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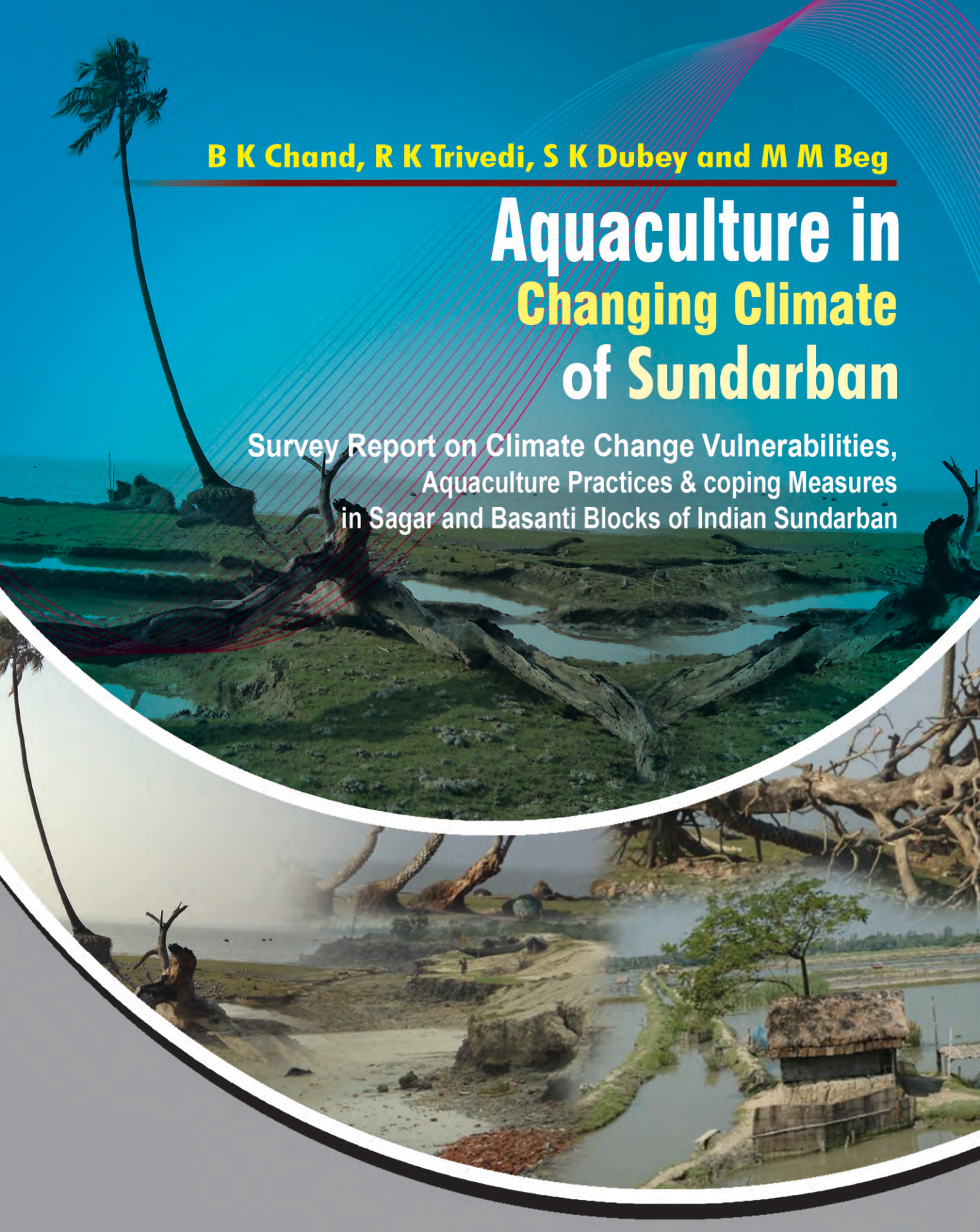
Aquaculture in Changing Climate of Sundarban

Survey Report on Climate Change Vulnerabilities, Aquaculture Practices & coping Measures in Sagar and Basanti Blocks of Indian Sundarban



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Aquaculture in Changing Climate of Sundarban

Survey Report on Climate Change Vulnerabilities, Aquaculture Practices & Coping Measures in Sagar and Basanti Blocks of Indian Sundarban

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FOREWORD

Sundarban, a World Heritage Site, is the largest contiguous block of tidal halophytic mangrove forest in the globe. It is a delta of the rivers Ganga, Brahmaputra and Meghna and located in West Bengal state of India and neighbouring country of Bangladesh. With its array of trees and wildlife, the Sundarban is a showpiece of natural history. It is a dynamic ecosystems formed by interactions between land and water, and is considered as one of the most productive and bio-diverse wetlands on earth. Ecologically, the mangrove forests are important as barriers to cyclones, tidal upsurges, etc. It also acts as a huge sink of unlimited capacity for absorbing CO_2 and other pollutants from air and water which makes the surrounding environment free from pollution. Yet, these unique and biodiversity-rich forests are among the most threatened habitats due to biotic and abiotic pressure from the surrounding environment. Mangroves have been extensively exploited over centuries due to various human activities. In addition to this, the climate change phenomenon like sea level rise due to global warming and saline water inundation due to increased occurrence of extreme weather events like cyclone and storm surges etc. are posing threats to this fragile ecosystem and affecting human live and livelihood.

Aquaculture is considered as one of the major livelihood options for the peoples of Sundarban. Building the resilience to climate changes and uncertain future hazards is a cornerstone of the strategy for enhancing the adaptive capacity of fish farmers. Keeping these facts in mind, the project entitled "Development of Climate Resilient Aquaculture Strategies for Sagar and Basanti Blocks of Indian Sundarban" was awarded to West Bengal University of Animal and Fishery Sciences as a sponsored research component of NICRA (National Initiative on Climate Resilient Agriculture). I hope the scientists engaged in this project will put in their best effort to fulfil the objectives of the project. I congratulate all the members associated with this project for bringing out this excellent publication based on the benchmark survey is being conducted among the fish farmers of Sagar & Basanti blocks of Indian Sundarban which could prove useful in making policy and planning for the future aquaculture development program for the Sundarban region.

Dated the 17th May, 2012
New Delhi

(S. Ayyappan)

PREFACE

Climate change in the earth is an age old phenomenon. But such change due to human activities is a dangerous trend. With the ever growing human population necessity for more food production has become a demand of the day. To feed the population, every country has been exploiting its green coverage. Today, with food production ranking high on the priority lists of governments around the world, an increasingly large amount of resources and capital is being invested in agriculture and allied sectors. The clearance of vast forest land for agriculture has adversely affected earth's very own emissions-control mechanism. The modern agriculture has aggrevated the situation, in which, the greenhouse gas emissions that are released by agricultural activities bring about noticeable changes in climatic conditions, which, in turn, contribute to reduced yields. So, there is a big question. Does the food production necessarily have to come at the cost of environmental damage? The answer lies in revolutionising existing farming practices and replacing those with what is known as climate-resilient agriculture. National Initiative on Climate Resilient Agriculture (NICRA) is a project of the Indian Council of Agricultural Research (ICAR) which aims to enhance resilience of Indian agriculture to climate change and climate vulnerability through strategic research and technology demonstration. I am thankful to ICAR for awarding the project entitled "Development of Climate Resilient Aquaculture Strategies for Sagar and Basanti Blocks of Indian Sundarban" to our University. Sundarban, the largest estuarine delta of the World, is a climate change hotspot which is very much vulnerable to climate change impacts like sea level rise, coastal erosion, tidal surge, saline water inundation etc. Sundarban mangrove is the home of a number of endangered and globally threatened species and is considered as an important biosphere reserve of the world. Despite the ecological sensitivity of the region, Indian Sundarban is the home for about 4.5 million people who depend on its natural resources for the livelihood. Aquaculture being the one of the major livelihood options for the people of the region, the above project on climate resilient aquaculture has greater significance. The current survey carried out in Sagar and Basanti blocks, is to evaluate aquaculture activities of the farmers as well as socio-economic status and to identify the various constrains and challenges faced by them in the light of changing climate of Sundarban. I hope the findings of this survey would help building up the climate resilient adaptive strategies in aquaculture for the future. I congratulate all team members who are involved in survey process and contributed to this excellent publication. The publication will be beneficial for the researchers, extension workers, Non-Governmental Organizations, Community Based Organizations etc. engaged in aquaculture development of Sundarban.

(Prof. C S Chakrabarti)
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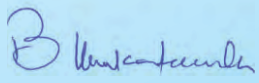
PREFACE

Sundarban, the estuarine delta of Ganges and Brahmaputra river systems, is the largest river-mouth system in the world as well as a UNESCO World Heritage site. The physical feature of this region is peculiar as it is crisscrossed by numerous tidal rivers, creeks & canals and river systems. By nature it is an area subjected to periodical tidal flooding and tempered by mangrove vegetation. Human settlement in Sundarban started from 18th century through clearing mangrove forests and constructing earthen embankments or dykes to protect the islands from tidal waters. The region is considered as one of the worst climate change hotspots that influences the lives and livelihoods of over 12 million people in India and Bangladesh. The shallow and funnel-shaped Bay of Bengal intensifies cyclones and storm surges, flooding the low-lying plains of Sundarban. Other climate-induced risks like sea level rise, salinity intrusion, temperature and rainfall variations, land erosion etc. also pose serious threats. The IPCC Fourth Assessment Report also predicts that the climate change will intensify extreme weather events such as cyclones and associated storm surges, especially along the Bay of Bengal. These will seriously affect the livelihood activities of the people involved in agriculture, animal husbandry and fishery (fishing and aquaculture) to great extent. With this background the project entitled "Development of Climate Resilient Aquaculture Strategies for Sagar and Basanti Blocks of Indian Sundarban" was awarded to West Bengal University of Animal and Fishery Sciences under sponsored research component of NICRA (National Initiative on Climate Resilient Agriculture). I am happy to note that under the said project, a survey has been conducted among the fish farmers of Sagar & Basanti blocks of Indian Sundarban to benchmark the socio-economic profile, current aquaculture practices, climate change pattern and coping measures. I congratulate the project team members for bringing out this publication based on detailed survey findings. I hope the survey report will be helpful for the scientists involved in NICRA projects in particular and policymakers, planners and others in general.



(B. Venkateswarlu)
Director
Central Research Institute
for Dryland Agriculture
Hyderabad

PREFACE

Climate change is one of the greatest threats of the new millennium as it alters the function, diversity and productivity of the ecosystem. The Ganges delta, Sundarban, named after the dominant mangrove species *Sundri*, is a complex ecosystem of mangrove forests in the world. The region is recognized as a site of national and international importance for its unique its wide range of flora and fauna. The most famous among these are the Royal Bengal tigers, but also habitat of numerous species of birds, spotted deer, crocodiles and snakes also inhabit it. The region is intersected by a complex network of tidal waterways, mudflats and small islands of salt-tolerant mangrove forests, and presents an excellent example of ongoing ecological processes. The region's low elevation above sea-level and proximity to the coast make it very much vulnerable to climate change as the area is increasingly exposed to natural calamities especially cyclone, storm surge and flood. The farmers and fishermen of Sundarban who primarily depend upon the nature for their livelihood are already the facing the problems due to climate change. The short term vulnerability of the region from climate related events has been amply demonstrated by the cyclone *Aila*, which has seriously affected the live and livelihood of the people.

The University is thankful to ICAR for awarding the research project entitled "Development of Climate Resilient Aquaculture Strategies for Sagar and Basanti Blocks of Indian Sundarban" under National Initiative on Climate Resilient Agriculture (NICRA) and giving an opportunity to conduct some research works for the benefit of the fish farmers of Sundarban. It is heartening to note that under the said project, a survey has been conducted among the fish farmers of the delta to understand the impacts of climate change on aquaculture. I praise the project team members for bringing out this publication based on survey findings and trust the publication to be helpful for the readers.

