has been discontinued in New Digha and Old Digha. To understand the impact changes on the dune vegetation, Normalised Difference Vegetation Index (NDVI) has been analysed. The increasing built up area on the coastal tourism centre taken as the stressor that might affect ecological components of the natural ecosystem (National Research Council, 1983). The spatial distribution and growth of vegetated area monitored through Normalised Difference Vegetation Index (NDVI) is used for mapping automatically. This NDVI method is able to serve as a worthwhile alternative for quickly and objectively mapping vegetated areas. The difference of NDVI can be granted by the land use difference of the same area through two different time point based photograph 2001 (Fig. 7(A) and 2019 (Fig. 7(B)).

Table 2. Shows the NDVI Value

NDVI	LOWEST	HIGHEST
1995	-0.062	0.42
NDVI	LOWEST	HIGHEST
2019	-0.11	0.29

For statistical formula NDVI values range from +1.0 to -1.0. Although there are several vegetation indices, one of the most widely used is the Normalized Difference Vegetation Index (NDVI) (www.usgs.gov). Areas of barren land or bare areas usually show very low NDVI value (for example, 0.1 or less). Approximately 0.2 to 0.5 indicates sparse to low vegetation while 0.5 to 0.9 corresponds to dense vegetation. When analysed through time, NDVI can reveal whether vegetation is changed due to human activities.

