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Development and Exclusion in India



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Chapter 8

Son Preference in India: A Study into its Nature and Causes from West Bengal

Papita Dutta

1. Introduction

Parents find satisfaction from their children directly and indirectly. Satisfaction of the parents from a child not only depends on the number of children; it depends on the socio-economic background of the parents and sex composition of the children. That is why; the preference pattern of the parents for the sex of their children is an important research issue to the social scientists. Becker (1960, 1988) has explained that the demand for children to parents is similar to the demand for durable goods. Often parents view the children as investment from which parents expect recurrent income. Sometimes children are viewed as consumer durables where children just living with parents gives direct satisfaction. Griliches (1974) has explained the children preference as liquidity preference. He has pointed out three distinct 'motives' for having children; (1) economic security (current labour and old-age provision); (2) the production of reciprocal caring; and (3) an attempt at immortality via one's offerings.

In many countries including India a large section of parents believe that male children compared to female are in better position to satisfy all these motives. This belief gives birth the philosophy of son preference. Son preference is one of the prime causes of gender inequality which threatens the development of human civilisation. A large section of parents around the globe, enthusiastically celebrates the birth of a boy whereas the birth of a girl is not warmly welcomed. This fact indicates parents' preference for sons over daughter. Son preference leads to many social problems like imbalanced sex ratio, which causes increase in sexual crime and increase in marital unhappiness due to marriage-age imbalance. Adverse sex-ratio towards female, higher mortality rate among girls child, lower enrollment

of girls in educational institution, missing female foetuses, lower birth interval etc. are some common indicators of gender inequality as well as preference for sons in Indian society. This study intends to investigate the nature and causes of son preference in Purba Bardhaman district of West Bengal in India.

2. Relevance and Objectives

Sex ratio and child sex ratio are considered as important indicator of son preference. If these ratios deviate from the natural biological ratios, we can assert that some abnormal incident has occurred. In terms of overall sex ratio, son preference is strong in the state of Haryana and least in Kerala. In accordance with the census report, 2011 sex-ratio in West Bengal is 947 which is highest in the last century. It is no doubt a good indicator towards gender equality. But the same report shows that child sex ratio in India is 914 which was 927 in 2001 and in West Bengal, it has reduced from 960 to 950 during 2001–2011. It is very disappointing. This is a clear indication of increasing trend of son preference of the parents in India as well as in West Bengal. This declining trend of sex-ratio under age six is an alarming issue to the policy makers, social science researchers and to the Government for the future development of human resource. Thus the study of the nature and causes of son preference in West Bengal is relevant one. Both sex ratio and child sex ratio are strong indicators of son preference at macro level. But they are not appropriate as indicators of son preference at household level.

Pande and Astone (2007) have shown that the extent of son preference varies statistically across the states of India. The nature of son preference and strength of the factors influencing son preference definitely varies from country to country depending on some social-economic and cultural background even environmental distinctions. Son preference is common in a band of countries stretching from North Africa, through the near east to south Asia. There is strong preference for son in India, Bangladesh, Nepal and Egypt, but a distinct preference for sons in turkey, Tunisia, Pakistan, Srilanka, Jordan and Morocco (Arnold, 1997). There are several common socio-economic-demographic causes behind son preference. In these countries male are given more importance than female. Even the common women do not get the respect that they deserve. A large section of women are internally oriented in such a way that they feel proud when they become mothers of sons. This orientation in girls starts at their early childhood at home when they learn that they should play with dolls and their brothers

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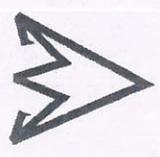
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**RELEVANCE OF
MAHATMA GANDHI :**

A Collection of Critical Essays

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To

Dr. Trishna Goswami

69

If we say that the twenty-first century is the century of the common man, then we see that *Gandhism* has even more relevance in this age, and Gandhi will inspire generations of individuals fighting for goodness of the society. If today we find that *Gandhism* is in severe test in countries like India, it is not because there is certain inherent weakness in *Gandhism*, but it is because we have not seen in India strong leaders with the required courage and conviction to fight the evils in society. We may borrow Gandhi's own words on *Ahimsa*, and say that *Gandhism* is only for the courageous people.

I would like to conclude with a tribute to Gandhi that Albert Einstein gave: "*Generations to come, it may well be, will scarce believe that such a man as this ever in flesh and blood walked upon this earth*".

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A Pathfinder Deliberation : BHU Speech of

M.K.Gandhi

Dr. Tamali Neogi

Being invited at the laying of the foundation stone of the Banaras Hindu University in February 1916, by Pandit Madan Mohan Malaviya, deeply wounded by the 'show', the grandeur the occasion incited, the great disregard of the vast poor mass who constituted the heart of the nation and the notable police protections all around, Gandhi made the first ever political speech in India which as Nehru later reflected was "like a whirlwind that upset many things, but most of all the working of people's minds." It was a speech that functioned "like a powerful current of fresh air" that made the Indian politicians having "paralysed" limbs and "deadened" minds to stretch themselves and take deep breaths "like a beam of light that pierced that darkness and removed the scales from our(their) eyes" (Shanker 1969) by providing them with the foundation of how to pull India out of the muddle of poverty and defeatism that had so far pulled her in. The purpose of the author here is to bring out the basic tenets of the speech so that it may aptly serve as an introduction to Gandhian Philosophy.

