Chapter I: Introduction

1.1 **Prologue**

Estuaries are considered to be amongst the most productive natural ecosystems because of the presence of nutrient-rich water and deltaic soils. They keep constant and active bridging between the sea water and continental fresh water along with lands (Nath, 2003). In India such systems spread over 3,00,000 ha (Sugunan, 2003) along the 5,600 KM coast line. India is treated as one of the 12 distinctive mega-biodiversity regions in the world due to presence of such estuarine resources.

Within these diversified systems there exist vast expanse of different aquatic resources like rivers and canals, creeks and lagoons, natural lakes, ponds, tanks, flood-plain wetlands, mangroves and of course a typical aqua-body named bheri (local name in West Bengal).

Bheries are the culture type inland fisheries farmed in impounded shallow wet lands in which the water depth seldom exceeds 1.00 metre (Ghosh, 2002). They take a significant part in food and nutritional security particularly in rural Bengal and broadly in rural India.

It is pertinent to mention here that excluding aquatic plants, 60% of world-production comes from inland and 40% from coastal or marine areas (Shearer et. al.,1997) and farmers in the Asia-Pacific Region contribute over 80% of world's aquaculture production, with China producing 50% of global production (Edward et. al., 1997). India stands second position in aquaculture producing 6% of world output (Elenchezhian et. al, 2005). Considering 56% of the total population taking fish in their diets @11Kg/head/year (minimum nutritional requirement as per WHO standard) India would require an extra fish of 0.8MT/year (Sugunan, 2003). Now, though total fishes come from both inland and marine sources, dependency on inland sector in India is exponentially increasing since India's major share (more than 57% of total fish production in 2005-06 in India) comes from inland sector and marine fishery is fast reaching its plateau even sometimes negative in recent years (in terms of growth rates) (Handbook on Fisheries Statistics, WB, 2006).

Amongst the states in India West Bengal has been maintaining its tradition in occupying first position in production of fish for the past consecutive 15 years (Department of Aquaculture,

Aquatic Resources and Fishery Harbours, Govt. of WB, 2006-07) producing more than 17% to 19% of all India total fish production (Handbook on Fisheries Statistics 2006, Government of India). In WB inland sector contributes to more than 87% and 81% of state's fish and shrimp production respectively in the year 2008-09 and growth rate of production of both fish and shrimp in marine sector is almost stalling (Hand Book on Fishery Statistics, WB, 2009-10).

On this perspective inland fishery and more precisely bheri-fishery (being a culture type fishery) may be considered as dependable sector of future fishery-expansion for the sake of meeting additional protein demand particularly in poor India since animal protein is too costly and remaining beyond purchasing capacity of those people.

Again, bheri is predominantly a rural based fishery and more than 70% of Indian population is rural habitants. Hence, this sector can be attributed to contribute a major share in maintaining livelihood, employment generation, poverty alleviation, socio-economic upliftment etc in rural parts of the country particularly where agriculture and other means are handicapped to generate sufficient earnings for existence and maintaining a fertile life-standard. Apart from these domestic sectors bheri helps to earn a great deal of foreign currency by producing various aqua crops like shrimp etc. Export of shrimp from India is increasing exponentially (Handbook on Fisheries Statistics 2006, Government of India) and almost 59% of the total exported shrimp (come from both capture and culture-resources) is contributed from aquaculture (Central Pollution Control Board, Govt of India). This is why aquaculture and more particularly bheri-culture has been getting an important component in our national economy. Some bheri-products are also used in other industries like pharmaceutical and cosmetics.

On the other hand paddy cum fish culture is an age-old practice in many parts of India. Hence, it can contribute a lot to food-grain production in parallel to supplying proteins at cheaper rates. Again with improved technology and scientific management-practice horticulture, pig, duck etc. can be produced in bheri along with rice, fish and shrimp and it can be a viable source of local economics producing those as allied crops.

Further, bheri can be considered as one of the environment controlling systems. Solar energy is trapped in the plants & phytoplanktons like any other aquatic resource and ultimately transmitted into animal population including human through various steps, mediums and forms.