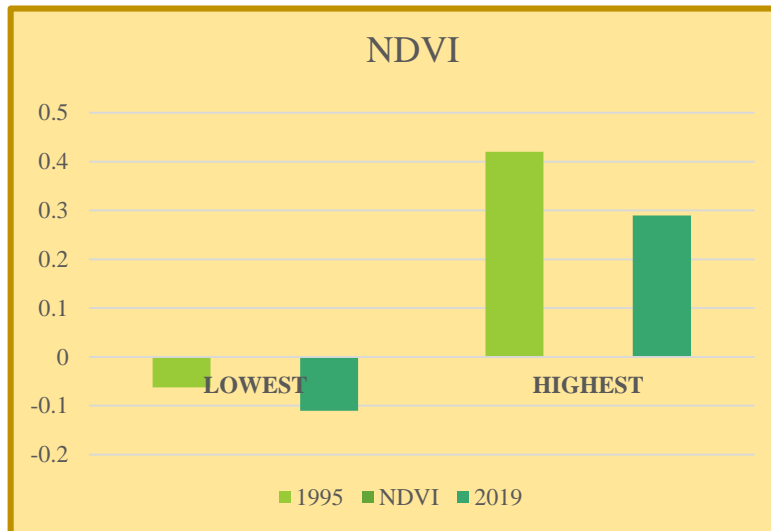


Figure 8. NDVI Value of the Year 1995 and 2019 of the Study Area

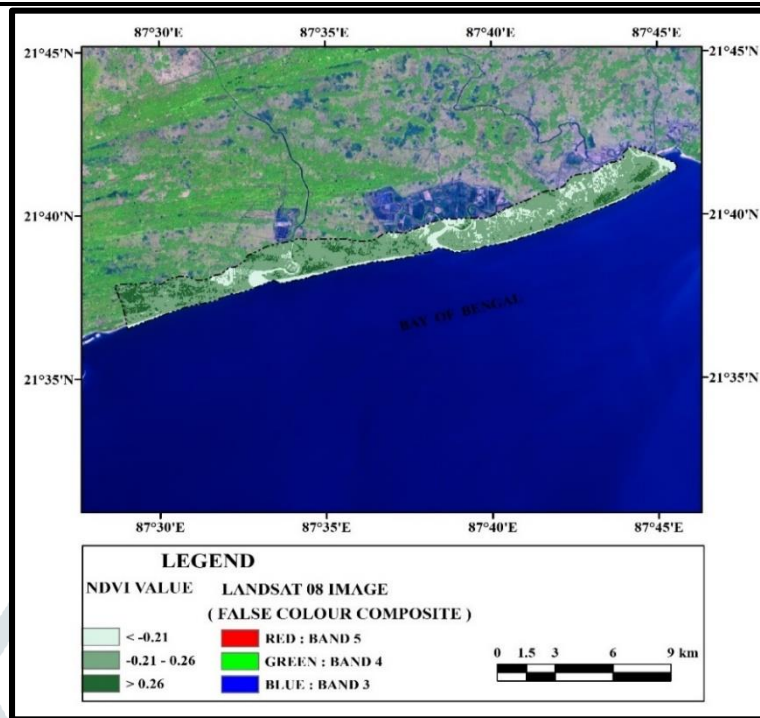


Figure 9(A) Tourism Promoting Drastic Change of Natural Cover (LANDSAT Image 1990)

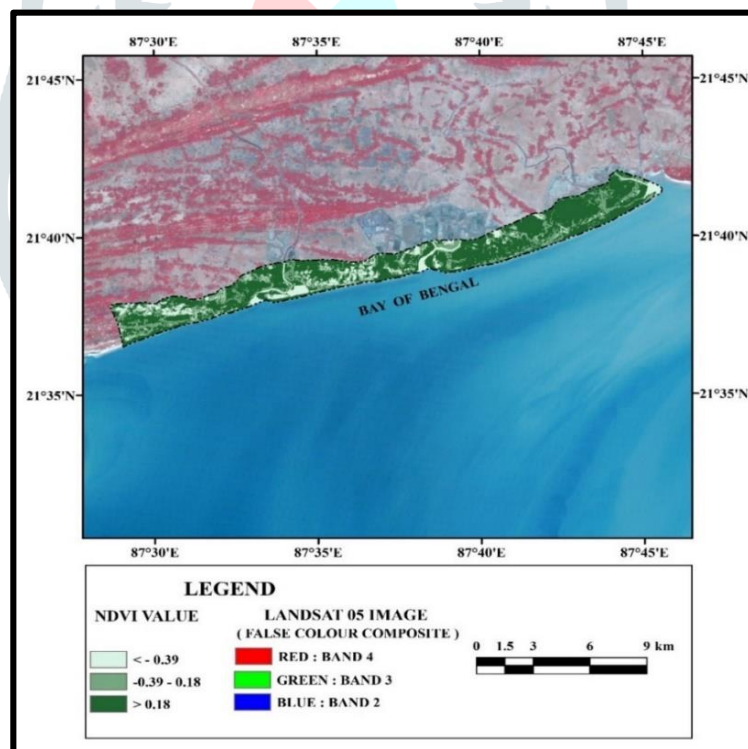


Figure 9(B) Tourism Promoting Drastic Change of Natural Cover LANDSAT Image 2019)

NDVI values also describe about the type of plants such as < -0.2 indicates barren areas, rock sand or snow cover, -0.2 to 0.2 indicates grassland or patches of grassland and > 0.2 indicates shrub ($0.2 - 0.5$)⁵. However, such a micro scale observation is not found here as the table 2. depicts (Fig. 8) the transformation of same piece land in 1995 (NDVI -0.062) to 2019 (NDVI -0.11) for low value and 0.42 to 0.29 for this value.

⁵ (en.wikipedia.org) (https://en.wikipedia.org/wiki/Normalized_difference_vegetation_index)

The index value of the map shows the difference in the class of the vegetation type. The lowest value of NDVI in 1995 and 2019 is less than 0, which shows the low density or bare areas, but in 2019 the lowest value goes more negative towards -0.2, which indicates more bare area than 1995. The upper value of NDVI in 1995 is 0.42 which indicate the high vegetation on the marked study area. where as in 2019 the value is decreased towards the sparse vegetation.

To ensure the cause behind the decreasing vegetation on the coastal sensitive ecosystem, respondents survey have been done (200 sample size) including tourists, local people, shop keepers who were interviewed (Fig. 10).