Tapan K. Ghosh

(Prof. T. K. Ghosh)
Director of Research, Extension & Farms
West Bengal University of Animal and Fishery Sciences

ACKNOWLEDGEMENTS

Sundarban, one of the most biodiversity-rich habitats in the world, is affected by climate change. Sea level rise, changes in water and air temperature, erratic monsoon, increase in frequency and intensity of cyclone and storm surge, breach of embankment leading to saline water flooding etc. are playing havoc on lives and livelihood of people and other biological phenomenon of Sundarban. Aquaculture is a major livelihood option for the people of the delta and contributes significantly to the economy of the region. The prevailing climatic condition is severely affecting this sector. The current project "Development of Climate Resilient Aquaculture Strategies for Sagar and Basanti Blocks of Indian Sundarban", awarded to the University by ICAR under NICRA (National Initiative on Climate Resilient Agriculture) is an attempt to give some relief to the affected fish farmers through adaptation strategies. As the part of the project, a cross-sectional interview-based survey was carried out at two climate change sensitive blocks of Sagar and Basanti in Indian Sundarban. The main objective of the survey is to evaluate aquaculture activities of the farmers as well as socio-economic status and to identify the various constrains and challenges faced by them in relation to climate change. Total 451 households (244 households in Sagar Island and 207 households in Basanti) were surveyed with the help of 20 numbers of surveyors & 4 numbers of reviewers. The present publication is a compendium of information on climate change aspects of Indian Sundarban alongwith survey findings.

The authors wish to place their utmost gratitude to Dr. S. Ayyappan, Secretary, DARE & Director General, ICAR for his kind patronage. We express our sincere thanks to our beloved Vice Chancellor, Prof. C. S. Chakrabarti for his timely advice and keen interest in execution of the project. We owe a lot to Dr. A. K. Singh, DDG (NRM); Dr. B. Venkateswarlu, Director, CRIDA and Dr. M. Maheswari, PI, NICRA for their kind counsel. The authors wish to record deepest sense of gratitude to Prof. T. K. Ghosh, Director of Research, Extension & Farms, WBUAFS and Prof. N. R. Pradhan, Former Director of Research, Extension & Farms, WBUAFS for their whole hearted

cooperation for the successful implementation of the programme. We are thankful to Prof. A. Chowdhury, Rtd. Professor Emeritus, University of Calcutta & Secretary, S D Marine Biological Research Institute for his sincere involvement and valuable suggestions. The authors are thankful to Prof. A.P. Sharma, Director, CIFRI, Barrackpore for his valuable suggestions. The authors are grateful to Dr. (Mrs.) A. Sinha, Principal Scientist & OIC, CIFRI, Kolkata Centre; Dr. A. Danda, WWF-India, Sundarbans programme; Prof. T. J. Abraham, Faculty of Fishery Sciences; Dr. T. S. Nagesh, Associate Professor, Faculty of Fishery Sciences; Dr. A. S. Ghosh, Dy. Project Director (Fishery), Sundarban Development Board; Dr. S. N. Biswas, Dy. Director, West Bengal State Fisheries Department and Mr. S. Ghosh, Junior Project Officer (Fishery), Sundarban Development Board for their unstinted support. We are indebted to Mrs. A. Biswas, Computer Programmer, WBUAFS, for her help in developing in-house data base software for data entry and analysis. The authors owe their heartfelt thanks to Dr. A. Mishra, Secretary, Paribesh Unnayan Parishad (PUPA) and Biswajit Mahakur, Secretary, Joygopalpur Gram Vikash Kendra (JGVK) for their active cooperation during survey. The service provided by the surveyors & reviewers are duly acknowledged. The institutional support received from WWF-India Sundarban Programme, Sundarban Development Board, Central Institute of Fisheries Education and West Bengal State Fisheries Department is thankfully acknowledged. Last but not the least; the authors are indebted to all the fish farmers covered during the survey for their volunteered disclosure of information and making this survey a grand success.

Kolkata
Date: 31. 05.2012

(B K Chand) (R K Trivedi) (S K Dubey) (M M Beg)

EXECUTIVE SUMMARY

Sundarban, the estuarine delta of Ganges-Brahmaputra-Meghna, is the largest river-mouth system in the world as well as a UNESCO World Heritage site. With its array of halophytic mangrove vegetation and diverse wildlife, the Sundarban is a showpiece of natural history. It is a dynamic and vibrating ecosystem formed by interactions between land and water, and is considered as one of the most productive wetlands on earth. The important morphotypes of Sundarban include beaches, mudflats, coastal dunes, estuaries, creeks and swamps. In the Globe, the region is spreading across West Bengal state of India and neighboring country of Bangladesh (between $21^0$32"N-$23^0$31'N Latitude and $88^0$10'E-$92^0$15'E Longitude). The entire Sundarban is about 26000 sq. km, the one-third of which falls in India. The Indian part of Sundarban is comprised of 102 islands; of which 54 islands are inhabited by human where more than 45 lakh people live and the rest is reserve mangrove forest. The Indian region is demarcated by the river Hooghly on the west, the Bay of Bengal on the south, the Ichamati-Kalindi -Raimongal rivers on the east and the Dampier-Hodges line on the north. It comprises of 19 Community Development blocks of which 6 in North and 13 in South 24-Parganas districts with total 190 Gram Panchayats and 1064 villages.

The region is considered as one of the worst climate change hotspots. The climate of Sundarban is changing fast and the changes observed during the last two and a half decade (1976-2010) reveal decrease in dew deposition, increasing behaviour of erratic nature of weather, reducing nature of winter span, faster rising trends of average daily minimum temperature, uncertainty of post monsoon weather and rising Incidences of partial break or mid-monsoon. The review of literature on climate change studies of Sundarban showed the changes in air temperature, surface water temperature, rainfall & monsoonal pattern, salinity regimes, cyclonic storms and depressions, sea level rise, and erosion & accretion. The people of the delta are experiencing extended, extreme and hot summer, whereas the winters are becoming shorter, warmer, and drier. A study on air temperature of Sagar island in Sundarban revealed that during 80 years (1891-1970) the average daily temperature increased 0.1°C. However, in general, the air temperature over the Bay of Bengal is rising at a rate of 0.019 °C per year and if this trend continues, the air temperature in this area is expected to rise by 1 ° C in next 50 years. Regarding surface water temperature, the delta has shown significant rising trend and over the past 30 years (1978-2008) it has increased at a rate of approximately 0.05°C/year. In case of Bay of Bengal, sea surface temperature (SST) near Sagar island showed a rising trend at the rate of 0.0453 °C per year during 2004-2009.

Aquaculture in Changing Climate of Sundarban

In Sundarban, the average annual rainfall is 1625 mm but in case of high rainfall year this may increase to 2000mm where as this may drop to 1300mm in exceptionally low rainfall year. There is a trend of delayed monsoon and heavy rains at the beginning as well as late recession and sometimes heavy precipitation during *khariff* harvest. The earliest (25th May, 2009) and latest (26th June 1983) onset of monsoon over this region has occurred within the period of last 25 years. Significant changes in salinity observed in the rivers of Sundarban. The analysis of data over a period of 5 years (1996 – 2000) revealed that the salinity increased in the rivers Matla, Thakuran and Saptamukhi and decreased in the two river systems *viz.* Hoogly & Harinbhanga-Ichamati-Roymangal having connection with upstream fresh water inputs. In Bay of Bengal during 120 years (1891-2010), disturbances like depressions and cyclonic storms occurred at a rate of 10.79 per year. However, in the last 40 years (1971-2010), the total number of disturbances has reduced but the frequency of severe storms and intensity increased remarkably. During the last part of decade (2006-2009) the northern part of Bay of Bengal registered four cyclones *viz. Sidr, Nargis, Bijli and Aila*.

Sundarban is under the threat of severe erosion and drowning due to relative sea level rise and increasing cyclonic activity. Sea levels in Indian sub-continent are increasing at the rate of about 2.5 mm/year. But in case of Sundarban, the relative sea level rise is higher than this which is due to subsidence of land. The data of Sagar island for the period of 2002-2009 indicated a rise of Relative Mean Sea Level (RMSL) at the rate of 12mm/year during the decade. The western banks of rivers are more vulnerable to erosion than the east and marginal accretion is localized in the inner estuaries particularly along the eastern and northern margins of islands and along the coast where it is mostly east-west oriented and sea facing. Coastal erosion is prominent in 12 sea facing southern islands. Few islands *viz*. Lohachara, Bedford, Kabasgadi and Suparibhanga have already vanished from the map. Most vulnerable islands to erosion are Sagar, Ghoramara, Dakshin Surendranagar, Mousuni, Namkhana, Dhanchi, Dalhousie, Bulchery, Bhangaduni and Jambudwip.

The inhabited islands of the delta are protected by man-made embankments against the ingression of saline water and this makes agriculture and aquaculture possible in the islands. The earthen embankments constructed in mid 19th century have already been worn out in several locations at the same time the river beds are raised through continuous siltation. Out of total 3500 km of embankment, 800 km is vulnerable to breach during high intensity weather events like cyclone and storm surge.

Fishery (fishing and aquaculture) is treated as the backbone of Sundarban economy. Sundarban boasts around 172 species of fishes, 20 species of prawn and 44 species of crabs including two commercial species. This region is the top producer of fish and prawn, with both districts (South & North 24 Parganas) combined producing roughly

31% of the total inland fish/prawn production of West Bengal. Apart from coastal and brackishwater aquaculture, freshwater aquaculture is increasing steadily and contributes parallel economy and livelihood security in the region.

A Cross-sectional questionnaire-based survey conducted among the fish farmers of Sagar & Basanti blocks of Indian Sundarban to benchmark the socio-economic profile, current aquaculture practices, climate change pattern & its impact on aquaculture and prevailing coping measures during the months of September to December 2011, using random sampling technique. Total 20 Gram Panchayats in the 2 blocks were covered during in the survey (9 Gram Panchayats in Sagar block, 11 Gram Panchayats in Basanti block). Total 451 households (244 households in Sagar Island and 207 households in Baasnti) were surveyed with the help of the two reputed local NGOs. The multilayer survey questionnaire consisted four major categories, *i.e.* (a) general information on farmers, (b) information on aquaculture, (c) pond management practices and (d) climate change / environment issues. The collected data were recorded and analysed using an in-house data base software using *Microsoft Access 2007.*

Majority of surveyed farmers in two blocks are marginal and small-scale farmers having perennial fishponds and practise traditional farming. Brackishwater aquaculture is prevalent only in peripheral areas which are adjacent to river or creek and tide-fed. On the contrary, freshwater aquaculture is vast, wide spread and rain-fed. In freshwater, composite carp culture is popular, though in some cases farmers culture high value Scampi (*Macrobrachium rosenbergii*) with the carps. Farmers often culture tilapia (*Oreochromis mossambicus* and *O. niloticus*) in fresh and brackish water with other fish / prawn for better production. In brackishwater, farmers mostly culture tiger shrimp (*Penaeus monodon*) with the fishes like *Lates calcerifer, Liza tade, Liza parsia, Mugil cephalus, Etroplus suratensis, Scatophagus argus etc.*

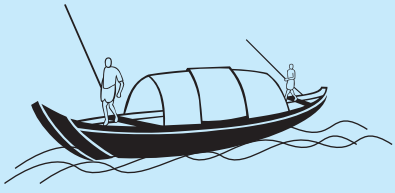
Survey results reveal that the fishponds in low-lying areas of Gangasagar, Dhablat, Ramkarchar, Daspara Sumati Nagar and Ghoramara Gram Panchayats of Sagar block are prone to coastal flooding during rainy seasons. It leads to breach of pond dyke, ingression of saline water into freshwater pond, escape of fish stock from the pond, entry of other (often unwanted) fish species, fish mortality *etc*. Basanti block which is located in eastern sector of Indian Sundarban, is prone to cyclone and storm surge. Ponds located at Jharkhali and Nafargunj Gram Panchayats of Basanti block are sensitive to saline water inundation during monsoonal storm. Risk analysis of climate induced threats associated with aquaculture revealed that in both Sagar and Basanti blocks, farmers considered breach of pond embankment, mortality of fishes due to saline water ingression as extreme risk; escape of fish stock and diseases as high risk; entry of unwanted species, retardation of growth and deterioration of water quality as medium risk; and damage of pond environment as low risk. To reduce the threats against saline water ingression, farmers are taking some coping measures like increase in pond dyke height; repair and strengthening of dyke; plantation on dyke; dewatering and addition of fresh/rain water;

application of chemicals/ lime/ dung; addition of tree branches in pond for hide outs *etc*. Few instances of natural adaptation of fish to climate change like survival of freshwater fish in low saline water; survival of brackishwater fish & shell fish in fresh water are reported by the farmers.