Nothing is unmixed blessing and bheri, of course, is not an exception. Acres after acres agricultural lands in India including WB have been transformed into bheri-fisheries resulting an enhanced pressure on to the rest of the lands available for the purpose of additional agriculture, industry, domestic uses, livestock-grazing, transports & communications, vegetables & horticulture etc particularly when population is increasing exponentially in our country. Again it is very difficult to retrieve the lands for agricultural purposes once they are swallowed by bheries particularly due to salinity-problems. Further bheries cause to spread soil-salinity in the nearby lands and hence agricultural productivity is bitterly affected. Beside these bherie has some adverse environmental effects like eutrophication, spread of various diseases, polluting the related water resources, violation of coastal zone regulation etc.

However, it is understood that bheri is, although renewable source of energy, not finite in nature without sacrificing environmental qualities and lands which can be used for several other purposes. Hence, it needs to be rationally managed and farmed to get optimum economic, nutritional, environmental and social returns from it for the sake of overall betterment of the people directly and indirectly related in present days and of the posterity in future.

For the purpose a close, effective and comprehensive study of the impacts of this unique aqua-culture on socio-economic perspectives is felt necessary to get optimum output from an environment-friendly, technically appropriate, economically viable & returnable and socially acceptable bheri-system since it supports as well as controls people's ways of life.

1.2 Delimitation of the Study Area

Bheri-culture is practiced almost all over the coastal states in India, though with different local names and in different procedures. However, for easy and convenient approach the present study is limited to the saline water bheries in North Twenty Four Parganas, WB, India.

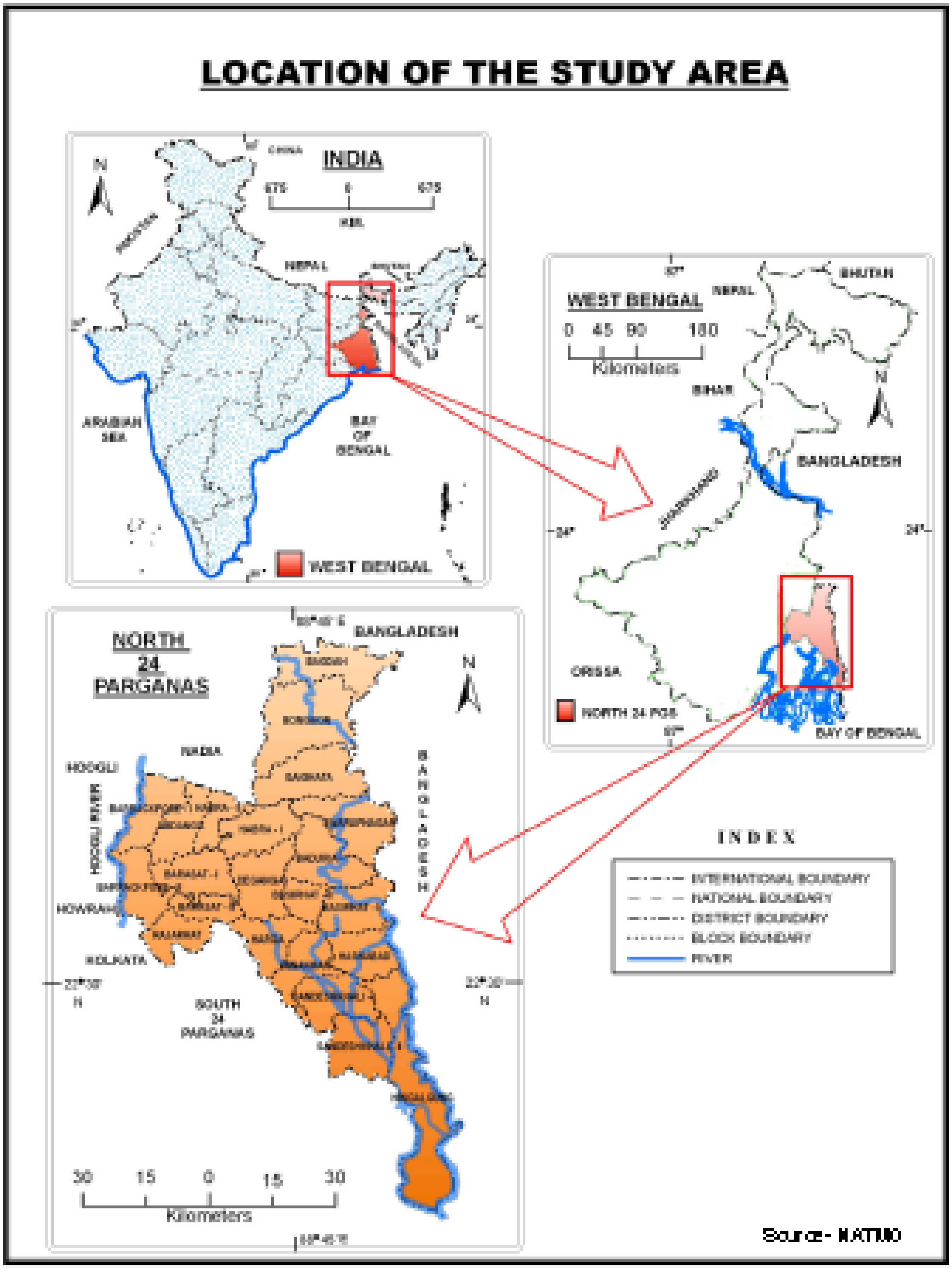
The district is located in the south eastern part of the state West Bengal (India) adjoining Bangladesh. Officially the district emerged as a separate and new district bi-furcating the erstwhile un-divided 'Twenty Four Parganas' with its northern part on the 1st March 1986,