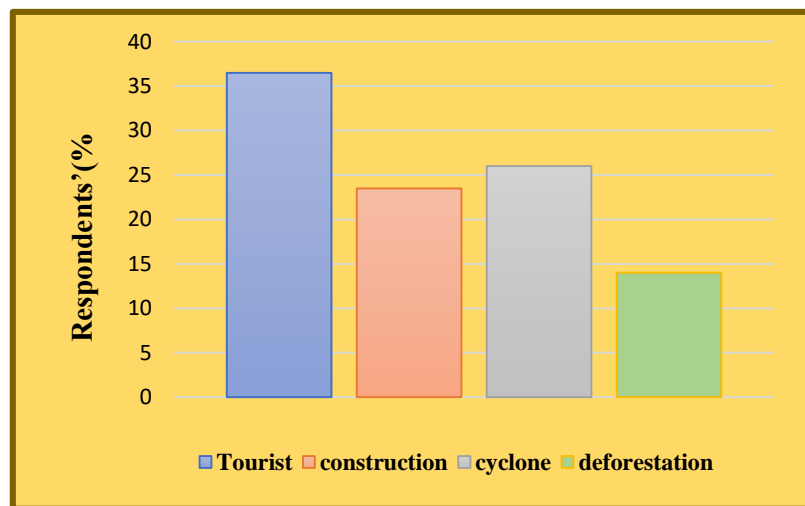


Figure 10. The Reason Behind the Decreasing Dune Vegetation

The direct intervention of tourists like parking, picnicking, hangout as well as throwing lots of waste-garbage on the dune has made it bare land. Various flora and fauna species of the transition zone of land and water area which are sensitive in terms of their individual survival, population, community and ecosystem stress are in great trouble for the construction and urbanisation. Some species are going to be abolished (the sea grass, casuarina etc.) and some are finished (Bera, 2013). On the basis of the floral changes some faunas have lost their habitat. As per respondents' view, previously there were variety of birds sheltered in the casuarina forest but presently those are not found. Some birds have become rare like black caped Kingfisher, Plover, Balubatan (IUCN threatened category), Hottiti, Khanjan (Wagtail) etc. as per the statement of the local people.

B. IMPACT ON BEACH ECOSYSTEM

Tourist trampling:

Digha for its beach facility, scenic beauty and for better recreational facilities attract the tourist more than any other coastal location of West Bengal. The sandy sea beach is the main attraction that renders



Figure 11. Tourist Crowding over the Beach

walking along the beach, bathing and playing with water. All these activities are detrimental to beach habitat of aquatic fauna.

Trampling is one of the most common disturbances found to occur done by the tourist over the beach (Fig. 11). In the said sandy beach, beach fauna displays a range of unique adaptations to these highly dynamic, three-dimensional environment. At the morning the species are available on the beach surface but at peak hours those are not present. The adaptations are mobility and burrowing abilities, which can be found in every sandy beach coast across the world as Brown and McLachlan recorded rhythmicity in their behaviour, advanced sensory mechanisms and orientation, and plasticity in their work (Brown & McLachlan, 2010; Brown, 1996; Scapini et al., 1997).

Loss of life:

The response of individuals to their environment (biotic and abiotic) is the key issue to the ecosystem. But if the natural habitat is disturbed by increased human activities it threatens habitat quality,



and fall of habitat quality leads to migration of fauna and massive loss by death due to drastic alteration. The

areas which have mass tourism such as New Digha beaches (Merina ghat, Khanika ghat) and Old Digha beaches have no such attendance of species on the surface. Crabs are seen as dead by trampling of human being. The beach areas which are facing mass tourism have an impact of trampling by the tourist, shops/stalls, horse rider. Crab, molluscs shells, star fish have been found dead at Khanika ghat, New Digha (Fig. 12). Digha has a strong market demand for mollusc craft-item. Although they say no mollusc are collected from this sea surface, but the collectors in other beaches say that they collect the items from the beaches and sell those to the craftsmen. The prices of these type of items (the ornaments like bracelet) made from marine molluscs and shells is increasing three times than before and the price and size related to each other.