Apart from climate change issues, indiscriminate collection of shrimp seeds from the waters of Sundarban results in biodiversity loss of the region. According to an estimate to catch one shrimp seed, around 60-70 others fish/shrimp seeds of uneconomical varieties are either injured or killed. Crab catching is another activity affecting the biodiversity. Due to high demand of gravid females in the export market, matured females are overexploited from the natural water leading to acute shortage of mother crabs which will affect their natural breeding and thus decline of crab population in Sundarban water.

The farmers awareness opinions about wild shrimp seed catching are categorize like loss of riverine ecosystem & biodiversity; killing of seed of miscellaneous shellfish and finfish; strong Govt. rule to stop shrimp seed catch; air pollution due to bad odour by dead seeds thrown on the dyke; damage of river bund due to constant shrimp seed catching activities; destruction of mangrove seedlings.

During survey, people opined the drastic reduction of some native fish species in last thirty years. These are *Ompok pabda, Wallago attu, Heteropneustes fossilis*, *Clarias batrachus, Anabas testudineus, Glossogobius sp., Anguilla bengalensis*, *Amblypharyngodon mola, Colisa fasciata*, *Chitala chitala, Notopterus notopterus, Mystus vittatus, Mystus guilo*, *Channa marulius, C. striata*, C. *punctata*, *C. gachua*, *Mastacembelus armatus, Macrognathus pancalus, Puntius sarana, Ticto ticto, Chanda nama, Nandus nandus etc.* Few invasive fish species like *Pygocentrus nattereri, Clarias gariepinus* are recorded during the survey.



1. ABOUT SUNDARBAN

Sndarban, the estuarine delta of Ganges-Brahmaputra-Meghna, is the largest river-mouth system in the world which has been formed mainly by the continuous deposition of silt carried down by above rivers. It is stretched across West Bengal state of India and neighbouring country of Bangladesh. In the globe it is located within the latitude of $21^0$32"N-$23^0$31'N and the longitude of $88^0$10'E-$92^0$15'E. It is the World's largest mangrove ecosystem and famous as the only Mangrove Tiger Land of the world. The Indian region is demarcated by the river Hooghly on the west, the Bay of Bengal on the south, the Ichamati-Kalindi-Raimongal rivers on the east and the Dampier-Hodges line on the north. The entire Sundarban is about 26000 sq. km, the one-third of which falls in India. The Indian part of Sundarban is comprised of 102 islands; of which 54 islands are inhabited by men where more than 45 lakh people live and the rest is reserve mangrove forest. The physical feature of this region is peculiar as it is crisscrossed by numerous tidal rivers, creeks & canals and river system. Sundarban has the highest and very unique biodiversity. It is home to several threatened, endangered and endemic species of animals and plants. Unique succession, adoption and interdependence of both the mangrove forest flora and tidal river dwelling fauna are very interesting in terms of their food habits, breeding behaviour and migration pathways. Human settlement in the region started prematurely at a time when the soil of the area was still undergoing natural process of formation and was in an adolescent state. The process of colonization started from 18^{th} century even before the formation of islands through natural siltation. People started living through clearing mangrove forests and constructing earthen embankments or dykes to protect the islands from tidal waters. A network of interconnecting waterways, of which the larger channels are often few kilometers or more in width run in a north-south direction intersecting the area. These waterways now carry little fresh water as they are mostly cut off from the Ganges fundamentally changing the ecology of the region. Sundarban comprises of nineteen blocks of 6 in North and 13 in South 24-Parganas districts having 190 Gram Panchayats and 1064 villages. The water area of 1,874 sq. km comprises of sub-estuaries, broad to narrow rivers, tidal creeks, canals and swamps. The area is known for its highest biodiversity, unique with interesting flora and fauna. The climate is mainly tropical humid maritime with moderate rainfall, temperature and high humidity with fierce cyclonic storms and depressions during pre-monsoon, monsoon and post-monsoon months. Sundarban acts as a great protector of environment, yet it is a great victim of climate change. The mangrove forest acts as 'Bio-wall' and plays distinct role in checking soil erosion, protecting coastal zone from frequent tidal thrust and severe cyclones and sea surges. It further helps in abating the global warming as it alone absorbs each year about 40,000 metric ton of CO2, the major causative factor for global warming. Moreover, the mangroves serve as filter for 1,100 million litres of effluents that flow into Sundarban from Kolkata megacity everyday.

Table 1a: Indian Sundarban - At a Glance

Physiography	World's largest river-mouth system formed by confluence of Ganga-Brahmaputra-Meghna rivers (the undivided Sundarban)
Ecosystem	Estuarine Mangrove ecosystem; complex network of tidal waterways, mudflats and small islands
Geographical Location	Between 21°40'04" N & 22°09'21" N latitude, and 88°01'56" E & 89°06'01" E longitude.
Boundary	**West** - Hugli river; **East** - Ichamati-Raimangal river; **South** - Bay of Bengal; **North** - Dampier-Hodges Line
Area	Spread over about 9630km^2 (102 islands) of which 5364 sq. km (comprising of 54 islands) is inhabited by humansettlement and rest 4265 sq. km (48 islands) is protected Mangrove Forest
Administrative Division	**South 24 Parganas District** - 13 Blocks (Sagar, Namkhana, Kakdwip, Patharpratima, Kultali, Mathurapur-I, Mathurapur-II, Joynagar-I, Joynagar-II, Canning-I, Canning II, Basanti and Gosaba) **North 24 Parganas District** - 6 Blocks (Hingalganj, Hasnabad, Sandeshkhali-I, Sandeshkhali-II, Haroa and Minakhan)
Ecological Distinction	UNESCO World Heritage site since 1997 UNESCO World Network of International Biosphere Reserves since 2001
Protected Area with year of Declaration	**Sundarban Tiger Reserve** (1973) - 2,585 sq. km [Land Component-1,600 sq. km, Water Component- 985 sq. km] **Core Tiger Habitat** (2007) - 1,699.62 sq. km **Sundarban National Park** (1984) - 1,330 sq. km **Sajnekhali Wildlife Sanctuary** (1976) - 362.40 sq. km **Sundarban Biosphere Reserve** (1989) - 9,630 sq. km
Biodiversity	Over 40 **mammal** species; over 270 **bird** species; over 45 **reptile** species; at least 11 **amphibian** species; over 120 **fish species**; unknown number of **invertebrates**; more than 330 plant species; **Flagship species** - Royal Bengal Tiger
Major Mangrove Flora	Genwa *(Excaecaria sp.),* Sundari *(Heritiera sp.),* Keora *(Sonneratia sp.),* Bain *(Avicennia sp.),* Garjan *(Rhizophora sp.),* Dhundal *(Xylocarpus sp.),* Kankra *(Bruguiera sp.),* Goran (*Ceriops sp.),* Passur (*Xylocarpus sp.),* Golpata (*Nypa sp.),* Hetal *(Phoenix sp.*), Dhani ghas (*Porteresia coarctata*)
Major Wildlife	Tiger, Wild boar, Spotted deer, Rhesus macaque, Fishing cat, Water monitor, Estuarine crocodile
Major Threatened Fauna	Tiger (*Panthera tigris),* Estuarine Crocodile (*Crocodilus porosus*), Fishing Cat (*Felis viverrina*), Common otter (*Lutra lutra*), Water Monitor lizard (*Varanus salvator*), Gangetic Dolphin (*Platinista gangetica*), River Terrapin (*Batagur baska*), marine turtles like Olive Ridley (*Lepidochelys olivacea*), Horseshoe crab (*Carcinoscorpius rotundicauda)* etc.
Species Extirpated	Water buffalo (Bubalus *bubalis)*; Swamp deer (Cervus *duvaucelli*); Javan rhinoceros (*Rhinoceros sondaicus*); Great Indian one-horned rhinoceros (*Rhinoceros unicornis*); Gharial (*Gavialis gangeticus*); and Chitra turtle (*Chitra indica*)
Livelihood Option	Agriculture, Aquaculture, Fishing, Animal husbandry, Honey collection, etc.
Major Agricultural products	**Grains**: Rice; **Pulses**: Moong (Green Gram); **Oil Seeds**: Sunflower and Sesame (Til); **Fruits**: Sapota, coconut; **Vegetables** : Chilies, Tomato, Lady's Finger, Gourds, Mushroom, **Cash crop**: Betel (*pan*)
Major Tourist Spot	Gangasagar in Sagar Island, Bakkhali – Frejerganj, Bhagabatpur, Kaikhali in Kultali, Jharkhali in Basanti, Sitarampur in G-Plot, Sajnekhali / Pakhiralay in Gosaba, Sudhanyakhali, Dobanki, Netidhopani, Boni Camp, Hemnagar/ Kalitala in Hingalganj
Gods & Goddesses	Dakshin Ray and Banabibi
Novels on Sundarban	*Padma Nadir Majhi, The Hungry Tide, Sundarbaney Arjan Sardar, The Man-Eating Tigers of Sundarbans etc.*

1.1 Climate Change trends and related risks in Sundarban: A review

Earth's climate changes naturally. Throughout its long history, earth has warmed and cooled time and again, but at a very slow rate. However, in the past century, another unnatural (anthropogenic) force has started to influence earth's climate. As per IPCC (2007), although the earth is passing through a period of natural warming for about 18000 years, the current global warming is attributed largely to anthropogenic factors. Greenhouse gas emission generated through long term and intensive industrial growth and high consumption lifestyles is the root cause of anthropogenic global warming. Major greenhouse gases are water vapour, carbon dioxide, nitrous oxide, methane and ozone. The largest contributing source of greenhouse gas is the burning of fossil fuels leading to the emission of carbon dioxide. The climate of the Sundarban is also changing and this change is consistent with climate changes that are occurring throughout the world. The salient features related to climate changes in Sundarban are described below.

1.1.1 Air temperature

The inhabitants of Sundarban are experiencing extended and extreme summer & short winter. There has been an observable rise in the air temperature that may affect the overall physical and socio-economic processes of this region. The air temperature data in Sagar island for 80 years (1891-1970) reveals 0.6 °C increase in the average daily minimum temperature and 0.1°C increase in the average daily temperature. After 1970, increasing trend is well marked and more marked after 2000. Another important observation is that the daily minimum temperature is rising faster than the daily maximum temperature resulting in a gradual decrease in diurnal range (Mishra, 2010). Air temperature over the Bay of Bengal is rising at a rate of 0.019 °C per year. If this trend continues, the air temperature in this area is expected to rise by 1 ° C by 2050 (Hazra *et al.,* 2002).