Barasat serving the administrative headquarter. However, it is the 3rd newest district in the state.

The district is situated almost in the heart of Bengal Delta bounded by the river Hooghly and Nadia district to the west, Bangladesh and Nadia to the north, Bangladesh to the east, South 24 Parganas to the south and Kolkata to the south-west. Of course, it is too troublesome and complicated to identify and demarcate the south-western border line adjacent to Kolkata since the city is very closely mixed with the mostly urbanized part of the district. It lies within 22°11'06''N to 23°01'02''N latitudinal extensions and 88°20'E to 89°05'E longitudes covering an area of 4,094 sq Km and a population of 89,30,295 (2001 Census). That is, it occupies only 4.50% of the state's (WB) land area but supports more than 11% of the state's human population. The district stands 3rd position in the state in respect of Human Development Index (HDI) considering life expectancy, literacy, school enrollment, per capita GDP, health, education and income index just after Kolkata and Howrah (West Bengal Human Development Report, 2004). The topographical maps of Survey of India falling within the district are 79B/6 to 79B/12.

However, all the bheries in the district are saline water type with varying degree of salinity-concentration except in Rajarhat and Barrackpur-I blocks where a very small area of sewage-fed bheri exists. Saline water bheries are cultured in low lands of the district's south and eastern parts. The areas are criss-crossed by innumerous tidal rivers and tributaries and literally characterized by delta formation. In some bheries paddy is cultivated during monsoon seasons.

Map 1.2.1


LOCATION OF THE STUDY AREA
INDIA
NEPAL
ARABIAN SEA
BAY OF BENGAL
WEST BENGAL
WEST BENGAL
0 45 90 180
Kilometers
NEPAL
BHUTAN
BIHAR
BANGLADESH
ORISSA
NORTH 24 PGS
BAY OF BENGAL
NORTH 24 PARGANAS
BANGLADESH
NADIA
HOOGLI
HOOGLI RIVER
HOWRAH
KOLKATA
SOUTH 24 PARGANAS
BANGLADESH
30 15 0 15 30
Kilometers
INDEX
INTERNATIONAL BOUNDARY
NATIONAL BOUNDARY
DISTRICT BOUNDARY
BLOCK BOUNDARY
RIVER
Source- NATMO

1.3 Reasons for Selection of the Topic and the Study Area

Bheri is a typical and unique culture-type fishery in terms of its operation, maintenance, managing, trading etc, in all respects and does not resemble any traditional culture fishery. Hence, it simply draws a curious & interesting attention to make a work out on this aquaculture.

The brackish water fishery covering 26% area of total inland fishery sector in WB (Hand Book on Fishery Statistics, WB, 2003-04) contributes more than 9% fish and more than 67% shrimp of total production in inland sector in WB. This shrimp is a very valuable bheri-product and India begated more than 43% foreign currency earned by exporting only 21% frozen shrimp against export of all fish product in the year 2007-08 (Statistics of Marine Products, 2008, The MPEDA, India). In WB these figures are 70.78% and 88.07% respectively in the year 2002-03. Here it is pertinent to say that almost 59% of the total exported shrimp (come from both capture and culture-resources) is contributed from aquaculture (Central Pollution Control Board, Govt of India). Hence bheri being one kind of aquaculture has great role in earning foreign currency.