Availability and diversity of species:

In the beach area of this coastal region different kind of species are observed. Of them most are crab, different types of Molluscs, Urchin, Green-mussels etc. But they are found mainly in the undisturbed zones devoid of huge crowding. Therefore it is not found in old Digha and New Digha beach but common in Udaypur. In undisturbed beaches the richness of species has been found and those species are found to float/walk on the surface of beach. Near Udaypur beach, mollusc species richness is very high. The richness of mollusc’s species at Udaypur ghat due to presence of substratum as shelter that provide suitable physico-chemical parameters of soil and water and peaceful environment. (Das and Maity, 2018).

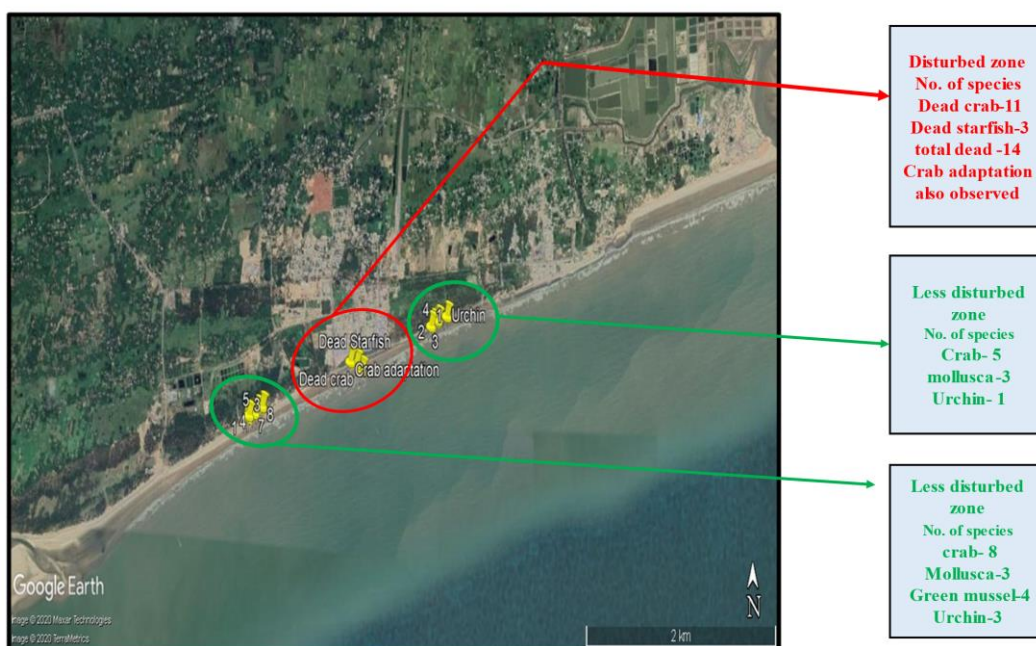


Figure 13. Zone of Availability of Aquatic Species in Beach

If some one visit to new Digha and observe the species and compare the map related area demarcation, can easily conclude that high pedestrian density reduces aquatic fauna over the beach as the habitat condition is deteriorated (Fig.13). The following table shows the species availability on different beaches on the coastal belt. The data have been collected on the same day , same time for an hour in every beach in winter during Neap tide with (16.12.22) with peak tourist time.