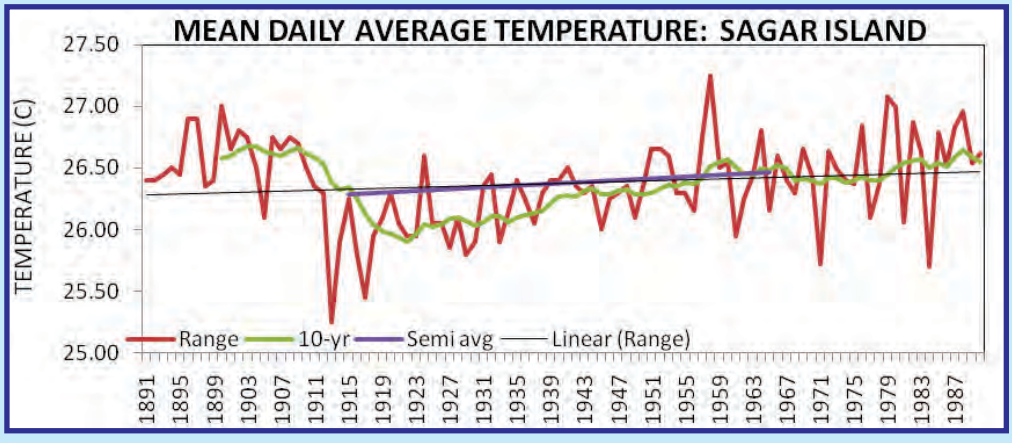


Fig 1.1.1a: Mean daily average of air temperature (1891-1987) of Sagar island (Source: Mishra, 2010)

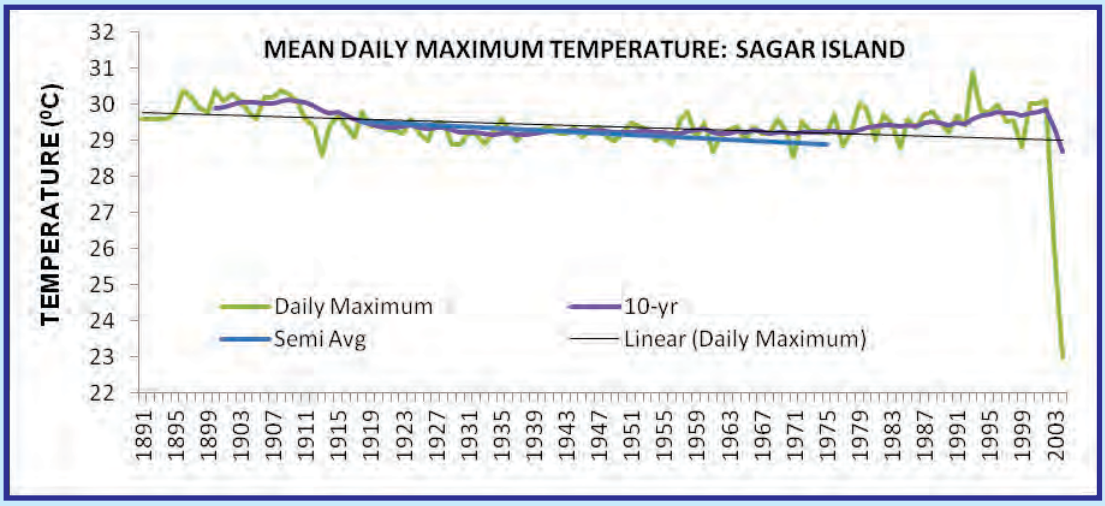


Fig1.1.1b: Mean daily maximum of air temperature (1891-2003) of Sagar island (Source: Mishra, 2010)

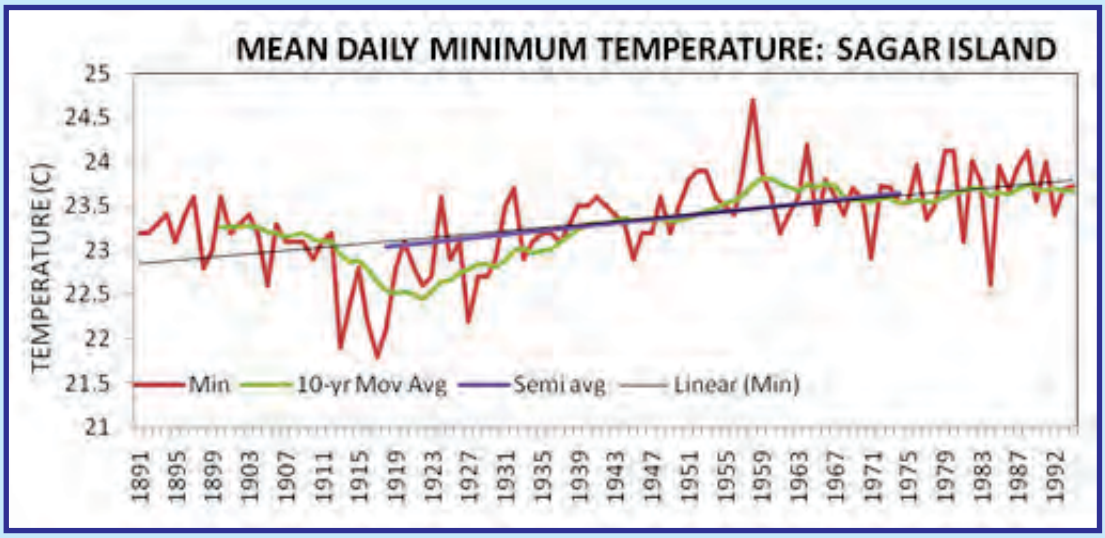


Fig 1.1.1c: Mean daily minimum of air temperature (1891-1992) of Sagar island (Source: Mishra, 2010)

Table 1.1.1: Air temperature (°C) record of Sagar island (Source: Mishra, 2010)

Period		Average daily maximum (°C)	Average daily minimum (°C)	Diurnal range	Average daily (°C)
1891- 1930		29.658	22.935	6.723	26.296
1931- 1970		29.249	23.510	5.739	26.379
1971- 2002		29.471	23.660	5.811	26.545

1.1.2 Surface water temperature

The surface water temperatures in Sundarban (Eastern and Western sector) have shown significant rising trends for both pre-monsoon and monsoon periods. Quantitatively, these temperatures have risen by 6.14% in the western sector and by 6.12% in the eastern sector over the past 30 years (1978-2008) at a rate of approximately 0.05°C/year (Mitra *et al*., 2009). In another study, the annual composite sea surface temperature of Bay of Bengal near Sagar island during the period 2003-2009 varied from 28.023 °C in the year 2004 to 29.381 °C in the year 2009. During the period the sea surface temperature showed rising trend at the rate of 0.0453 °C per year (Hazra, 2010). This observed rate is found to be in conformity with the estimation done by Singh (2002), which estimates a decadal rate of about 0.4 °C to 0.5 °C. Rising sea surface temperature is directly related with the increased frequency and severity of cyclonic storms and depression in the Bay of Bengal. It is also reported that increasing trend in SST may result in changes to the chemical composition of sea water, leading to increased acidification & decreased dissolved Oxygen level.

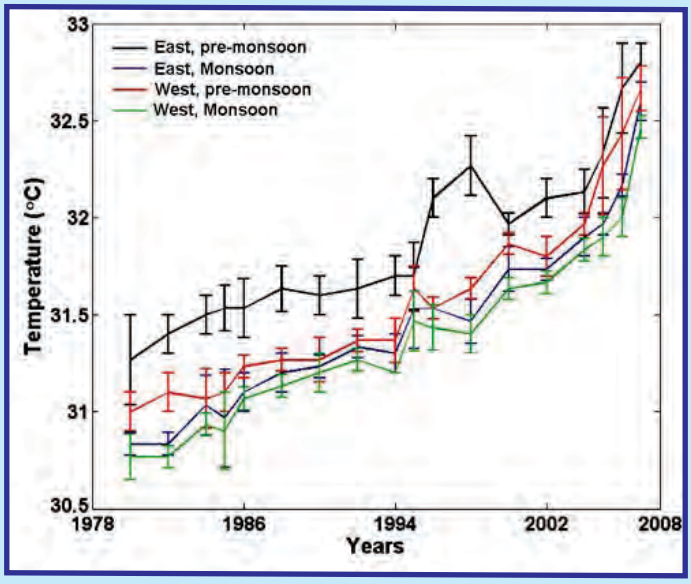


Fig. 1.1.2: Warming trend of surface water temperature in western and eastern sector of Indian Sundarban during pre-monsoon and monsoon (Source: Mitra *et al.,* 2009)

1.1.3 Rainfall and monsoonal pattern

Sundarban receives rain mainly from South-West monsoon which generally starts in the middle of June and withdraws during the second week of October. August is the rainiest month which contributes 21 % - 22% of the annual precipitation. The average annual rainfall is 1625 mm but in case of high rainfall year this may increase to 2000mm where as this may drop to 1300mm in exceptionally low rainfall year. The analysis looking at data over a period of 1990-99 have received a slight increase in monsoon

especially post monsoon rainfall in Sundarban. The most important aspect of rain fall with specific relevance to agriculture and aquaculture is the erraticness in its distribution. There is remarkable change in the onset and recession of monsoon in South Bengal very specifically in Sundarban. There is a trend of delayed monsoon and heavy rains at the beginning as well as late recession and sometimes heavy precipitation during *khariff* harvest. The period of retreating monsoon is October and November. This season shares with about 10% average annual precipitation which comes mostly with the passage of depressions and cyclonic storms. Onset of monsoon is being highly delayed while the withdrawal remaining almost the same causes a reduction in the span of monsoon. The earliest (25th May, 2009) and latest (26th June 1983) onset of monsoon over this region has occurred within the period of last 25 years.

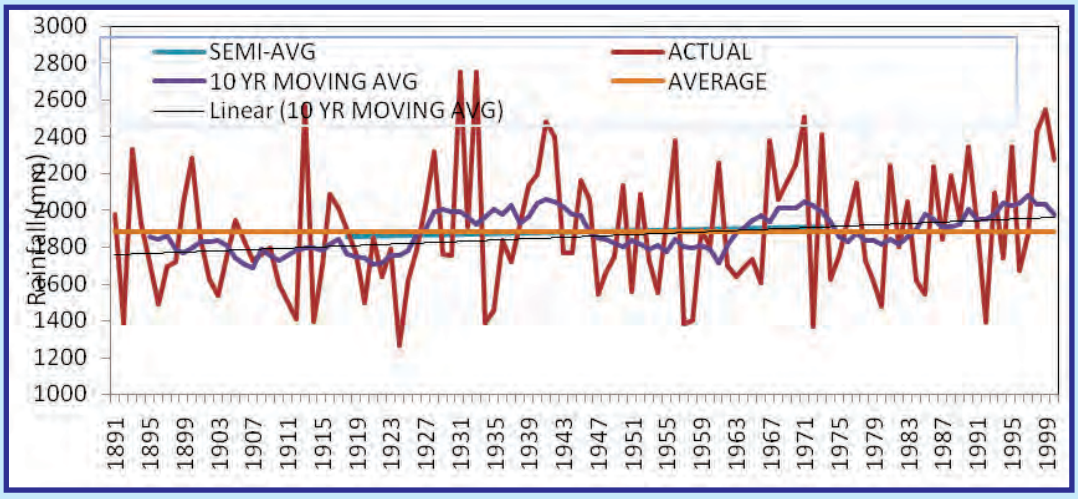


***Fig 1.1.3a*:** Precipitation trend (1891- 1991) in Sagar island (Source: Mishra, 2002)

Another WMO recommended method of trend study is the 30 years successive mean. Study of last 110 years rainfall data (1891-2000) of sager Island also shows and increasing trend during the last three successive mean periods.

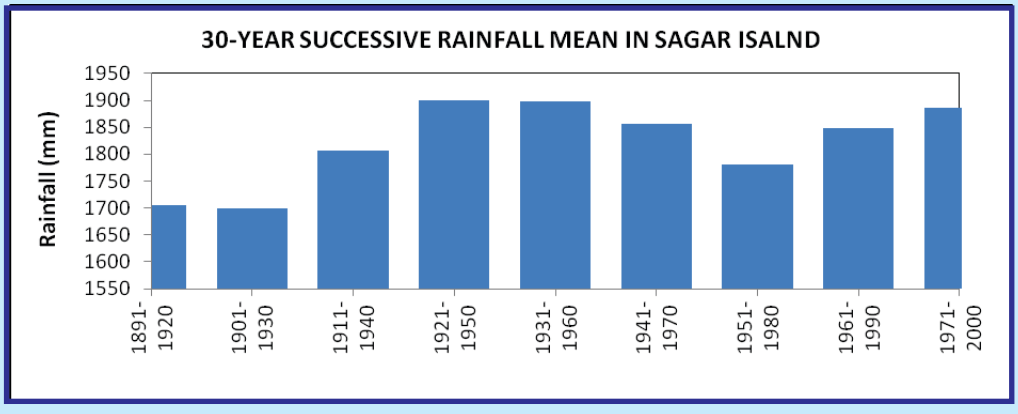


Fig 1.1.3b: 30-year successive rainfall mean (1891- 2000) in Sagar island (Source: Mishra, 2002)

1.1.4 Sea level rise

Sea levels in Indian Sub-continent are increasing at the rate of about 2.5 mm/year. But the studies reveal a relative mean sea level rise of 3.14 mm / year in Sagar Island and adjoining Bay of Bengal (Hazra *et al.*, 2002). The tidal gauge data of Sagar island observatory for the period of 2002-2009 indicated that a rise of relative mean sea level at the rate of 12mm/year during the decade (Hazra, 2010). Considering the record of past 25 years, the rate of relative mean sea level rise comes close to 8 mm / year, which of course is significantly higher than the rate of 3.14 mm / year observed during previous decade (Hazra *et al.*, 2002). Since the islands of Sundarban are formed due to gradual siltation, these are in consolidation mode causing subsidence of land. Therefore, the localized sinking of the delta is causing relative sea level rise of 3 to 8 mm/year depending on location, translating to 30-80 cm per century. The estimated rise in sea level will pose serious problems during the pre & post- monsoon phase when most of cyclone storms occur.