In presence of Lord Harding, the Viceroy, and the most eminent personalities of India including bejewelled Princes and Maharajas, the first thing that was highly remarkable about Gandhi was his dress code. Didn't he want to represent the mass while clad in a short coarse dhoti, kathiawadi cloak and turban he rose to speak? Rightly then a politician could appropriately say "Our salvation can only come through the farmers. Neither the lawyers, nor the doctors, nor the rich landlords are going to secure it" (BHU Speech Gandhi). Otherwise who could have envisioned the million mutinous divisions that constituted the then India arising in a unified manner for the first time to serve a cause?

Gandhi was highly critical about hypocrisy of those speakers who being engaged in the celebration of pomp and luxury, laid stress upon the poverty of India. By mentioning the occasion "a most gorgeous show, an

Brick Temples of Purba Bardhaman : A Study on Structure, Style and Motifs of Ornamentation

Dr. Surajit Rauth

A survey of the temples of Purba Bardhaman has been conducted to study the different types of temple architecture and the various features of terracotta sculptures depicted on the temples. It aims to understand the origin and evolution of the temple architecture of Purba Bardhaman as well as their terracotta art associated with the social, cultural and religious life of the people in the region.

History : The temples of Bengal (West Bengal) which were built between the sixteenth and nineteenth centuries form one of the most distinctive groups of sacred monuments in India. Considering the variety of forms and techniques, the Bengal temples constitute a coherent series in both, their architecture and sculpture, characteristically expressed in brick and terracotta. The chronological span of the temples is also significant, coinciding with the emergence of a new Bengali culture. Not only that, the Bengal temples specially the temples with terracotta art may be viewed as one of the most important manifestations of this region's culture, closely associated with contemporary movements in religion, literature and the arts, as well as with broader political, social and economic developments.¹

One of the most remarkable features of the history of monumental architecture in Bengal is the sharp break in tradition that coincided with the Muslim conquest. During fourteenth and fifteenth centuries a distinctive Bengali culture developed, specially in the spheres of literature and architecture. The predominant architecture of course was Muslim-mosques, tombs, serais-for which the basic form, a large domed chamber with corner minarets, was imported. With this local characteristics were added such as curved cornice taken from the bent bamboo of the village hut. Many decorative motifs were borrowed from the previous Hindu

tradition. But structurally there was a significant shift from the old Hindu corbelling system to Islamic vaults, domes, and keystone arches.² After the coming of the Mughals at the beginning of the seventeenth century, Mughal architecture imported the imperial Delhi style, abandoning terracotta and the curved cornice. The indigenous tradition was carried on by the temples.

During the fifteenth and sixteenth centuries, Bengal witnessed a deep political, social, religious and 'Cultural Revolution' the result of which was the formation of a distinct regional identity. Perhaps the most important factors in this revolution were the political unification and independence of Bengal as well as the wave of 'Local Hindu revivalism' and a distinct style of monumental architecture. Another important feature of this cultural culmination was its popular appeal, mainly achieved through the medium of Bengali language. This was the foundation for the new religious movements, as well as for the several literary works such as dramas, songs, poems, and texts that rapidly gained a wide audience throughout the region. The distinct Bengali style of architecture and sculptural decoration which emerged at this time was also a product of these local idioms.³ The Sultans appealed to the regional spirit of the people and encouraged the new Bengali literature and architecture. This developed a dynamic interaction between Muslims and Hindus, in which many Bengali cultural features came to be adopted by Muslim rulers. It was during this period that the most important movements of Hindu revivalism took place, largely inspired by the teachings of Sri Chaitanya (1486-1533).

Among the various religious movements that swept Bengal in the sixteenth century, the *Gauriya Vaishnavism* of Sri Chaitanya was the most important one. Chaitanya promulgated a reorganization of Hindu society by abolishing the caste system and all distinctions between Brahmins and other classes. Essentially a monotheistic religion, Chaitanya's *Vaishnavism* concentrated on one God, *Krishna*, the worship of whom was based on *bhakti* or devotion. During the sixteenth and seventeenth centuries, it became the most important religious movement in Bengal, a truly cultural force that attracted followers from different strata of society, specially the lower castes, even the tribes.⁴

The new Bengali literature also served as a vehicle for popularizing religious and secular stories as well as the teachings of religious movements. The Sultans also acted as patrons of Bengali literature.

the latter two being two different incarnations of lord *Visnu*. He further went to say that irrespective of a *Shaiva*, *Shakta* or *Vaisnav*, God as the presiding deity of the temple, themes of *Ramayana*, *Mahabharata* or *Krishnalila* were freely depicted by the artists for decorating the temples.

With reference to the architectural elements and the schematic planning of the narratives on the temple façade, it can be said that, every inch of this visual imagery, had a meaning to be conveyed. Such planning thereby changed both the purpose and meaning of the temple. The structures bore two functions. Firstly, it acted as a place of worship and secondly, it provided a visual canvas for representing power and construction of identity. This functional duality therefore poses some questions before us, answers of which are determined by the place of the temple within the society and its relation to the society. Importance of the second dimension of the late medieval temples of Purba Bardhaman within the context of social and economic history has been ignored by most of the scholars.