Table 3. Numbers of Dead and Alive Fauna on the Study Area

Places	Availability of fauna (alive)	Dead Fauna
Udaypur	42	2
New Digha	9	11
Old Digha	0	0
Digha Mohana	15	15
Shankarpur	35	0
Tajpur	48	0
Mondermoni	15	3

It was the apprehension before the field visit as the scholar is familiar to this area from childhood, still, for research purpose, the questions were asked to find out reasons for decreasing amount of fauna with

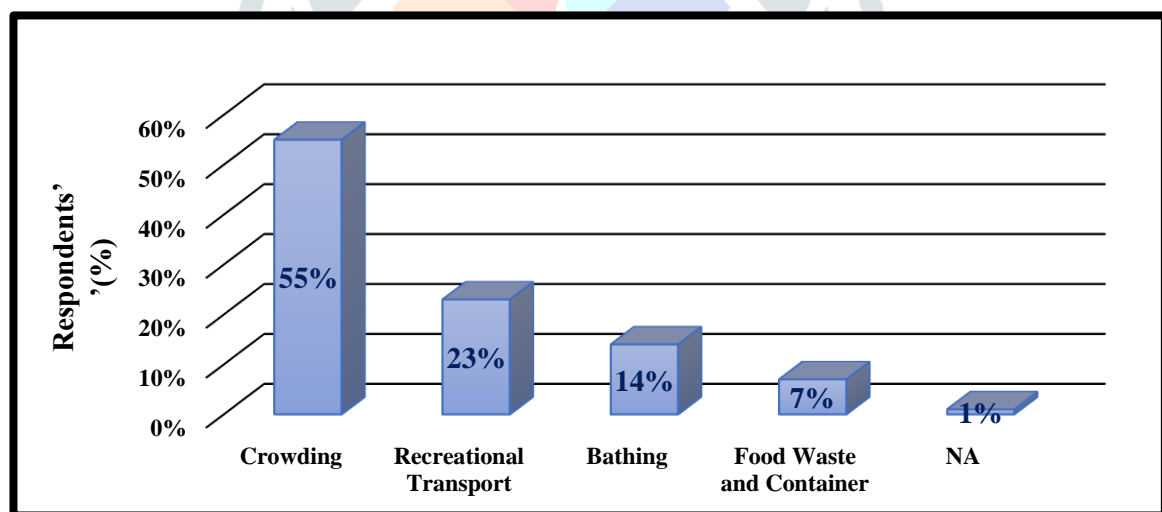


Figure 14. Showing the Respondents' View Reason Behind Beach Pollution

the increasing tourist density over the beaches. Figure 14 clearly shows that crowding and recreational transport (horse riding, bech car riding, boating) are the main reason for the habitat destruction. These two share 78% of toatl response where crowding is more than 50%

Pollution:

Due to rapidly increasing tourist influx from 1990s and recurrence flow of tourists almost through out the year due to change of academic school calender of the state form 2000 onwards, a huge number of hotels along with recreational activities has been developed. The increase of tourist's pressure and the day to day

increasing rate of pollution on the dunes as well as in the beach areas has partially or totally in some pockets has led to the ecological stability. So, identification of the causes for the beach pollution is to be needed. Respondents' opinion has been taken where throwing of food waste and committing nuisance and burning of solid waste are the main causes for the pollution in the beach areas (Fig. 15).

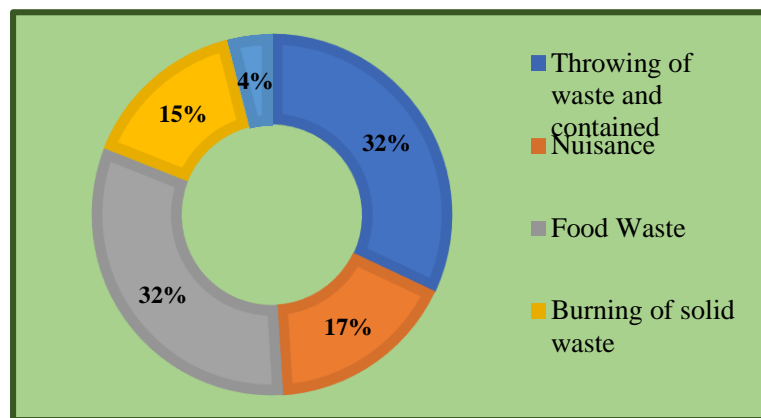


Figure 15. Reasons that Cause Decrease of Fauna over the Beaches

Due to havoc beach pollution in Digha living species in the beach are almost rare in comparison to Udaypur, Tajpur, Mandarmani etc. Crabs are seen as dead by trampling of human being. Apart from the pedestrian density, beach is polluted by the excreta of horse, outer shells of green coconut, waste of food stall close to beaches.