Again, the bheri touches not only the local people and the fish-farmers directly concerned but also other branches of economy, the society in general and environment as a whole. Hence, the researcher has made an effort to get an in-depth study on the impacts of this resourceful and multidimensional system on socio-economic perspectives.

Now, the district comprises the largest bheri-area more than 70% (The Director, Deptt. of Fishery, Govt. of WB) in the state and they are located particularly in the derelict southeastern parts which are basically a complex system of numerous islands. However, on account of availability of vast area suitable for establishing brackishwater aquaculture, occurrence of ideal climatic conditions favourable for shrimp production, presence of physical and socio-economic environments for running of bheries, availability of ample quantity of wild seeds of shrimps etc, the district can be regarded as ‘Sleeping Giant’ for coastal shrimp farming in India which is already a long-standing practice in the district.

The changing livelihood pattern of the district has been shifting the available lands, in many areas, from agriculture to non-agricultural uses to cope up with the growing population as well as the increasing demand of so called modern amenities. Agricultural fields are not properly irrigated in the south-eastern parts of the district those are nearer to Sundarban and

where a greater portion of the district's bheries exist due to non-availability of irrigable water though the yield is close to national average. The propensity of conversion of land to fishery-purposes is a common feature to obtain direct lucrative economics from bheri-farming. As a whole the areas, the researcher thinks, are too much under developed. These are some specific characteristics of the bheri-areas which attract the author to a great extent.

Afterall, North 24 Parganas is the home district of the researcher. Hence, for the sake of easy and convenient access to each and every pocket of the bheri-areas and to tribute the researcher's self-liability "North 24 Parganas" district has been selected for the present study.

1.4 Objectives

In this study an attempt has been made to evaluate the manifold socio-economic impacts of the bheries in the study area and the main objectives of the study are:-

a) To identify, locate and quantify the bheries in different blocks of North 24 Parganas,
b) To understand the knowhow of the farming-procedure of bheri,
c) To investigate spatio-seasonal variation of salinity in bheri-water,
d) To understand different socio-economic impacts of bheries,
e) To investigate swallowing of agricultural lands due to bheri-farming,
f) To assess the role of bheri in livelihood of the local people,

1.5 Methodology

Methodology is one of the paramount important parts in the exploration of research work undertaken for any purpose because of its dependence on the methods to be followed.

The present work is primarily based on empirical evidences and intensive field works with an integrated approach. Information and data have been gathered by direct interactions with the people concerned preferably with a pre-prepared questionnaire. There are also some secondary sources like published literatures, Govt. and non-Govt. organizations, different research

institutes, websites etc. On the whole the following methods have been adopted to fulfill the target of the study.

a) Pre-field works:- This involved development of concept and collection of various data and information regarding preparation and operation-maintenance of bheries, their ecological and physical parameters like salinity, turbidity etc., spread of bheries and their products in different districts in WB, collection of information on fishery, livestock, geology, physiology, demography, land use, agro-climatic conditions, infrastructural facilities, socio-cultural aspects etc. These have been achieved by various published literatures, maps and topographical sheets, CD etc. available from various secondary sources and some of them are:-

i) Topographical maps bearing no 79B/6 to 79B/12, published by Survey of India,

ii) Political and soil maps, Office of the District Magistrate, North 24 Parganas; Block maps, Department of Agriculture, Govt of WB; District Resource map published by Geological Survey of India; Fishery and Poultry map, District Planning Map Series and Special Map Series of Growth of Calcutta Metropolitan Area, WB in Map etc. prepared by NATMO, GOI,

iii) CD titled as 'Amar Sundarban' ('My Sundarban') published by 24 Ghanta, a Bengali TV news channel and CD titled as 'North 24 PGS, DCHB (2001)', Census of India,

iv) WB State District Profile 1991 and Provisional population total, Series 20, WB (2001) published by Census of India,

v) Institute of Wetland Management and Ecological Design, Govt. of WB,

vi) Hand Book on Fishery Statistics, 2006 by Deptt. Of Animal Husbandry, Dairy and Fisheries, Ministry of Agriculture, Govt. of India,