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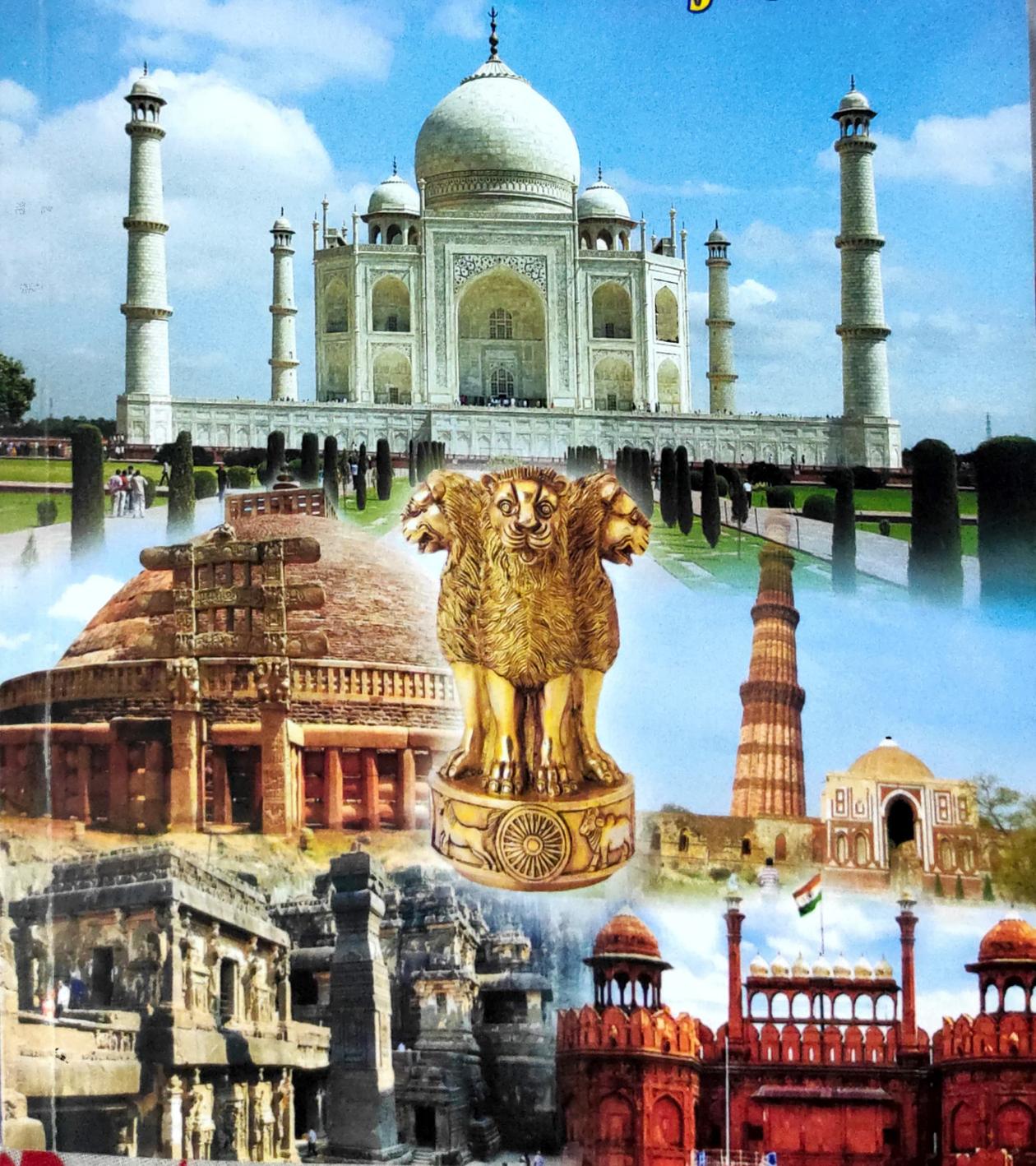
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HISTORY, HERITAGE AND RELIGION: PROBLEMS AND PERSPECTIVES

Jaydeb Sarkhel
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HISTORY, HERITAGE AND RELIGION : PROBLEMS AND PERSPECTIVES

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P R E F A C E

The present volume contains some of the papers presented in the 17th. Annual Conference of Bharata Vidya Charcha Kendra held on 16th. February, 2019 in collaboration with Dr. B. N. Dutta Smriti Mahavidyalaya, Hat Gobindapur, Purba Bardhaman. The theme of the conference was History, Heritage and Religion : Problems and Perspectives. Bharata Vidya Charcha Kendra is an interdisciplinary research organisation of Burdwan.

This book contains a set of selected articles of which fourteen are in English while three are in Bengali. BVCK has decided to publish this volume as a part of its academic activities and to circulate the selected papers presented in the conference among the academic fraternities at large. Before publication the papers have been blindly reviewed by a set of reviewers who are experts in the relevant area. Thus this is a peer-reviewed edited volume with ISBN. It is hoped that this volume will help the students, teachers and researchers in the relevant area.

We are thankful to the authorities of Dr. B. N. Dutta Smriti Mahavidyalaya, Hat Gobindapur where the 17th Annual Conference of BVCK was held. We are also thankful to the contributors for their cooperation in submitting the revised versions of their papers within the stipulated time. We must also thank the authorities of Book Syndicate (P) Ltd., particularly, Mr. Biplab Bhowal for his cooperation and help to publish this volume within a very short period of time. Mr. Subrata Bhowal of the production desk deserves thanks for his whole-hearted cooperation in the technical matters related to the publication of this volume. We beg to be excused for any deficiency that remains present in the book.

Jaydeb Sarkhel
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Red Cultivation in Plain Area Uproots the Traditional Plants : A Microstudy at Mekhliganj Block, Cooch Behar District

Ranjan Paul

Introduction :

Mekhliganj is a marginal CD Block of Cooch Behar district, mainly populated by Rajbanshi community. As per 2011 census of India Mekhliganj CD Block had a total population of 155,250, of which 150,767 were rural. Scheduled Castes numbered 110,595 and Scheduled Tribes numbered 1918.

Rajbangshi community has a long and significant past record that can be traced from the age of Mahabharata. They have got an age-old tradition to make their living from the crude nature. They look to nature for their medicine, food, fodder and daily life needs.