Adaptation:

During field observation some distinct adaptive behaviour has been observed for crab; they are found 10-20 cm below the beach surface. After the adaptation they are still not safe from the human interference. Tourist playing with beach sand and these activities or actions have led to their loss of life.

In the Digha area beach cleaning process is not well organised. They normally use sweep, spade, basket and shovel for cleaning purpose. Many of the living species from the beach are collected with the waste and are dumped in the particular sites. Thus, micro-organisms are destroyed. Stalls and shops on the beach are prohibited by the authority but many of these do not obey this rule. Bottom of recreational boats are dragged over the wet beach before and after the boating. The treatment of waste on the beach area also concerned enough, the worker gathered the solid waste of the area on one place in the beach and burned them openly, burning of waste releases a variety of toxic pollutants into air and also can exacerbate sandy beach pollution. Recently the authority has made a substratum by keeping some rocks and boulders along the sea beach road in Digha coast. Some species especially the Mollusca group thrive underneath such construction as such these areas are undisturbed habitat. It is expected that the availability of such species will be higher in near future at all ghats of old Digha due to presence of boulders as substratum (ibid.).

C. DISCUSSION ON AQUATIC ECOSYSTEM

Impact of Tourism:

Coastal development leads to habitat loss through filling and transformation of beach area. beach

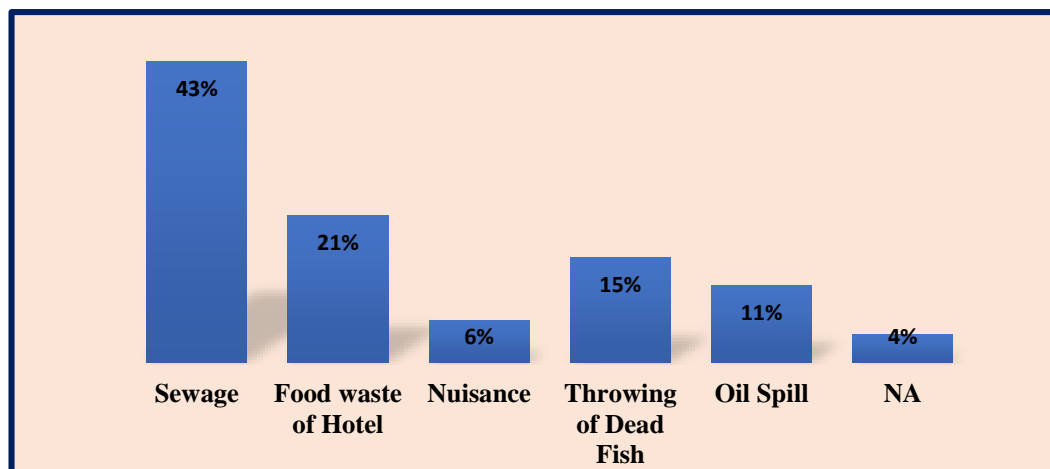


Figure 16. The Respondents' View about the Water Pollution

crowding, bathing in the wet beach during high tide are fatal for habitat destruction over the beaches. Old Digha and New Digha area on an average have a tourist density of 1000 – 2000 per day, 60% of which take bath on the sea-water. The water sports in Digha sea coast are one of the pressures on the aquatic ecosystem. The permission to water sports is given to the company namely Adline by the planning authority of DSDA. They run 2 Kilometres from the shore. But they are not aware of the sound limit of the engine of boats.