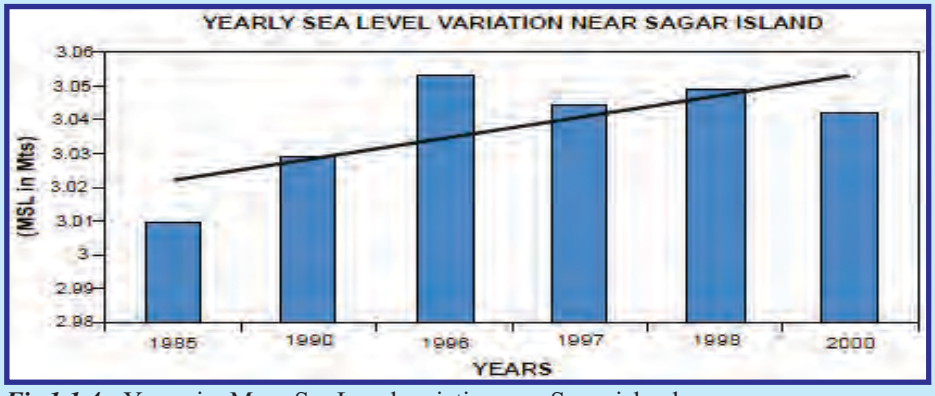


Fig 1.1.4 : Year wise Mean Sea Level variation near Sagar island
(Source : Sundarbans : Future Imperfect Climate Adaptation Report, 2010, WWF-India)

1.1.5 Erosion & accretion

There is a process of natural erosion & accretion in the islands of Sundarban. But climate induced extreme events like cyclone, tidal surge etc. are causing greater erosion. According to the study conducted by the School of Oceanographic Studies, Jadavpur University, erosion is prominent in 12 sea facing southern islands. Few islands viz. Lohachara, Bedford, Kabasgadi and Suparibhanga have already vanished from the map. Most vulnerable islands to erosion are Sagar, Ghoramara, Dakshin Surendranagar, Mousuni, Namkhana, Dhanchi, Dalhousie, Bulchery, Bhangaduni and Jambudwip. In general, the western banks of rivers are more vulnerable to erosion than the east and erosion is more along the sea facing sore lines where it is oblique. Marginal accretion is localized in the inner estuaries particularly along the eastern and northern margins of islands and along the coast where it is mostly east-west oriented and sea facing. The study conducted during 2001-2009 reveals that a total land area of 6402.09 km^2 of the Indian Sundarban in the year 2001 has reduced to 6358.05 km^2 in 2009. This amounts to

net land loss of 44.04 km^2 which includes erosion of 64.16 km^2 and the accretion of 20.12 km^2. The eastern matured islands are found to be comparatively more stable due to the presence of thick mangroves and lesser anthropogenic activities. Sagar island has suffered the bulk of erosion with an area loss of 30 sq. km and only marginal accretion.

Fig 1.1.5: Coastal erosion and accretion throughout the Indian Sundarban delta (Source: School of Oceanographic Studies, Jadavpur University)

1.1.6 Vulnerability of embankments

In Sundarban, inhabited islands are protected by man-made embankments against the ingression of saline water. This makes agriculture and aquaculture possible in the islands (Danda, 2007). In Indian Sundarban out of total 3500 km of embankment, 800 km is vulnerable to breach during high intensity weather events. Present trend in sea level rise will have serious impacts on the embankments making these more vulnerable and susceptible to breach & overtopping. The earthen embankments constructed in mid 19th century have already been worn out in several locations at the same time the river beds are raised through continuous siltation. The water level during high tide in most of the rivers remains above the adjacent inhabited areas. The crest height, slope including bottom & top width, alignment and materials used for maintenance of the existing embankments are not considered to be the proper defense to the rising trend in sea level and to save the inhabited islands from inundation. The condition as of today is alarming as any moderate east wind having speed of 30-40 km/hr at the ebb tide sequence can damage several kms of embankments and overtopping with sea water. There can be total wash out during cyclonic and storm surges. During such occasion, the river water rushes into the islands and ruins almost everything within minutes and incurs irreparable loss of assets, lives and livelihoods of the people.

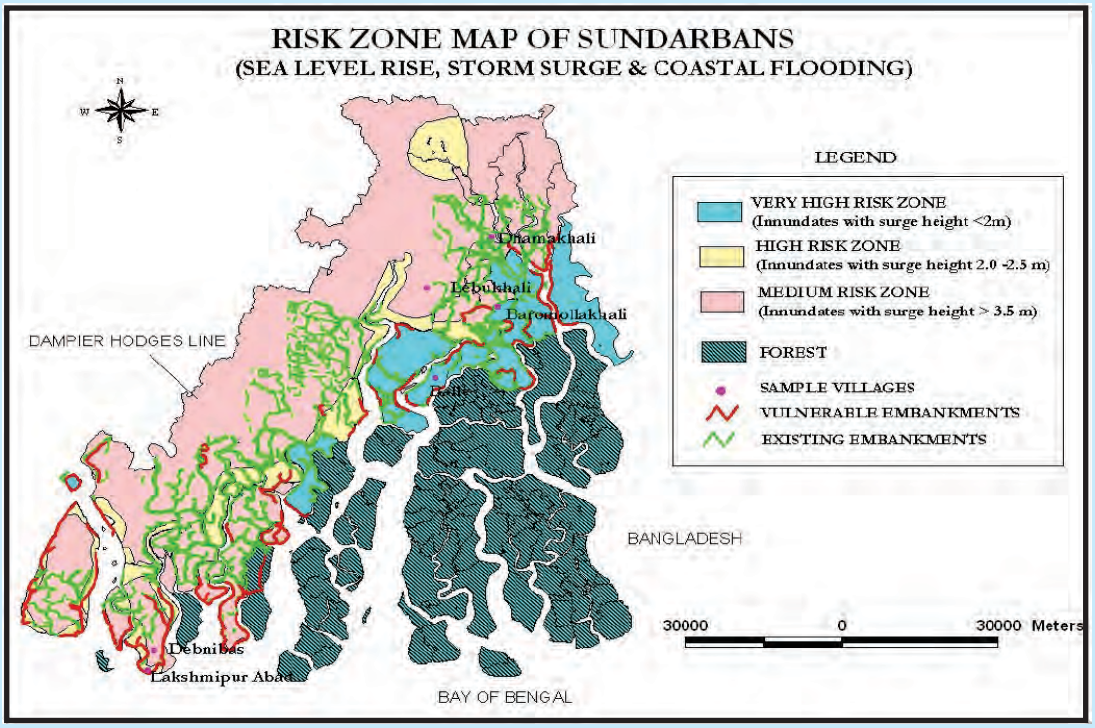


Fig 1.1.6: Map showing the risk zones of Indain Sundarban with respect to sea level rise, storm surge and coastal flooding (Source: Sundarban: Climate change-Adaptation and Mitigation efforts, by Prof. Sugata Hazra, Jadavpur University, Kolkata)

1.1.7 Salinity

In Sundarban, inhabited islands are protected by man-made embankments against the ingression of saline water. This makes agriculture and aquaculture possible in the islands (Danda, 2007). In Indian Sundarban out of total 3500 km of embankment, 800 km is vulnerable to breach during high intensity weather events. Present trend in sea level rise will have serious impacts on the embankments making these more vulnerable and susceptible to breach & overtopping. The earthen embankments constructed in mid 19th century have already been worn out in several locations at the same time the river beds are raised through continuous siltation. The water level during high tide in most of the rivers remains above the adjacent inhabited areas. The crest height, slope including bottom & top width, alignment and materials used for maintenance of the existing embankments are not considered to be the proper defense to the rising trend in sea level and to save the inhabited islands from inundation. The condition as of today is alarming as any moderate east wind having speed of 30-40 km/hr at the ebb tide sequence can damage several kms of embankments and overtopping with sea water. There can be total wash out during cyclonic and storm surges. During such occasion, the river water rushes into the islands and ruins almost everything within minutes and incurs irreparable loss of assets, lives and livelihoods of the people.

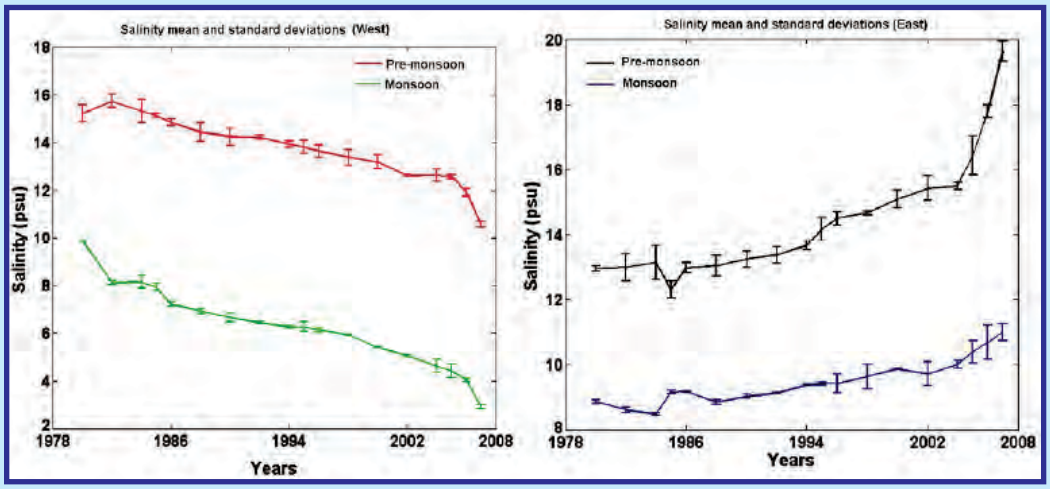


Fig 1.1.7: Changes in salinity regime in western & eastern Sector of Indian Sundarban over last 30 years (Source: Mitra *et al.,* 2009)

In general, global warming affects the salinity of sea waters in two different ways. First, in the open sea rising temperature would lead to increased evaporation, which in turn would result in increased salinity. In contrast, the salinity of surface water in bays, estuaries and coastal waters would decrease by freshwater input from glaciers, precipitation and subsequent runoff, and intrusion of sea water. But this generalization does not hold uniformly in all the segments of the Indian Sundarban. The western sector showed a significant and continuous decrease in salinity whereas the eastern sector showed an increase in salinity. Global warming and climate change may have the following consequences to salinity levels in Sunadarban:

- Increased evaporation of sea water resulting in increased salinity;
- Changes in upstream river flows due to an initially increased glacial melt potentially decreasing salinity in certain areas, depending on local river flow pattern;
- Rising sea levels and increased sea water intrusion leading to increased salinity;
- Changes in the severity of extreme weather events potentially increasing salinity as a result of coastal flooding; and
- Changes in precipitation patterns resulting in either increased or decreased salinity depending on the seasonal shift in amounts of rainfall.

Another review study on salinity of surface waters and groundwater within different locations of Sundarban estuary reveals distinct trends of increasing salinity many parts. Comparison of past data (1984) with more recent data (2001) shows drastic increase in salinity of the outer estuary (26 ppt to 36.2 ppt) and mid estuary (20

ppt to 26 ppt) for the summer data of the Eastern Sector. Salinity trends, as observed, for both surface waters and groundwater with respect to estuary location are given below.