Agriculture is the main source of their income. They were very much accustomed to the cultivation of traditional cash crops such as jute, tobacco, betel-nut and bamboo groves. Bamboo is very promising to reacclimatise the soil fertility.

Modern technology made a shift of the pattern of cultivation; potato and tea gradually take the leading roles in the agricultural field. Consequently bamboo groves, betel nut garden along with betel leaf are gradually losing their importance along with deterioration of soil, air and water quality. Huge loss of water occurs at ground level. Socially people of poor section gradually become dependent on richer section of society causing great socioeconomic imbalance among different strata of people.

A beautiful proverb mentioning the use of bamboo (bansh) and betel nut(gua) trees for making house in Rajbanshi society should be quoted here : “pube Hansh(pond)/uttare bansh/ paschime gua/ dakshine dhan(empt)’”. This is how the surroundings of the house should be.

Study Area :

Mekhliganj is a marginal CD Block of Cooch Behar district, delimited by Jalpaiguri district on north and Bangladesh on south, Haldhari Block on west and Mathabhanga on east and watered by the river Tista, Dharla, Sanajan, sutunga and number of other small streams. Mekhliganj located at 26°21'N 88°55'E has an area of 288.64 km². Total area available for cultivation in Mekhliganj CD block is 23,431 hectare.

Objectives :

To find out the impact of cultural upliftment of people of Rajbanshi community through the change of approach in agriculture.

To excavate the gradual dominance of modern cash crops like potatoes and tea over the traditional cash crops like betel nut and bamboo groves along with betel leaf.

To find out how the local people became dependent upon the big entrepreneurs.

To find out the impact of modern cash crops on soil's natural texture that needs more fertilizer and water.

Impact of weedicides and insecticides used to grow these cash crops is to be assessed.

To assess how the so called enlightenment, introduction of modern agricultural system in this area flourished at the cost of large varieties of so called weed plants the power of which is still unknown to the field of medicine as well as gene pool reservoir for developing new species for the future world.

Methodology :

Information was gathered, taking interviews of the informants and as witness of the uses during the period of studies in the field. The field study was carried out by putting questionnaires to people of different age groups of different socio-economic strata.

Information collected from them lured us to analyze the data scientifically and systematically that help us to correlate socio-economic upliftment with the changing pattern of agriculture. That leads to gradual loss of weeds and their importance.

HISTORY, HERITAGE AND RELIGION : PROBLEMS AND PERSPECTIVES**findings :**

It is after 1971 with the large scale infiltration of refugees from East Pakistan along with emergence of left front government, a great change developed in Cooch Behar district. Living style of the undemanding people of Rajbangsi community got havoc change. Left Front movements like 'langal jar zami tar' - altered the relationship between so called Jotdar and Praja. Consequently large holdings of land became smaller. Hauli like 'langal jar zami tar' - altered the relationship between so called Jotdar and Praja. Consequently large holdings of land became smaller. Hauli system of working was replaced by paid labour system. (Hauli was a system of working common in Rajbangsi society of Cooch Behar, in which people help spontaneously other people's cultivation process without any monetary transactions.). Other two factors i.e. electrification and the development of road and transport brought havoc socio economic change in the life of Rajbangsi people. They were very much associated with traditional types of cultivation. Earlier every household used to have large bamboo groves and betel nut gardens. We have already seen that both the crops have some social linking and are also environment friendly. With about 22 genera and 130 species, India is the second largest reservoir of bamboos, next only to China¹. It can also be grown on marginal and degraded land. In addition, benefits of living biomass and soil organic matter content in bamboo stands have been well reported². A bamboo plant grows so vigorously that releases some 35 per cent more oxygen into the air than a similar-sized stand of trees, and it matures (and can be replanted) within five years (compared to 30-50 years for a stand of trees). Bamboo is so fast-growing that it can yield 20-times more timber than trees on the same area (<http://life.gaiam.com/article/how-eco-friendly-bamboo>, accessed 19 December, 2011). It slows down soil erosion and that is why it is a common practice of Rajbangsi community people to plant it on river banks. In Cooch Behar, Jalpaiguri, Dinajpur the species of Bamboo such as *Bamboo balcooa*, *B. bambos*, *B. natus* are planted in close spacing in one to two rows along the north western side of rice field as windbreaks against the dry and cold winds blowing from Nepal and Bihar³. As tobacco needs more time to grow and hazardous to marketise than that of potato but is labor intensive cash crop, all the members of the family can take part in the process of its cultivation. But with the domination of cash crop the crop pattern of this area drastically changed. Means of agriculture gradually changed from langal to power tiller or tractors. Uses of chemical fertilizers started. Power generated water extractions from deep ground became a common

practice. In the field of agriculture, high yielding hybrid seed was first introduced in paddy in the form of IR-8. Gradually pure breeds lost its ground. Modern cash crops like tea, potatoes became prevalent.