The diagram shows the respondents' view about the water pollution of the shallow wet beach area (Fig. 16). About 43% of the respondents' say sewage is the main cause behind the water pollution succeeded by food waste of hotel (21%), throwing of dead fish (15%), Oil spill (11%) and Nuisances (6%). D. Dam, official of the Marine Aquarium and Research Centre (MARC) of Digha, working on "The effect of tourism on the marine faunal diversity along the beaches of Indian Coast," says that "Shankarpur and Talasari beach are enjoying low tourist pressure and some living species are found along those beaches while it is not found in Old and new Digha; He has mentioned the number of living species in different locations of coastal Medinipur [in Shankarpur Mollusca (151), Fish (Sting ray, Gutter fish, etc. 38) Crab (11), Shrimp (2) and in the Talasari Mollusca (98), Fish (2), Crab (6) present when the tide water recedes but on the same day they are almost absent in Digha beach].

Release of sewage materials mainly from hotels deteriorates water quality near by the high drains. The chemical parameter like pH, salinity and physical parameter like temperature of the water has been tested, collected along the effluent points of high drains and river mouth. Five such sites are chosen on the basis of the presence of river estuaries and high drains which show significant difference. The pH of water affects fauna in an aquatic ecosystem whereas sewage materials are associated with toxicity of ammonia and hydrogen sulphide that affects the solubility of nutrient (Sarkar et al., 2018).

The pH less than 7 indicates acid, whereas a pH of greater than 7 indicates a base. The pH of water determines the solubility (amount that can be dissolved in the water) and biological availability (amount that

can be utilized by aquatic life) of chemical constituents such as nutrients (phosphorus, nitrogen, and carbon) and heavy metals (lead, copper, cadmium, etc.). Sewage water is acidic, whereas sea water is saline. Therefore, it is difficult for the inter-tidal zone fauna to thrive where sewage water is mixed with the sea water. Therefore, dead cells are more for the beach areas where effluents are mixed with sea water.

Table 4. Cell Count at Different Points (Direct cell count by Haemocytometer)

Sl. No.	Beach	Total Cell count
1	Tajpur	300
2	Mohana	700
3	Digha	800
4	Jatranala	0
5	Taalsari	400

The samples collected from five stations (Fig.17), Jatranala area did not show the presence of alive cell (Table 4). Jatranala is drained by the polluted water from hotels and adjoining town area that’s why cell is not able to count. They are likely

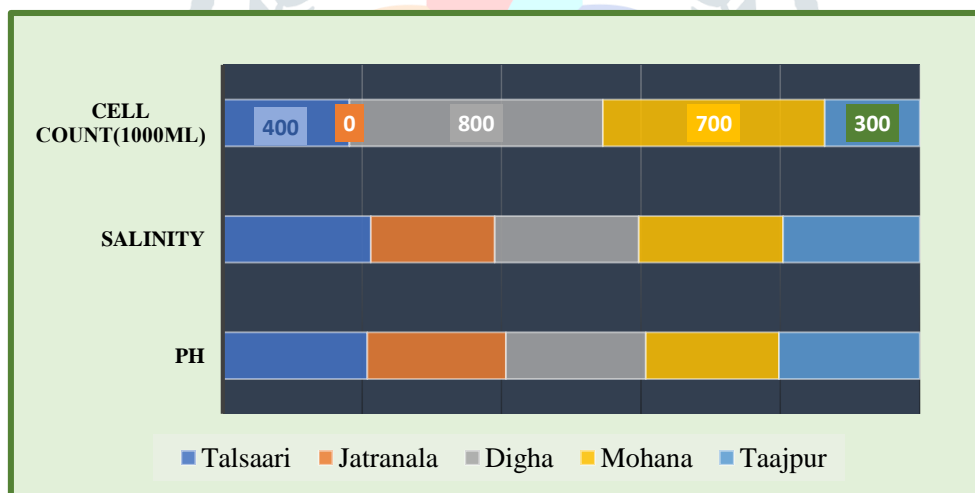


Figure 17. Water Quality and Cell Count at Different Points

to be frozen due to less productive power or fertility of the surface water.