Table 1.1.7: Salinity trends in Sundarban

Estuary position		Seasonal Trend (Increasing/Decreasing)		Pearson Correlation	
Sector	**Out/Mid/In**	**Pre-monsoon (N)**	**Monsoon (N)**	**' r ' value**	**P**
Pattern of Changes in Surface Water Salinity Trends during last three decades (1980-2010)					
Western	Outer	Insignificant (16)	Insignificant (16)	0.1/ 0.28	--
	Middle	Insignificant (5)	Insignificant (7)	0.07/ 0.45	--
	Inner	**Increasing** (7)	Insignificant (9)	**0.97**/ 0.06	**0.001**
Central	Outer	**Increasing** (7)	**Increasing** (6)	**0.69/ 0.83**	0.08/0.04
	Middle	**Decreasing** (3)	Insignificant (5)	**-1.804878**	P = 0.47
	Inner	**Increasing** (7)	Insignificant (4)	**0.87**/ 0.64	0.02/0.34
Eastern	Outer	Insignificant (6)	**Increasing** (7)	0.64/ **0.70**	0.04
	Middle	Insignificant (11)	**Increasing** (5)	0.43/ **0.93**	/0.01
	Inner	**Increasing** (26)	Insignificant (16)	**0.58**/ 0.23	0.002
Pattern of Changes in Ground water Salinity Trends during last three decades (1980-2010)					
Western	Outer	**Increasing** (7)	**Increasing** (11)	**0.83/ 0.75**	**0.022/0.009**
	Middle	Insignificant (7)	Insignificant (9)	0.5/0.13	0.253
	Inner	Insignificant (4)	**Increasing** (4)	0.76/ **0.95**	0.237/**0.046**
Central	Outer	Data lacking	Data lacking		
	Middle	**Increasing** (5)	Insignificant (5)	**0.993**	**0.001**
	Inner	**Increasing**(4)	**Increasing** (4)	0.75/0.79	0.024/ 0.021
Eastern	Outer	Data lacking	Data lacking		
	Middle	Insignificant(3)	**Increasing**(4)	0.91/**0.996**	**0.004**
	Inner	**Increasing**(8)	**Increasing**(9)	0.86/0.75	0.008

Summary: An analysis of salinity trends indicate that communities living in the following regions will suffer for increasing salinity trends:

- Western Sector outer estuary and inner estuary (**Sagar** and Mathurapur Block)
- Central Sector mid estuary (Kultali Block)
- Eastern Sector mid and inner estuary (Gosaba and part of **Basanti** Block, Sandeshkhali Block)

(**Source**: Adopted from World Bank report on India: Climate Change Adaptation, Biodiversity Conservation and Socio-economic Development for the Sundarbans area of West Bengal, July, 2011)

1.1.8 Extreme weather events

Frequency of storms and depressions having direct bearing upon the distribution of rainfall in Sundarban and the adjoining coastal areas have been studied (Mishra, 2002) for the period of 80 years (1891-1970). The study of annual frequency reveals that on an average , 8 such systems develop over the area per year which affect the weather of the region particularly its rainfall. Up to 1922 the frequency of such systems were mostly bellow the average, but after 1922 there has been a considerable increase in the frequency of occurrence of such systems particularly up to 1953 and after 1964. In Bay of Bengal during 120 years (1891-2010), disturbances like depressions and cyclonic storms occurred at a rate of 10.79 per year. However, in the last 40 years (1971-2010), the total number of disturbances has reduced but the frequency of severe storms and intensity increased remarkably. This increasing trend is reflected on an increasing trend in rainfall. According to Singh (2007), severe cyclonic storms over Bay of Bengal registered 26% increase over the last 120 years, intensifying in post monsoon. During the last part of decade (2006-2009) the northern part of Bay of Bengal registered four cyclones *viz. Sidr, Nargis , Bijli* and *Aila*.

Table1.1.8a: 40-year successive average frequency of high intensity weather events per year

Period	Depression	Cyclonic Storms	Severe Cyclonic Storms	All disturbances
1891-1930	5.40	3.33	1.6	10.33
1931-1970	8.83	2.5	1.98	13.31
1971-2010	5.35	1.35	2.05	8.75

(Source: Cyclone e-atlas, India Meteorological Department)

The table shows that during the last 40 years although the total number of disturbances has reduced but the frequency of severe storms increased remarkably. The cyclones bring high wind, heavy rain and storm surge causing embankment failure and devastation through saline water inundation. The floods damage the houses, cultivable lands, ponds and washed away domestic animals.

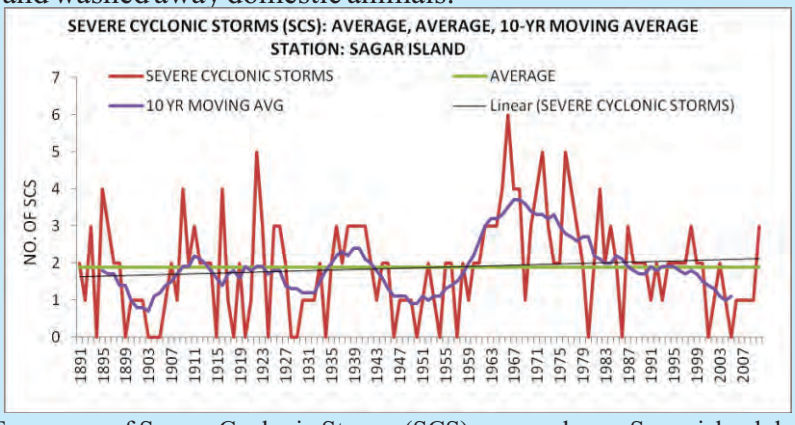


Fig.1.1.8a: Frequency of Severe Cyclonic Storms (SCS) occurred over Sagar island during 1891-2007 (Source: Mishra, 2010)

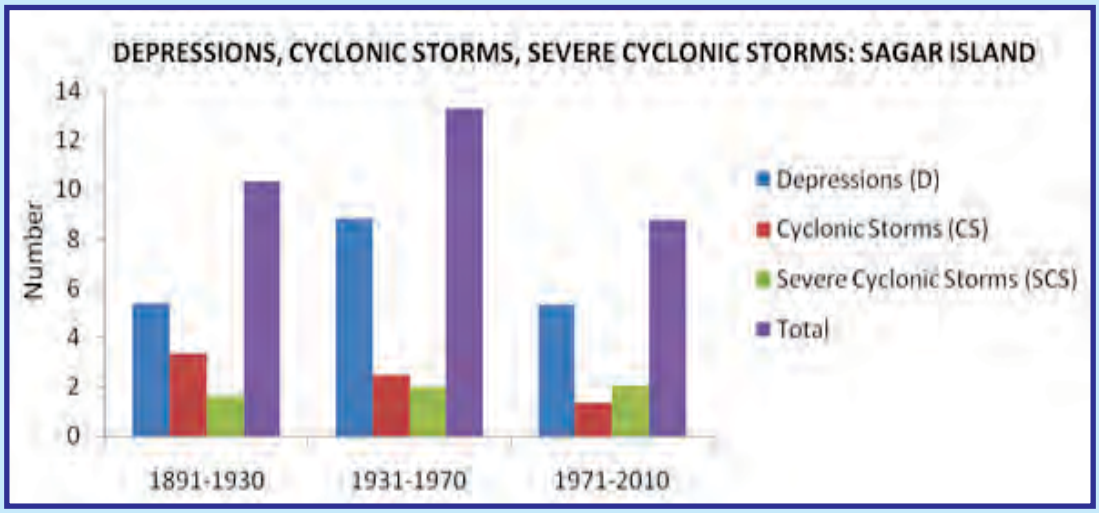


***Fig. 1.1.8b*:** 40-year successive average frequency of depression, cyclonic storm and sever cyclonic storm per year over Northern part of Bay of Bengal (Source: Mishra, 2010)

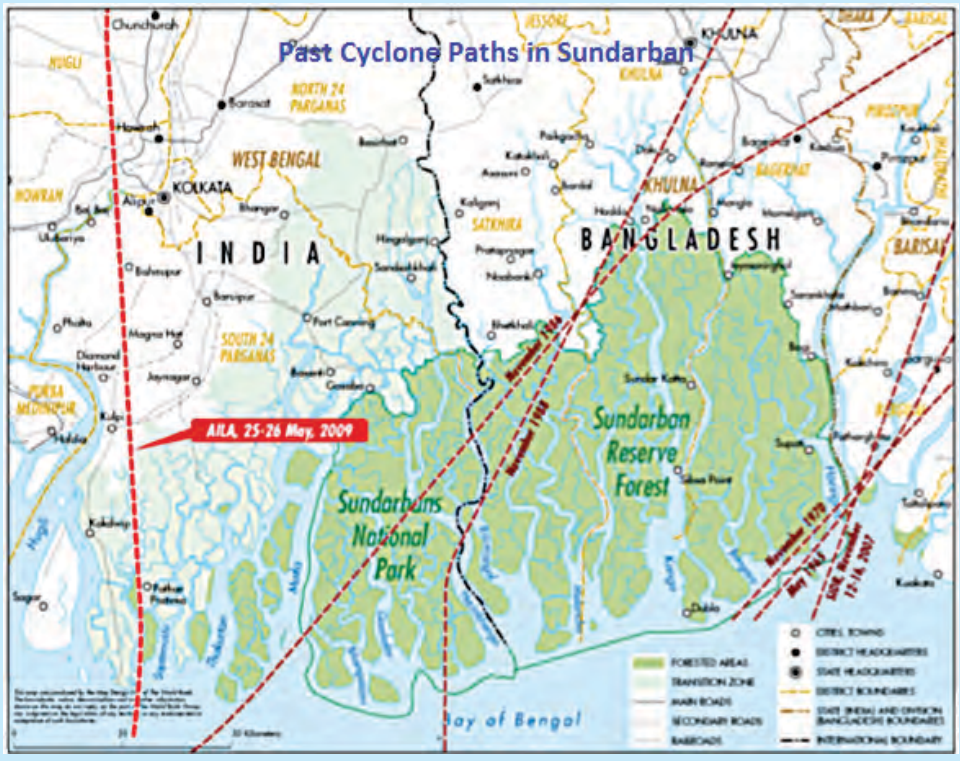


Fig.1.1.8c : Past Cyclone paths in Sundarban (Source: Adopted from World Bank report on India: Climate Change Adaptation, Biodiversity Conservation and Socio-economic Development for the Sundarbans area of West Bengal, July 2011)

Table 1.1.8b: Historical records of Severe Cyclones forming in Northern part Bay of Bengal during 1970-2009

Date (Formed-Dissipated)	**Devastation**
Sept 27 - Oct1, 1971	Crossed West Bengal coast near Sundarbans. Continued its movement towards NW, weakened into a low over Bihar State on October 1.60 People died and thousands of houses were collapsed in West Bengal.
August 13-20, 1974	Crossed West Bengal coast near Contai at about 0700 UTC on 15th afternoon and remained cyclonic storm over land until August 17.Maximum wind speed was 139 km/hr. The storm caused floods in parts of districts of Midnapur, Hooghly, Howrah and 24 -districts of West Bengal.
December 4-11, 1981	Crossed West Bengal Coast near Sagar Island around 1300 UTC on December 10 and weakened into a depression on 11th morning over Bangladesh and into a low the same evening over Assam and Meghalaya. 200 people died in 24 Parganas district of West Bengal One Million people affect in the districts of 24 Parganas.
November 23-30, 1988	Crossed 20 Km west of Indo-Bangladesh border in West Bengal. At 0000 UTC of 30th it lay centered near Dhaka. 2000 People killed. 6000 people reported missing in Bangladesh
May 23-27, 1989	Crossed 40 Km northeast of Balasore 61 persons died in Orissa and West Bengal, 1000 Cattle heads perished in West Bengal
November 11-16, 2007 **Sird**	Sidr formed in the central Bay of Bengal, and quickly strengthened to reach peak 1-minute sustained winds of 260 km/h, which would make it a Category-5 equivalent tropical cyclone. The storm eventually made landfall in Bangladesh on November 15, 2007. The storm caused large-scale evacuations. 3,447 deaths were blamed on the storm.
April 27-May 3, 2008 **Nargis**	Very Severe Cyclonic Storm Nargis, was a strong tropical cyclone that caused the worst natural disaster in the recorded history of Burma. The cyclone made landfall in Burma on Friday, May 2, 2008, causing catastrophic destruction and at least 138,000 fatalities. India, Sri Lanka and Bangladesh were also affected partly. Highest wind speed was 215 km/h
April 14-17, 2009 **Bijli**	Cyclonic Storm Bijli formed from an area of Low Pressure on April 14. Affected areas are Eastern India, Bangladesh, Myanmar. Highest wind speed was 75 km/h. A storm surge of 2.1 m (7 ft) was recorded in the Cox's Bazar District, Bangladesh.
May 23-26, 2009 **Aila**	Developed as a tropical depression on May 23 in the North Indian Ocean, south of West Bengal, India. Aila reached its maximum sustained winds near 120 km/hr on May 25, becoming a severe cyclonic storm prior to landfall near the India-Bangladesh border later that same day. The storm brought heavy rain and strong winds to parts of eastern India and Bangladesh, claiming the lives of over 260 people and leaving half a million of people homeless. The storm dissipated by May 26.