vii) Hand Book on Fishery Statistics of WB, 2003-04 by Deptt. Of Fisheries, Aquaculture, Aquatic Resource and Fishery Harbour, Govt. of WB,

viii) District Statistical Hand Book (2006), Bureau of Applied Economics and Statics, Govt. of WB,

ix) Meteorological data from Indian Meteorological Department, Govt. of India,

x) Different literatures, data and informations from different State Govt. Departments. like Deptt. of Fishery, Deptt. Of Agriculture, Deptt. Of Environment etc, Govt. of WB,

xi) 17th All India Livestock Census, Agriculture Implements & Machinery, Fishery Statistics, WB, North 24 Parganas District, Volume I, published by Directorate of Animal Resources and Animal Health, Govt. of WB,

xii) Different literature, data and information from Central Ground Water Board, State Water Investigation Department, Indian Statistical Institute, Central Inland Fisheries Research Institute, Central Institute of Brakishwater Aquaculture,

xiii) Various websites and so on.

b) Field Works:- In this stage intensive field works have been performed in different seasons all over the 12 blocks in North 24 Parganas where saline water bheries are found to be practiced. Here a lots of multidimensional primary data, concept, know how, clues etc. like building up of knowledge regarding farming-procedure of bheries, crop-harvesting & marketing, difficulties and obstacles encountered by the farmers and local people and their views to have a way out, their mutual relation and dependency, seasonal variation of profession and socio-economic conditions, local rituals and religio-cultural events, infrastructural facilities and amenities available in the localities and many more things in different seasons. Role of bheri on the aspect of environmental degradation has also been identified. The farmers and land-owners of bheries vis-à-vis the local people have been interviewed for the purpose through a pre-prepared formal questionnaire as well as in informal ways of talking and gossiping on random sample survey basis. The tidal amplitudes at different locations in different seasons have been observed. Water of saline water bheries of all the twelve blocks in the district in different seasons was collected for the purpose of testing and ascertaining spatio-seasonal salinity variation. Overall special stress has been paid on the collection and registration of views of the local people towards negative aspects of bheri-farming prevailing in the areas and finding a way out of the same.

c) Post-field Works:- It is the last phase of the 3-stage methodologies and has been carried out at home, laboratory, class rooms etc. It involved compilation, computation, processing &

analysis and tabulation of necessary data and information. There after they have been represented in the form of maps, diagrams, charts, tables etc. with suitable cartographic techniques as required. Due emphasis has been laid on the application of modern tools like use of satellite imagery etc.

Salinity of the samples of bheri-water has been tested with help of digital salinity meter model 671E in the laboratory, Department of Geography, University of Calcutta. The laboratory results i.e. the spatio-seasonal variation of salinity has been depicted on maps block-wise.

1.6 Considerations

The below mentioned considerations have been taken in this research works.

a) The entire work has been carried out in four hierarchical levels vide: village level (the lowest level), Grampanchayet level, block level and lastly the district level as a whole,
b) Three seasons vide pre-monsoon, monsoon & post-monsoon have been considered to show the spatio-seasonal variation of salinity of bheri-water with block as a unit by convention, it being the lowest administrative set up,
c) Generally 2001 census has been considered for secondary demographical data,
d) Contribution of sewage-fed bheri in the district is very few in respect of area covered and production as compared to saline water bheries. Hence, only saline water bheries have been considered in this study.

1.7 Literatures Reviewed

The complex nature of the estuarine bheri-fishery implies that multi-disciplinary academicians are involved in its study. Right from the basic streams like Geography, Economics, Sociology etc. to the specialized disciplines such as Fishery Sciences, Ecological Sciences, Environmental Studies, Population Studies, Estuarine Geography, Forestry etc. contribute to make an attempt to understand its in-depth characteristics. Though, in the context of this work the researcher could not cover all of them with equal endeavor and the books directly related to the present topic is not adequately available to her. Hence, various reports of different Govt. and non-Govt. organizations, relevant papers of multi-disciplinary scientists, research fellows, academicians etc.

published in different journals have mainly been reviewed. However, some of them are briefly described below:-

A detailed generalized view of undivided 24 Parganas was carried out by W.W. Hunter in his books entitled 'A Statistical Account of Bengal (Vol I, Part I), Statistical Account of the District of 24 Parganas' and 'A Statistical Account of Bengal (Vol I, Part II), Statistical Account of the Sundarbans' (published by WB District Gazetteers, Department of Higher Education, Govt. of WB, Calcutta, 1998). These two volumes are verbatim reprint of the books originally published by Trubner & CO., London, in 1875 and 1876 respectively. These two books give a realistic scenario of the then geography, demography, agriculture, natural calamities, communication systems & commerce, administrative set up, meteorology, medical & sanitation etc. including fishery, marsh cultivation, immigration of people for the purpose of reclamation of the jungles and their subsequent livelihood etc.