VII. CONCLUSION:

Tourism in those areas is the root for the rapid economic development as well as the livelihood of local people. However, coastal ecology which is fragile for its transitional nature are adversely affected by such rapid pace of development which was a point space phenomenon within the period of 1980 -2000 and a linear pattern of development thereafter. A massive Loss of floral Diversity is observed nearby old and New Digha. Ground is almost bare at the base of the dunes at old and New Digha and tree cover is almost devoid of undergrowth due to huge pedestrian density. It is true that human intervention is highest at the beaches which lead to destruction of the beach fauna due to increase in pedestrian density day by day. Coastal

Regulation zone rule is violated, even no restriction on beach by the use through pedestrian walk or vehicle running. Development authority has formed but they have no such role for solid waste management or sewage treatment. Therefore, beach ecology is adversely affected by solid waste and shallow water zone is regularly affected by pollution. A unified coastal regulation act for the areas of coastal tourism is the need of the hour. Eco-tourism perspective should strictly be imposed for the emerging or potential tourist spots of this area for the survival of coastal ecology as well as tourism keeping aside the Old and New Digha for popular tourism with proper management.

REFERENCES:

1. Bera, A. (2015). "Impact of Tourism on Coastal Ecology in the Coastal Region of Digha (West Bengal)", *International Journal of Science and Research (IJSR)*, Volume 4 Issue 6, June 2015, 2034 – 2039. Retrieved from <https://www.ijsr.net/archive/v4i6/SUB155797.pdf>
2. Bhattacharya, A., Sarkar, S. K., & Bhattacharya, A. (2003, November). An assessment of coastal modification in the low-lying tropical coast of northeast India and role of natural and artificial forcings. In *Proceed of the Internat Conf on Estuaries and Coasts* (Vol. 9, pp. 158-165).
3. Brown, A. C., & McLachlan, A. (2010). *The ecology of sandy shores*. Elsevier.
4. Brown, A. C. (1996). Behavioural plasticity as a key factor in the survival and evolution of the macrofauna on exposed sandy beaches. *Revista Chilena de Historia Natural*, 69, 469-474.
5. Das, D., & Das, M. (2014). Vegetation Ecology of Coastal belt of Khejuri area of Purba Medinipur District with special reference to Hijli Coast, West Bengal, India. *IOSR-Jour of Pharmacy*, 4(2), 2319-4219.
6. Das, M., Maity, J., (2018). Availability and utilization of molluscs at Digha coast, East coast of India. *International Journal of Biology Research*. Volume 3; Issue 3; July 2018; Page No. 46-53. Retrieved from <http://www.biologyjournal.in/download/267/3-3-30-725.pdf>
7. Davenport, J., & Davenport, J. L. (2006). The impact of tourism and personal leisure transport on coastal environments: a review. *Estuarine, coastal and shelf science*, 67(1-2), 280-292.
8. Gormsen, E. (1997). The impact of tourism on coastal areas. *GeoJournal*, 42(1), 39-54.
9. Mandal, M., Dandapath, P. K., & Shukla, J. (2013). Emerging Dimension Of Coastal Eco-Tourism Resources Along The Coast Of West Bengal, India. *International Journal of Advanced Research in Management and Social Sciences*, 2(1), 58-73.
10. Sarkar, S., Adhikari, S., & Tiwari, P. K. (2018). Importance of Soil and Water Quality Management in Freshwater Aquaculture with Special Reference to Catfish Farming. *Mass Breeding and Culture Technique of Catfishes*, 25.
11. Scapini, F., Audoglio, M., Chelazzi, L., Colombini, I., & Fallaci, M. (1997). Astronomical, landscape and climatic factors influencing oriented movements of *Talitrus saltator* in nature. *Marine Biology*, 128(1), 63-72.
12. Verma, R., Vinoda, K. S., Papireddy, M., & Gowda, A. N. S. (2016). Toxic pollutants from plastic waste-a review. *Procedia Environmental Sciences*, 35, 701-708.