Source: http://www.imd.gov.in/section/nhac/static/cyclone-history-bb.htm; http://www.ncdc.noaa.gov/sotc/index.php?report=hazards&year=2009&month=5

Aquaculture in Changing Climate of Sundarban

There is no doubt that the specter of climate change is a significant potential threat to the welfare of the 4.5 million inhabitants of India's Sundarban. They are living with extreme weather events, rising sea levels, changing natural environments, and other stresses for centuries. Fundamentally, all potential responses to climate-related hazards require some form of adaptive response / disaster risk management. The summary of climate related hazards in Indian Sundarban as per World Bank Report (2011) is as below.

Table 1b: Summary of Climate Related Hazards in Indian Sundarban

Issue	Magnitude
Isostatic Sea Level Rise *	Localized sinking of the delta causes an implicit annual sea level rise of 3 to 8 mm depending on location, translating to 30 to 80 cm per century.
Eustatic Sea Level Rise *	Global thermal expansion of the oceans from climate change is forecast (IPCC) to result in up to 18-59 cm of sea level rise in 21st century.
Relative Sea Level Rise *	In Sagar island, Relative Mean Sea Level (RMSL) in Indian Sundarban (with reference to Sagar island rise during 2002-2009 is 12 mm/year. Total RSL rise for Sundarban is of between 0.46 m and 1.39 m by 2100.
Cyclonic Storms	The region experiences about 9 cyclonic storms every decade, with a third classified as "severe"; these are expected to increase in energy intensity by 15% over the coming century.
Salinity Intrusion	All 19 blocks of the Sundarbans have seen persistent salinity intrusion that limits drinking water availability and decreases soil fertility
Tidal Flushing from Aquaculture	Inland tidal aquaculture over expanses of >40,000 ha creates a daily tidal flushing that erodes embankments and channels seaward.
Embankment Over-topping and Failure	Historical embankment alignments have prevented natural geomorphological processes from creating wider channels and larger meanders to accommodate long-term easterly migration of the delta. As a consequence, embankments have weakened. A century of neglect has contributed to fragility. Almost 800 of the 3500 km system were destroyed by Cyclone Aila (2009).

* Isostatic Sea Level Rise is the sea level change on a local scale.

*Eustatic Sea Level Rise is the sea level change on a global scale.

*Isostatic and eustatic in Combination make a relative sea level change.

Source: Adopted from World Bank report on India: Climate Change Adaptation, Biodiversity Conservation and Socio-economic Development for the Sundarbans area of West Bengal, July 2011.

Photo sheet I : Devastations by cyclones & storm surge

Soil erosion at eastern Sagar island

Erosion of embankment at Mousuni island, Namkhana block, Sundarban

Post *Aila* scenario at Jharkhali, Basanti block

Futile effort to repair embankment, Sagar island

Nature's fury : Demage of Vegetation

Vegetation Demage near embankment

* Photos have been collected from various sources

Photo sheet II : People Suffering during flood

Old couple fleeing to safer place

Helpless family waiting for rescue team

Littel boy trying for shelter on tree

Storm water overtopping the embankment

Loss in fishery & agriculture after the flood of saline water

Braving the flood water

* Photos have been collected from various sources

Photo sheet III : Damage caused by extreme weather events

Desperate attempt to save belongings

Rescue of domestic animal

Aerial view of submerged village

Homestead submarged in floor water

Damage of pond environment

Uprooted tree by cyclone

* Photos have been collected from various sources

1.2 Climate Change Voice from Sagar Block

Md. Abahydulla, Age: 41
Bamankhali, Sagar Block,
Sundarban

I come from Sagar island (the largest and sea-facing island of Indian Sundarban). The island is very vulnerable to sea level rise and erosion. Sea alongwith mighty rivers Hoogly and Muriganga (distributaries of Ganga) surround the island. The island is a famous Hindu pilgrim place (Gangasagar). Every year on the day of Makar Sankranti (mid January), lakhs of Hindu gather to take holy dip at the confluence of river Ganga and sea and offer puja in the Kapil Muni Temple. Unfortunately, the very existence of this island is under threat due to the climate change related factors.

Erosion

Western bank of the island is known for high erosion. But now Southern bank and South-Eastern banks are also eroding. In front of us the island is disappearing slowly. I fear one day whole island will perish under water just like Lohachara (an adjoining island) which is no more. The nearby island Ghoramara is also vanishing fast. We have dark future.

Rising Sea level

Now-a-days rising sea level is a major discussion point. Sagar being an island, we believe it is also the victim of sea level rise. Shrinking island is the testimony. Frequent flooding devastates many household by taking human lives, washing away domestic animals, damaging standing crops and leaving agricultural land unproductive.

Fishing

Fishermen are finding fishing as non-remunerative. Falling fish catch and increasing operating expenses are making it difficult for them to survive. Sea is not productive as earlier due to overfishing and other climate related reasons. Some fishermen are crossing state and international boundaries during fishing in search of good catch, but all in vain.

Agriculture

Aman (Kharif) paddy is the main crop. Change in monsoon trend and saline water inundation is causing low yield and sometime total crop failure. Now people feel the need for reintroduction of salt tolerant paddy varieties in the place of high-yield paddy. During winter and summer, some people grow vegetables, chillies, pulses and oilseeds. Due to temperature rise, pest attacks in these crops are rampant. Pan (Betel leaf) is the major cash crop.

Aquaculture

Aquaculture is facing the brunt of climate change. Cyclones and tidal surges are inundating the pond causing escape of farmed fish as well as mortality of freshwater species. Disease incidences in fish and prawn are rising in the area. This may be due to water pollution and temperature rise. Indigenous fish species which normally breed in paddy fields during rainy season are the victim of excessive pesticide use in agriculture. Out of greed, people sometimes are introducing alien species in their ponds.

Suggestions

Early warning system on natural calamity should be strengthening so that people get some time to prepare. After these natural calamities, we get little or no monetary compensation to bring back our lives to normal. More plantations near the embankment will protect embankment.

1.3 Climate Change Voice from Basanti Block

Kamal Roy, Age: 49
Jharkhali, Basanti Block, Sundarban

Hello! I am Kamal Roy. I am born and brought up on this island. My parents had come here in 1959 from Khulna district of erstwhile East Pakistan (now Bangladesh). Government had rehabilitated people displaced from Bangladesh in this place after clearing mangrove forest. A patch of mangrove forest is still there. I am married and have one boy (21 year) and a daughter (14 year). I have 2 bigha (0.25 ha.) of agricultural land and a small fishpond which is used for domestic consumption. I work on daily wage in a Government fish farm near to my village.

Changing climate

Climate change impact is very much visible here. From our own experience, we can say temperature is rising. We no more enjoy six seasons in a year (as mentioned in the book). We now distinctly experience only summer, rainy and winter. Summer is getting longer and winter shorter. Monsoon pattern is also changing. In the rainy season, we are getting more rain at the beginning and at the end of the season. Sometimes heavy rain even during Kharif harvest. Our main agriculture (Kharif crop) is getting affected due to insufficient rain during middle of the season. We hear from media that the global warming is putting Sundarban under treat due to sea level rise.

Nature's fury

We live very close to mighty river. Our village frequently faces nature's fury in form of cyclone and tidal surge. We face constant of saline water flooding our house and agricultural land. We feel helpless when disaster strikes. We don't get time to collect our belongings and move to safer places.

Aila

I still remember that fateful day (25th May, 2009) when Aila (high velocity cyclone of 120kph) hit our village. We lost everything. River dyke was broken at many places. The houses close to river demolished without a trace. Saline water flooded the village, cultivable land and pond. Domestic animals washed away. Drinking water source got polluted. Tidal flood did not go away even after Aila as dyke was still broken. For a week or more, we survived totally on relief.

Biodiversity loss

Our village is very close to Sundarban tiger reserve. Our village has a good patch of dense mangrove forest along the river embankment and the creeks. Earlier wild animals like boar, dear, jackle were common in this forest. We used to drive away tiger by burning masal (Torch). Now wildlife has disappeared. Only monkeys are there. Occasionally tigers swim across the river and enter the village in search our domestic animal. Bird population has also reduced drastically. Fish species available in our rivers have declined. Recently we are hearing that Govt. is planning to develop an eco-tourism center here. Forest Department has developed a tiger rescue center here.

Losing livelihood

We are losing our main food source like rice, vegetable and fish. Salt water enters into the agriculture land and fish pond. It destroys our crops, resulting in loss of yields. Wildlife sanctuary is just opposite to our village (on other side of river). Earlier people use to depend on forest and river for livelihood (through collection of wood, honey, shrimp seed etc.). But now government restriction is there on these activities. In search of alternate livelihood, the youth are leaving the village for jobs in neighbouring states.

2. AQUACULTURE ACTIVITIES IN SUNDARBAN

West Bengal contributes a lion share in aquaculture production of India. In the inland fishery sector, West Bengal accounts for about 30% of the total fish production of the country, which is dominated by production of North and South 24 Parganas that fall in Indian Sundarban. Based on the total production for 2007-08, the state of West Bengal alone would be the 19th biggest fish producer in the world. Indian Sundarban is the top producer of fish and prawn, with both districts combined producing roughly 31% of the total inland fish/prawn production. South 24 Parganas alone produced 30% of the total marine fish/prawn production of West Bengal in 2007-08. A large population is dependent on culture and capture fishery. Fishery is treated as the backbone of Sundarban economy. Apart from coastal and brackishwater aquaculture, freshwater aquaculture is increasing day by day and contributes parallel economy and livelihood security in Sundarban eco-region. Sundarban boasts around 172 species of fishes, 20 species of prawn and 44 species of crabs including two commercial species.

2.1 Uniqueness of Sundarban ecosystem & its contribution to aquaculture

Sundarban acts as the nursery ground for nearly 90% of the aquatic species of eastern coast of India. The availability of important commercial species of the continental shelf that are harvested in India and neighbouring countries, very much depends on the heath of Sundarban ecosystem. The Sundarban delta provides physiologically suitable environment with respect to temperature, salinity and other physico-chemical parameters. Generally estuary receives abundant supply of nutrients from land drainage and large quantities of organic detritus from mangrove forest which is an important source of energy for a wide variety of estuarine consumers. Further, many commercial estuarine fishes grow to maturity here and make up a large part of the near-shore fishery of the northern Bay of Bengal. Other fishes and prawns that spend most of their lives in freshwater descend annually to the estuary for spawning. Therefore, many marine and freshwater prawn and fish require this environment to complete their lifecycle. Aquaculture in Sundarban is based upon both inland and marine fisheries resources. A proper linkage between the two culture systems can change the whole outlook of aquaculture in this area.