Before 1980, Mekhliganj Block of Cooch Behar district was completely devoid of any tea garden. And it is unexpected that Mekhliganj block should support the tea plantation as it is far away from the base of Dooars in Cooch Behar district. Yet it is a fact. Mushroom like growth of small tea gardens occurred in the area of Mekhliganj Block. The Tea Board of India adopted the concept of STGs during the eighth five year plan⁴. Small Tea Growers (STGs) is defined, as a person or group having plantation area up to 10-12 hectares (as per the norms of Tea Board of India). Report from Cooch Behar district shows that in 1911, 23 registered tea gardens were present in Mekhliganj Block. Among 25000 hectares of cultivated land 3420 hectares have already come under tea cultivation (Sources: B.L. & L.R.O. of Mekhliganj & Manager, Mekhliganj Tea Estate). Along with heavy impacts upon soil profile due to prolonged monoculture, many changes have occurred in the tea soils of eastern India. Soil compaction, intensive leaching of bases and increased acidity⁵, low nutrient holding capacity and reduced biodiversity of the tea soils are some of the consequences. In 1980's a company named Long View first introduced tea plantation in Kuchlibari and Jamaladaha anchal in the Mekhliganj Block. To meet the rising demand, tea bought-leaf factory was introduced by the India govt. thereby making the separation of tea gardens and tea factory. Richer section of society appears in the tea field with the finance from bank or from share market. They purchase huge quantities of fertile land (without paying any heed to the law that only soil of poor quality are to be used for tea cultivation) from the poor people on condition that a member of the seller family will get job in the tea estate. Most of the times, the presence of indicator plant like *Lucas sativa* on the land provoked the grower to initiate tea garden without taking the hazards of soil testing. Short term profit lures the poor cultivator of this region to initiate tea garden in their uplands which were previously occupied by betel nut garden or bamboo groves. Often tea gardening spreads beyond to encroach paddy lands unlawfully.

Besides tea, potatoes are the other types of cash crops now dominating in this area. Tea and potatoes are capital intensive crops and need proper nourishment from the growers. They need huge amount of fertilizers



insecticides and herbicides. Sufficient amount of water is also required for both the cash crops; farmers generally collect water from nearby streams or from deep soil. Just to get more green leaf of tea, growers very often use collagen powder which is locally known as vitamin (Isabion, Oviron etc.). In case of potatoes the so called vitamins along with borax are used unscientifically to get larger size of the product.

Result and Discussion

It is a story of a number of marginal land owners of this locality that they first became a paid labor of their own land and finally become jobless people.

Besides so called crop plants, a large number of plants are playing an important role in the life of Rajbanshi community people.

Tea as monoculture type of crop needs eradication of all kinds of weeds from its soil. We are losing a great variety of herbs which might be a great gene reserve pool for future plants.

As the demand of water is satisfied by deep soil water or nearby stream already ground water level has been lowered down.

Improper use of insecticides has heavily come down over the water ecology. Number of fish variety has already disappeared in this area.

Improper use of chemical fertilizer leads to the spoilage of soil fertility and texture in this area. N fertilizer can also accelerate soil acidification.

Again Nitrogen release from NO_3 salt as N is mobile and can be easily lost from the soil by leaching and runoff, resulting in NO_3 -N contamination to groundwater and surface water^{7,8}. The public perceive NO_3 -N leaching as the greatest environmental threat. Owners of large tea gardens take huge bank loan showing the tea garden, acquire land from poor farmers with the conditions of one family member's employment in the garden.

After few years often the owners announce lock out of the garden. Same was happened to Long View and Mou Piya Tea garden in Jamalata and Bhogramuri Anchal.

Owners of small holdings become labourers in the gardens. Owners of small tea garden have to depend on big entrepreneurs for selling their green leaf as the price of green leaf is totally controlled by them.

Bamboo to the poor people is an immediate cash producing crop. Whenever the money is needed they can cut few bamboos and sell them to the nearby market.

After plantation bamboo takes three years to be mature enough without any use of fertilizer.

Betel nut garden is a traditional cash crop. A full grown garden of one bigha land yearly yields betel nut of more or less thirty thousand rupees, without any nourishment from the grower. Growers of this region generally planted betel leaf plant along with betel nut plant. Consequently they get

economic benefit from both the plants simultaneously. With the introduction of modern cash crops markets are flourished with herbicides, which can penetrate up to one foot deep into the soil to destroy the root system of natural herbs and fern.

Recommendation :

Immediate measures should be taken to formulate the indigenous knowledge the people of this area have. Traditional crop cultivation is to be encouraged. Insecticides and herbicides uses should be regulated scientifically. Weeds, relatives of crop species may remain as a reservoir of genes and should be conserved as they may be needed in future.

Our attitude towards environment particularly to the edaphic and hydrological end should be changed.

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Recent Trends of Ecosystem Health and Biodiversity Status of Pelagic-Benthic Coupled System in Indian Estuaries with Special Emphasis on Hooghly Estuary, India



Nabyendu Rakshit, Arnab Banerjee, Swagata Sinha and Santanu Ray

Abstract An Ecosystem can be defined as a community of interconnected elements comprising of living (biotic) and nonliving (abiotic) components of their surrounding environment interacting with each other. Among different types of ecosystems, estuarine system is of interest because the most sensitive land-water-atmosphere interactions are pronounced at these regions. It provides diverse habitat for wide variety of aquatic resources of ecological and economic significance including fin-fish, prawn, bivalve, gastropod, fiddler crab and plankton and so on. But recent years have seen gradual degradation of estuarine ecosystem, mainly in coastal landscape of India, owing to the different anthropogenic factors such as overfishing, development of agriculture and sewage from aquaculture farms, expansion of human settlements. These hamper the ecological balance affecting the food web of the concerned systems. It may lead to impacts including extinction of species, alternation of species diversity of different trophic levels, declination of mean trophic level within the system and significant habitat modification or destruction. Beside this, it also affects the social and economic wellbeing of the coastal communities. So it is important for us to know about recent trends of Indian estuarine ecosystems biodiversity and their proper sustainable management in future. For this purpose, understanding of how ecosystems are structured and how they function is much necessary and ecosystem health analysis is a more scientific and appropriate approach than any other ecological studies. So, our study emphasizes on three major aspects: (1) current scenario of ecosystem health and biodiversity of Indian estuaries at both temporal and spatial scales; (2) Importance of Hooghly estuary and associated modelling studies (3) The necessary actions required for improvement of their ecosystem health status.