The 'District Human Development Report, North 24 Parganas' published by the Development and Planning Department, Government of WB has dealt with some salient features of the district viz demography, livelihood options in rural and urban areas, different amenities like healthcare services, education, roads etc., arsenic contamination in ground water, environment and disaster management, block-wise human development index & deprivation index etc. including changing use pattern of agricultural land due to brackishwater bheri culture.

Central Institute of Brackishwater Aquaculture (CIBA), Kakdweep, WB and Central Inland Fishery Research Institute (CIFRI), Barrackpur, WB are the two pioneering research institutes in this state in the related fields and have published so many books, journals, bulletins etc. Several related articles in the bulletin numbers 46, 109, 11, 113, 115, 125, 130 etc. and policy paper nos. 1, 2 etc. of CIFRI, Barrackpur describe preparation, operation and management, ecological impacts etc of bheries in the district. A good number of scientists of CIFRI such as V.V. Sugunan, B.C. Jha, M.K. Das, T. Rajyalakshmi, H.C. Karmakar, A.K. Ghosh and others have outlined in different journals the various aspects related to bheri-farming like environments, diseases, pin-collections, supplementary feeds, cost involvement, hazards coming out of bheri-cultivation etc.

A. Kaviraj & H. Guhathakurta (2004) and Mahua Das (2009) in the Journal of Asian Fisheries Science Society, Manila, Philipine have reflected heavy metal deposition in brackishwater and the impacts of commercial coastal fishing both in Sundarbans respectively. Kunal Chattopadhay of ISI, Kolkata has described about environmental conservation of East Calcutta Wetland (ECW). Apurba Ghosh (1990) and Utpal Bhowmik & S.K. Saha (1994), all of CIFRI, approached to economic feasibility of rice-cum-fish culture in 24 Parganas and socio-economic status of fishing people in Sundarban estuary respectively. In the journal of Environment & Ecology 10(4): 919-922, 1992 U. Bhaumik et. al of CIFRI, Barrackpur, WB and in the J. Inland Fish Soc. India, 27 (1), 1995, 35-39 B.K. Mahapatra, D. Saha & N.C. Datta of Ramkrishna Ashram Krishi Vigyan Kendra, Nimpith Ashram, South 24 Parganas, WB have described the necessity of conservation of fin fish and shell fish seeds in the Sundarban areas and suggested some suitable measures for the same.

In the J. Indian Soc. Coastal agric. Res. in vol 8(1), P 37-41, 1990; in vol 9(1/2),P 93-97, 1991; in vol 23(1), P 57-60, 2005; in vol 5(1), P 257-65, 1987; in vol 9(1/2), P 395-96, 1991; in vol 3(2), P 115-24, 1985; in vol 5(1), P 267-71, 1987; in vol 1(1), P 27-30, 1983; in vol 16(2), P 73-79, 1998; in vol 3(2), P 107-14, 1985 and in vol 5(1), P 279-86, 1987 C.R. Biswas et. al of Central Soil Salinity Research Institute, Regional Research Station Canning, WB; C.R. Biswas et. al of Central Soil Salinity Research Institute, Regional Research Station Canning, WB; T. Elenchezhian et. al of Department of Agricultural Economics, Centre for Agricultural and Rural Development Studies, Tamil Nadu Agricultural University, Coimbatore- 641 003, Tamil Nadu; A.B. Mukherjee & Apurba Ghosh of CIFRI, Barrackpur, WB; P. Dhara et. al of Department of Agricultural Engineering, BCKV, Mohanpur, Nadia, WB; K.R. Naskar of CIFRI, Rahara Research Centre, Rahara- 743 186, WB; G.N. Saha of CIFRI, Kolkata; A.V. Natarajan, Director, CIFRI, Barrackpur, WB; B.K. Bandyopadhyay of Central Soil Salinity Research Institute, Regional Research Station , Canning Town-743 329, WB; A.K. Roy et. al of CIFRI, Kakdwip-743 347, WB; R.N. Pal et. al of CIFRI, Barrackpur, WB respectively have described different aspects related to saline water aquaculture viz 'Resource Management Through Paddy-cum-fish Culture in Coastal Saline Areas'; 'Prospects and Retrospects of Paddy-cum-fish Farming in Coastal Low Land Rice Fields'; 'Comparative Economics of Rice and Shrimp Farming: The Plight of Agricultural Labour in Coastal Districts of Tamil Nadu'; 'Engineering Aspects of