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Table 2 Summary of work done in different Indian estuaries with respect to Hydro-chemical, Geo-chemical

Worker	Work done
<i>Hydro-chemical properties</i>	
Nair and Azis [37]	Studied hydrochemical and geochemical properties of water and sediment nutrients of Ashtamudi estuary, Kerala
Upadhyay [65]	Monitored seasonal pattern of temperature, salinity, pH, dissolved oxygen, phosphate, nitrate and silicate profiles of the Mahanadi estuary
Sastry and Chandramohan [58]	Comprehensive survey of the pollution status of Godavari estuary
Anilkumar et al. [2]	Monitored mixing characteristics and seasonal dynamics of Beypore estuary
Saha et al. [55]	Focused on physicochemical characteristics in relation to pollution and phytoplankton production potential of brackish water in Sundarbans of India
Balakrishna and Probst [4]	Studied the source of organic carbon and nitrogen in the Godavari river and its tributaries, the yield of organic carbon from the catchment, seasonal variability in their concentration and the ultimate flux of organic and inorganic carbon into the Bay of Bengal
Biswas et al. [6]	Studied seasonal and spatial variation of dissolved and atmospheric methane (CH ₄) in the estuaries of the Sundarban mangrove ecosystem.
Anil Kumar et al. [2]	Studied water quality of Adimalathura estuary, a small brackish water biotope of Kerala, exposed to pollution from the domestic wastes and coconut husk rotting. This study revealed the deleterious effects of waste disposal on the water quality and showed marked increase in the concentration level of nutrients and a decrease in dissolved oxygen
Prabu et al. [43]	Reported higher nutrient concentrations during the monsoon season and lower during summer while studying seasonal variations in Uppanar estuary
Krihika et al. [21]	Seasonal and tidal dynamics of dissolved nutrients, chlorophyll and primary production in the Pichavaram mangrove system, Southeast coast of India
Soundarapandian et al. [61]	Investigated physicochemical parameters such as rainfall, temperature, salinity, pH, dissolved oxygen and nutrients like nitrate, nitrite, inorganic phosphate and reactive silicate in Uppanar estuary, Cuddalore, southeast coast of India
Pradhan et al. [43]	Applied multivariate statistics and principal component analysis (PCA) to mark the influence of modernization on the quality of the Devi estuary
<i>Geo-chemical properties</i>	
Ghosh and Choudhury [9]	Focused on the sediments of Hoogly estuary and also distribution of organic carbon, total nitrogen, available nitrogen, total phosphorus and available phosphorus in relation to the texture of the sediment
Nasnolkar et al. [39]	Studied sediment organic carbon, total nitrogen, total phosphorus and hydrography of the overlying waters of the estuarine region in Mandovi estuary and a significant linear variation was indicated among nutrients and sediment characteristics
Rajasegar et al. [45]	Emphasized the effect of nutrient rich water from the shrimp farms on sediment composition, organic carbon, total phosphorus and total nitrogen content of sediments in Vellar estuary
Ram et al. [47]	Determined concentrations of Total Organic Carbon (TOC), Hg, Al, Fe in sediment of the Amba estuary in Mumbai harbor

5 Future Prospects

Even Existing ecosystem models of Hooghly estuary both dynamic and static models are briefly discussed and summarized. But coupling of physical and biological models are still unexplored in this system due to much more complexity. In future, it will be better predicting biodiversity status of whole system, its productivity and as well as dynamic behavior of benthic pelagic coupling. In this regard, it should be mentioned that pelagic-benthic coupling plays an important role in nutrient cycling and increasing productivity of system. Recent study by Rakshit et al. [49] using static models for temporal comparison of trophic structure of the Hooghly-Matla estuarine system considers only a few benthic compartments. However, modelling approaches including benthic-pelagic coupling have been negligible. So. In future more scientific and better predicting aquatic models including pelagic as well as benthic environment are expected. Now it should be concluded for development of better predicting models, extensive and more scientific empirical works should be required (Tables 4 and 5).

Table 4 Functional fish groups including species with references included in modelling of Hooghly estuary

Group	Included species	Biomass	P/B	Q/B
Cartilaginous fish	Skates or Guitarfish (<i>Rhinobatos</i> sp.), Sawfish (<i>Pristis microdon</i>), sting ray (<i>Himantura</i> sp.) and Shark (<i>Scoliodon laticaudus</i>)	Srinath et al. [62]	Mohamed et al. [28]	
Polynemids	<i>Polynemus paradiseus</i> , <i>Eleutheronema tetradactylum</i> (Gurjeoli)	Nath et al. [38], Sinha [58]	Khan et al. [34] and Nabi et al. [18]	
Demersal fish	Large (<i>Lates calcarifer</i>), Medium (<i>Sillaginopsis panijus</i>) or small (<i>Harpadon nehereus</i>)	Nath et al. [38], Sinha [58]	Balli et al. [5], Karmakar [17], Khan et al. [19, 20]	
Pelagic fish	Medium Pelagic fish (<i>Rastrelliger kanagurta</i>) and small pelagic fish (<i>Setipinna</i> sp., <i>Coilia</i> sp.)	Nath et al. [38], Sinha [58]	Khan et al. [19, 20], Nabi et al. [33]	
Benthopelagic fish	Medium (<i>Trichiurus gangeticus</i> –Ganges hairtail) and large (<i>Daysciaena albida</i> , <i>Sciaena biauritus</i> , <i>Otolithoides pama</i>)	Nath et al. [38], Sinha [58]	Chakraborty [7], Reuben et al. [52]	
Mesopelagic Fish	<i>Pampus argenteus</i> (Butter fish)	Nath et al. [38], Sinha [58]	Khan et al. [20]	
Mulletts	<i>Liza parsia</i> , <i>Liza tade</i>	Nath et al. [38], Sinha [58]	Moorthy et al. [29], Rangaswamy [48]	
Catfish	<i>Tachysurus jella</i> , <i>Mystus gulio</i> , <i>Plotosus canius</i> , <i>Pangasius pangasius</i> , <i>Osteogeneiosus militaris</i>	Nath et al. [38], Sinha [58]	Raje et al. [4]	
Hilsa	<i>Tenualosa ilisha</i> ; <i>Ilisha megaloptera</i> ; <i>Ilisha elongate</i> ; <i>Ilisha toil</i>	Nath et al. [38], Sinha [58]	Amin et al. [1], Reuben et al. [52]	

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Modelling Studies Focusing on Microphytobenthos and Its Role in Benthic-Pelagic Coupling



Swagata Sinha, Arnab Banerjee, Nabyendu Rakshit and Santanu Ray

Abstract Microphytobenthos (MPB) are much less conspicuous than other groups of organisms occupying the benthic photic zone but are ecologically much important due to their roles in benthic-pelagic coupling, nutrient cycling, association with macrophytes and as food source for many benthic as well as pelagic predators. While there have been numerous studies on MPB, modelling studies on its role in benthic-pelagic couple (BPC) and BPC in general has been negligible. Most modelling studies on MPB have focused on its productivity which depends on many factors such as irradiance, tidal wave, sediment texture and so on. The role of MPB in benthicpelagic coupling helps in maintaining the resilience of the ecosystem, in increasing the productivity of the system and also regulating the dynamics of the entire system. The present work is a review article that highlights such modelling studies that have focused on MPB, its role in coupling and their effectiveness in depicting the real system and to suggest a future modelling approach that could be applied to study the aquatic ecosystem as whole including both benthic and pelagic food webs.

Keywords Microalgae · Light attenuation · Nutrient recycling · Vertical migration · Biofilm resuspension

1 Introduction

Benthos (Greek: ‘*bevoō*’—meaning bottom) refers to the community of organisms that live on, in, or near the seabed—the benthic zone. Benthos in euphotic zone is predominately characterised by photosynthetically active microorganisms though macroscopic vegetation is also seen. The term microphytobenthos (MPB) refers to microscopic, unicellular eukaryotic algae (Baccilariophyceae, Chlorophyceae and Dinophyceae) and prokaryotic Cyanobacteria that grow in a wide range of habitats

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4 Benthic-Pelagic Coupling

In freshwater lakes, benthic primary production was seen to account for up to 98% of total primary production [29]. Griffiths et al. [30] defined benthic-pelagic coupling (BPC) as those processes which connect the bottom substrate and the water column habitats through the exchange of mass, energy and nutrient. Essential ecosystem functions, such as production and energy transfer in food webs, biogeochemical cycling and provisioning of fish nursery areas [31] are supported by multiple and interacting benthic-pelagic coupling processes [32]. Contributions of 30–80% of the phytoplanktonic nitrogen requirement in shallow (5–50 m) coastal environments originate from the sediments [33]. Nutrients exported to sediment in the form of detritus, when re-introduced in water column as re-mineralised inorganic nutrients creates potential for high primary productivity in the water column even when terrestrial nutrient input is low [34].

4.1 Mechanisms of BPC

BPC mechanisms are essential for the ecological understanding of the structure and function of aquatic ecosystems [35]. Processes involved in benthic pelagic coupling are shown in Fig. 1.

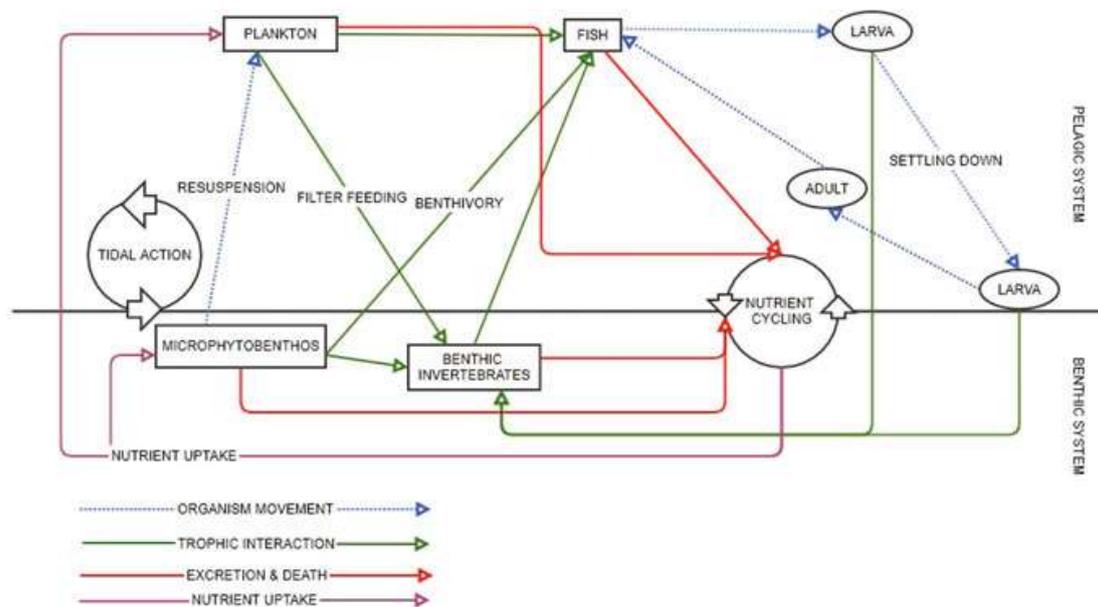


Fig. 1 Diagrammatic representation of different processes involved in benthic pelagic coupling (adapted from [36])