Designing Prawn Farms in Tidal Regions of Sundarbans'; 'Effect of Waterbodies on the Quality of Groundwater in Coastal Areas of South 24-Parganas in West Bengal, India'; 'A Short History and the Present Trends of Brakishwater Fish Culture in Paddy Fields at the Kulti-Minakhan Areas of Sunderbans in West Bengal'; 'Present Status of Brakishwater Bheri Fishery in West Bengal with Reference to its Soil and Water Qualities, Problems and Management for Improving Fish and Prawn Production'; 'Possibilities of Brakishwater Paddy-cum-fish Farming in Coastal Saline Soils'; 'Submergence of Coastal Lands under Brakish Water Aquaculture—effect on Soil Properties and Ecology of Coastal Region'; 'Observations on Silt Load Distribution in Relation to Tidal Amplitude and Lunar Periodicity and its Control in Brakishwater Fish Farming' and 'Problems of Fish Health in Bheries of the Districts North and South 24 Parganas, WB' respectively.

In the journal of Environment & Ecology vol 4, no 2, P 244-47, 1986 N.C. Datta et. al of Fishery and Ecology Research Unit, Department of zoology, University of Calcutta, Calcutta-700 019, India; in vol 17(4), P 808-13, 1999 T.K. De and A. Mitra of Department of Marine Science, Calcutta University, India and D.P. Bhattacharya of Department of Theoritical Physics, Indian Association for the Cultivation of Science, Calcutta-700 032, India; in vol 4(2), P 199-204, 2007 Apurba Mukherjee et. al of Department of Zoology, University of Calcutta, 35, B.C. Road, Kolkata- 700 019; in vol 9(3), P 629-34, 1991 Asim K. Nath and Samir Banerjee of Aquaculture Research Unit, Department of Zoology, Calcutta University, 35 Ballygunge Circullar Road, Calcutta- 700 019, India discussed various topics and they are 'Effect of Some Physico-Chemical Parameters on the Abundance of Cladocerans in a Brakishwater Impoundment of West Bengal, India'; 'Physico-Chemical Characteristics of Sewage Polluted Kulti Estuary, West Bengal, India'; 'Culture of Penaeus Mondon Using Plant Based Additives in Indian Sunderbans'; 'Exploitation of Natural Resources of Fish and Prawn Seeds in Estuarine Areas of West Bengal' respectively.

In the J. Inland Fish Soc. India 27(1), 1995:35-39, 25(1),1993:44-50, 26(2),1994:78-84, vol VII,December,1975:216-24, 28(2),1996:85-90, B.K. Mahapatra, D. Saha and N.C. Saha of Ramkrishna Ashram Krishi Vigyan Kendra, Nimpith Ashram, South 24 Parganas, WB, India; Utpal Bhaumik, S.K. Saha and P.M. Mitra of Central Inland Capture Fisheries Research

Institute, Barrackpur; A.K. Ghosh, P.K. Pandit, K.R. Naskar, R.K. Banerjee and H.C. Karmakar of Central Inland Capture Fisheries Research Station, M.S.O. Building, DF Block, Salt Lake, Calcutta-700 064; V. Gopalkrishnan, K.K. Bhanot, S.N. Datta and S.B. Saha of CIFRI, Barrackpur, WB, India; D. Nath and D.K. De of Central Inland Capture Fisheries Research Institute, Barrackpur, WB wrote papers entitled 'Destruction of Shelfish and Finfish Seed Resources of the Sunderbans, WB and Suggestion for their Conservation'; 'Scenerio of Brakishwater Finfish and Shellfish Seed Collection in the Sunderbans, WB'; 'Studies on the Production Dynamics of Different Saline Bheries in 24 Parganas, WB'; 'Procurement of Stocking Materials for Brackishwater Fish Culture from the Hooghly-Matlah Estuarine System'; 'Changes in the Environmental Features of the Hooghly Estuary in Relation to Bore Tide' respectively.