8 Difficulties of Conducting Studies on Benthic-Pelagic Coupling

- Coupled links integrate different depths within the water column and may also do the same on a smaller scale over depths within sediments. However, most of the surveillance techniques and experimental methodologies available usually focus on the sediment-water interface. Thus proper quantification of the linkages between two compartments is a huge undertaking [73].
- Moreover, because of the size constraints of the recording devices of most surveillance and experimental approaches, the materials are observed only when they fall within a very specific and restricted size range.
- Simple knowledge about the amount of material leaving or arriving at the sediment-water interface, without following the subsequent fate of the organisms as to their spatial distribution provides only a limited view of the benthic-pelagic coupling.
- Biological components of both benthic and pelagic systems have patchy distribution, along both vertical and horizontal axes which poses many difficulties in sampling.
- Relating emergence and settlement processes of macrofaunal organisms to sediment physico-chemical and microbiological features is also potentially complicated by the scale at which those features are routinely measured.

9 Future Prospects

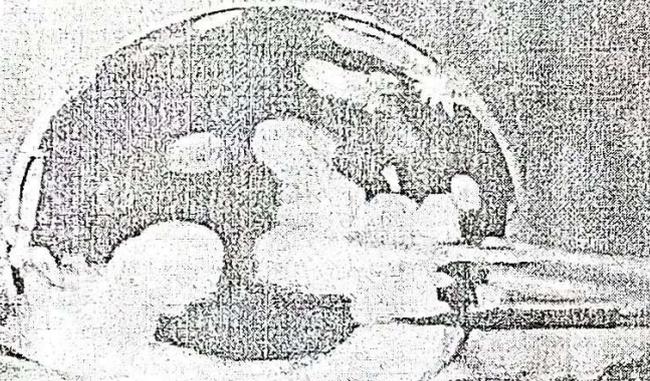
Even though MPB performs many functions—from maintaining the resilience of the ecosystem to increasing its productivity and preventing nutrient loss from the system (through benthic pelagic coupling and its role in nutrient cycling respectively)—its importance in the studied ecosystem models are understated. There are many studies focusing on the functional role of MPB, however, studies of aquatic food web dynamics especially those in the marine systems have mostly focused on pelagic interactions of phytoplankton production and consumption by herbivorous grazers while completely ignoring the fate of detritus that settle to bottom and the role of MPB in recycling the nutrients obtained from these organic matters to the pelagic system.

Whole system can only be successfully studied if benthic and pelagic systems are considered in unison. As discussed in Sect. 3, BPC is what connects the two systems. In Sect. 4, the importance of MPB over other benthic components in BPC has been highlighted. The main aim of this work was to study the available modelling works focusing on MPB and its role in BPC. While there are many studies focusing on MPB, they mainly focus on MPB productivity and very few have been done on its role in BPC. Studies focusing on BPC mainly consider the biogeochemical aspect and have not been considered here. The few studies mentioned in Sect. 6, are the only ones considering some other mechanisms as well but still they consider only MPB

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In Recognition of your Outstanding Research Chapter Entitled
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Authored by



Mr. Sourish Dey

SACT-I in Philosophy, Gushkara Mahavidyalaya.

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Environmental Approach in Vedic Tradition

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Introduction

India is one of the ancient civilizations in the world with a multifarious diversity and flourishing cultural tradition. India is a country of enormous variety. In India there are several religious communities like Hinduism living in full socio-cultural unity. Nature was revered in almost all Indian religious communities and it was regarded as the principle of the unity of creation. In ancient Indian civilization people learnt to live with five elements of nature, the "earth", "water", "air", "fire", "sky" and they were worshipped these elements as idols and symbols. From the various sacred and religious texts of ancient India, we learn about the deep connection of man with nature, where nature was regarded as an essential element of life.

Almost all Indian philosophical communities recognize human beings as a part of God's inherent being. They also acknowledged an intimate relationship between nature and God. Indian philosophical communities acknowledged the unity and harmony between man and nature. Indian literature is flourishing with brisk narration of nature, throughout the time, from primitive era to modern day.

Actually our heritage culture and tradition may illuminate us about the path man conceived his attachment with nature for a long time. As teachers guided their students, our early Vedic literatures may be considered as a dependable indicator to solve the environmental issues. They wanted to instill in the human beings the sense by which the balance of nature is properly maintained. In this paper, I want to show, through the interpretation of the various verses of the Vedas, that the ancient Vedic civilization is much more aware of the unity and proper balance of environment. The Vedic seers were much more conscious than the present civilization in regard to the preservation and protection of nature.

Environmental approach in early Indian civilization

Environmental awareness is not a current issue to make people alert. One of the major features of Indian culture is the unity in immense diversity. The relevance between culture and environment was the integral side of earlier Indian societies. Hinduism is one of the oldest and most important religions in India. From the Vishnu Puran we came to know that, once Lord Vishnu took a form of a boar (varaha) to rescue the mother Earth. It happened, when Hiranyaksha a demon dragged the earth to the ground of the sea. After a long thousand years of war, Lord Vishnu kills the