In the articles 'Soils of the Sundarbans' by S. Bhattacharya and 'Importance of Sunderbans Region in West Bengal's Economy' by Rabindra Kumar Sengupta in the book 'The Bhagirathi-Hooghly Basin (Proceedings of the Interdisciplinary Symposium' edited by Kanan Gopal Bagchi, published (1972) by Sibendranath Kanjilal, 48, Hazra Road, Calcutta-19 soils and economics of Sundarban-estuaries respectively have been described.

'A Manual on Shrimp Farming' published by The Marine Products Export Development Authority (MPEDA) highlights in details about shrimp culture practices, site selection, farm construction & maintenance, water quality management, nutritional requirement, diseases, harvesting etc in India.

In two papers published in Science and Culture in its volume 20, No 9, P 418-423, in March 1955 and in the Journal of the Asiatic Society, Science, Vol. XVIII, No 1, 1952 Sunder Lal Hora, Director, Zoological Survey of India fantastically reflected the salinity problems in the rivers of WB and their effects on pisciculture and major problems faced by the fisheries of India with some suggestions for their solution respectively.

T.K. Chatterjee and Ramakrishnan of Marine Aquarium & Research Centre, Zoological Survey of India, Digha-721 428, WB in a paper in J. Andaman Sci. Assoc. 12(1 & 2): 89-93, 1996 has

highlighted the sustainable development of brackishwater fish farming in the Sundarbans of WB, India.

Ram Singh (Geographical Review of India 69(4), December-2007) has described the growth and consumption of fish in India through GIS. In a topic entitled 'Combating Disaster: Perspective in the New Millenium' edited by Antara Banerjee (acb Publication, 2005) has described about environmental degradation due to shrimp farming in 24 Parganas (North & South). The department of Fishery, Government of West Bengal in its various Administrative Reports has mentioned the status of pisciculture in WB including North 24 Parganas. An outline on status of different types of bheri-cultivation and its modernization and potential in WB including North 24 Parganas have been depicted in 'NABARD's Initiative in Development of Fishery Sector of WB'.

Dr. Kumud Ranjan Naskar's 'Mannual of Indian Mangrove' (Daya Publishing House, Delhi, 2004) and 'Mangrove Swamps of the Sundarbans' (Naya Prokash, 1987) are two dependable books on Sundarbans including bheri-farming areas and topography & physiography in Sundarban Delta. Rabindra Kumar Sengupta (Calcutta University, 1972) in 'The Bhagirathi-Hooghly Basin' has touched the role of fishery in Sundarbans in WB's economy.

DR. Dilip Biswas, Chairman, Central Pollution Control Board delivered a keynote address on different categories of coastal zones and their management in a seminar on 'Coastal Pollution in Bay of Bengal' organized by the Kolkata Chapter of Society for Indian Ocean Studies on 9th March,2002.

Graham Haylor, Aquatic Resources Programme Manager and Simond Bland, Senior Natural Resources Advisor of Department of International Development, C/O British Embassy, Wireless Road, Bankok 10330, Thailand in a topic entitled 'Integrating Aquaculture into Rural Development in Coastal and Rural Areas' have mentioned how aquaculture in some Asian countries can contribute to overall development in remote-rural and poor areas.

Government of West Bengal and National Bureau of Soil Survey & Land Use Planning (NBSS&LUP) in collaboration with Bidhan Chandra Krishi Visvabidyalaya (BCKV) (2009) have assessed and mapped some important soil parameters in 24 Parganas (North). Anchalik Itihas O Lokosanskriti Charcha Kendra (Centre for Culture of Local History and Folks), Hingalgunge, North 24 Parganas, WB has lightened different folk culture of the district through leaflets, booklets etc. and has been organizing various indigenous folk songs and culture round the year.

That is mainly the district in general and some specific aspects of bheries such as physico-chemical characteristics, biological analysis, purely economic output, technical features etc have ever been worked out but no work in respect of socio-economic impacts of bheries in the district is found available by the author. In this context the author has tried to make an overview of socio-economic impacts of such typical pisciculture in North 24 Parganas district.

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