2.2 Cultivable species of Sundarban

Cultivable species in Sundarban includes both freshwater and brackishwater species (finfish and shellfish). Freshwater aquaculture is practised mostly in backyard ponds. Villages in the Sundarban have lots of such ponds. Families excavate a portion of their low-lying paddy field to get earth to raise the land and construct dwelling houses and for drinking water. Therefore, almost every household possesses these excavated areas, which, in the monsoon season, store rain water. These ponds (small water body) are used for fresh water aquaculture. Water of these ponds is also used for household purposes like washing of utensils, bathing and even for drinking purpose. Fish produced

in these ponds are mostly used for domestic consumption and excess amount is sold. Apart from this, freshwater aquaculture is also carried out in big ponds (either owned by individuals or few families), land-shaping ponds (mainly excavated for agricultural irrigation purpose) and low-lying inundated paddy fields. Brackishwater aquaculture is practised in large artificial enclosures developed in coastal swamps by erecting earthen dykes, locally called *bheries*. Culture is carried out by taking the tidal saline water in and out through sluices from nearby rivers for commercial pisciculture. A wide varieties of fish species (freshwater and brackishwater) are cultured by the farmers of Sundarban. The lists of these species are given below.

Table 2.2: Cultivable species of Sundarban

Freshwater Finfish		
Common Name	**Local Name**	**Scientific Name**
Catla	Catla	*Catla catla*
Rohu	Rui	*Labeo rohita*
Mrigal	Mrigal	*Cirrhinus mrigala*
Bata	Bata	*Labeo bata*
Calbasu	Kalbos	*Labeo calbasu*
Olive Barb	Saral Punti	*Puntius sarana*
Ticto Barb	Punti	*Ticto ticto*
Tint Punti	Tint Punti	*Puntius puntius*
Japani Punti	Java Punti	*Puntius javanicus*
Grass carp	Gheso rui	*Ctenopharyngodon idella*
Common carp	Ameriacan rui	*Cyprinus carpio*
Silver carp	Silver carp	*Hypophthalmichthys molitrix*
Bighead carp	Bighead	*Aristichthys nobilis*
Pangas	Pangas	*Pangasius sutchi*
Rupchanda	Rupchand	*Pygocentrus nattereri*
Chitol (Feather back)	Chitol	*Chitala chitala*
Tilapia	Tilapia	*Oreochromis niloticus O.mossambicus*
Air breathing walking Catfish	Magur	*Clarias batrachus*
Air breathing stinging Catfish	Singi	*Heteropneustes fossilis*
Climbing perch	Koi	*Anabas testudineus*
Giant Murrel	Sall	*Channa marulius*
Striped Murrel	Sol	*Channa striata*
Spotted Murrel	Lata	*Channa punctata*
Barca snakehead	Chang	*Channa gachua, C. orientalis*
Pholui	Pholui	*Notopterus notopterus*
Goby	Bele	*Glossogobius sp.*
Gangetic leaf fish	Nadosh	*Nandus nandus*
Gangetic striped dwarf catfish	Tangra	*Mystus cavasius, Mystus vittatus*
Giant river catfish	Tangra	*Sperata seenghala*
Long whiskered catfish	Aar	*Sperata aor*
Wallago	Boal	*Wallago attu*
Pabdah Catfish	Pabda	*Ompok pabda. Ompok pabo*

Freshwater Shellfish		
Giant freshwater prawn	Golda chingri	*Macrobrachium rosenbergii*
Indian Freshwater prawn	Sada Chingri	*Macrobrachium malcomsonii*
Ganga River prawn	Chapra chingri	*Macrobrachium choprai*
Brackishwater Finfish		
Indian seabass	Bhetki	*Lates calcerifer*
Gold spot mullet	Parse	*Liza parsia*
Large scale mullet	Rupoli parse	*Liza macrolepis*
Tade mullet	Bhangan	*Liza tade*
Flathead Mullet	Ansh Bhangan	*Mugil cephalus*
Corsula	Khorsula	*Rhinomugil corsula*
Pearl spot	Mukta Gachha	*Etroplus suratensis*
Tank goby	Bele	*Glossogobius giuris*
Long whiskers catfish	Nona tengra	*Mystus gulio*
Paradise threadfin	Topse	*Polynemus paradiseus, P.Indicus*
Spotted scat	Pairachanda	*Scatophagus argus*
Milk fish	Milk fish	*Chanos chanos*
Yellowtail catfish	River pangus	*Pangasius. Pangasius*
Brackishwater Shellfish		
Gient Tiger prawn	Bagda chingri	*Penaeus monodon*
Ginger prawn	Honnye chingri	*Metapenaeus monoceros*
Banana prawn	Kola chingri	*Fenneropenaeus merguiensis*
Yellow prawn	Chamne chingri	*Metapenaeus brevicornis*
Kiddi shrimp	Rosna chongri	*Parapenaeopsis stylifera*
Indian white shrimp	Chapra chingri	*Fenneropenaeus indicus*
Mud crab	Kalo kankra	*Scylla serrata*
Mud crab	Neel kankra	*Scylla tranqueberica*

2.3 Shrimp farming status in Sundarban region

Development of brackishwater aquaculture in Sundarban is centred around shrimp farming. The dominant species under culture is *Peneaus monodon* or tiger shrimp due to its high unit value realisation and over expanding export demand. Scientific culture of shrimp started mid 80's and mid 90's more than 34,600 hectares of area was brought under culture in West Bengal. Estimated production of shrimp through aquaculture in this state increased from 12,500 Metric tonnes during the year1990-91 to 33,685 metric tonnes in 2009-10. However, the rapid growth of the shrimp farming industry halted suddenly in 1996-97. Annual production of shrimp from these traditional fields (*bheries)* is very low (200-350 kg/ha). This farming is normally practised in low-lying areas and shallow water bodies, influenced by tidal water especially during lunar phases. Brackish water from the adjacent water body *e.g.* river, creek, backwater, lake, lagoons *etc.* is let into by gravity flow to a large and shallow area of 10 to 100 ha, enclosed by constructed earthen bunds on its periphery. Entry of water is normally regulated by

means of a wooden sluice made of planks and bamboo poles. Screen made of bamboo is used for filtration of the water. Although seed of different fish and shrimp species also find entry into these areas along with the tidal water. Farmers usually stock natural or hatchery produced seed of *Penaeus monodon* for better yield. Such farming area is locally called as *bhery*. In many cases *Penaeus monodon* seeds are initially released in specially enclosed nursery area of below 1.0 ha located adjacent to the main rearing area and reared for about a month. There after seeds are allowed to escape to main *bhery* by cutting the earthen bund of the nursery pond are at 2-3 different places. Stocking and harvesting is periodic which is according to the lunar phase. Harvesting is normally done for 6 days during the full moon and new moon period 2 days before and 3 days after, using traps made of bamboo and partially by cast netting. In most of the bheries a single sluice is used for both letting in and draining out the water. Water depth of the rearing areas varies between 1-3 feet. Partial water exchange is done during the lunar phases taking advantage of the tidal amplitude of spring and neap tides. Natural growth of filamentous algae and other aquatic micro / macrophytes in these large and shallow rearing areas provide an excellent natural environment for the growth of shrimp. Usually in traditional farming system, no supplementary feed is used and shrimp grow on the natural productivity. Depending upon salinity variation in the water body, these areas are used exclusively for shrimp farming or together with other fish species. In areas experiencing higher salinity in the range of 10-35 ppt during the year, mostly shrimp monoculture is practiced. In such areas, farming starts during January / February months and harvesting is completed by October / November. However, in few cases farmers use supplementary feed and other inputs for higher production.

Table 2.3a: Year wise production details on shrimp farming in West Bengal

Year	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11
Area under culture (ha)	50,215	50,474	49,715	48,236	47,488	47,488	47588
Estimated production (MT)	35,432	42,336	42,006	27,668	27,418	33,685	40,725

Table 2.3b: District wise development of shrimp farming in West Bengal (2010-11)

District	Area Developed so far(ha)	Estimated production (MT)
North 24 Parganas	34,500	24,372
South 24 Parganas	11,500	8,725
Medinipore	1,588	7,628
Total	47,488	40,725

Source : MPEDA Annual Report 2010-2011 & MPEDA SRC (Aquaculture), Kolkata

2.4 Major threats associated with aquaculture & fishery of Sundarban

Impacts of climate change on aquaculture could be positive or negative, arising from direct and indirect impacts on the natural resources aquaculture requires, namely water, land, seed etc. As aquaculture needs significant feed and seed inputs, the impacts of climate change on them will also, in turn, affect the productivity and profitability of aquaculture systems. Vulnerability of aquaculture-based communities will stem from their resource dependency and exposure to extreme weather events. Climatic changes could increase physiological stress on cultured stock. This would not only affect productivity but also increase vulnerability to diseases and, in turn, impose higher risks and reduce returns to farmers. Interactions of fisheries and aquaculture subsectors could create other impacts. For example, extreme weather events could result in escapes of farmed stock and contribute to reductions in genetic diversity of the wild stock, affecting biodiversity more widely. In the context of Sundarban, the climate change will have mixed impacts on aquaculture which can be summarised as below.

- In climate warming scenario, fishes will be subjected to the hazard of rapid temperature changes. Such fluctuating temperature will disturb the homeostasis of fish and will subject them to physiological stress and shift in habitat or mortality. It will be more so in tropical waters where daily variations in water temperature and thermocline in deep water bodies will assume significance. These effects would often become additive or synergistic with those of other adverse (e.g. low pH, algae, oxygen shortage). It is essential to understand that these temperatures change thought sublethal, can place a stress of considerable magnitude on the homeostatic mechanism of fishes at primary, secondary and tertiary level (Das and Sahu, 2012).

- In the changed situation, the salination of lands and water in the inhabited areas of Sundarban may bring more areas under brackishwater aquaculture (*Bheries*) given the decreasing viability of fresh water aquaculture and agriculture sectors, thus presenting an opportunity for this sector to capitalize on the changes posed by climate change.

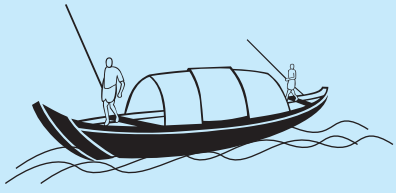
- Breach of pond dyke due to storm /tidal surge will cause ingression of saline water into the freshwater ponds, thus affecting the productivity of the region.

- Aquaculture operations may have to cope with changed disease & pest risks in Sundarban region as a result of climate change. Potential shifts in tidal patterns and salinity regimes will have implications for aquaculture prevailing in this region.

- Most of the aquaculture farms are running in agricultural lands without any legalized land conversion. Now the trend is to transfer these *bheries* to brick fields that too in most cases without conversion or permission from the competent authority. It is confirmed from different studies that the breaches of embankments adjacent to these *bheries* are due to poor maintenance causing embankment failure, breaches and erosion of *charlands*.

- Reductions in freshwater flows to the delta due to upstream diversions of the Ganges and its tributaries and indiscriminate fishing practices are reducing fish populations. Catch data from estuarine fisheries reveal an increase in the yield, but a decrease in the catch per unit effort. The change in freshwater flow in the rivers has led to the change in salinity in the estuarine water and soil, threatening fish species. Population pressures on aquatic resources are a major cause of concern, especially since 14.5% of the 4.5 million people that inhabit the Sundarban engage in fishing, with the majority active in inland fishery zones.

- Indiscriminate seed collection results in a loss of a variety of other aquatic species. Thousands of untrained workers who collect shrimp seeds from the sea, channels and rivers cause significant losses to fries of other fishes. Often, collectors discard non-shrimp fries back into the water, which is a major cause of the gradual decline in supply of different fish species. In addition, the use of fishing gear such as big bull trawlers, mechanized boats, PVC-made trawl, bag nets etc. are degrading the natural environment throughout the delta.



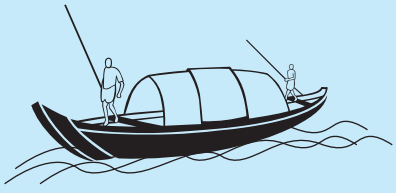
3. OBJECTIVES OF THE SURVEY

The survey is conducted under NICRA (National Initiative on Climate Resilient Agriculture) sponsored project entitled "Development of Climate Resilient Aquaculture Strategies for Sagar and Basanti Blocks of Indian Sundarban" which is being funded by ICAR (Indian Council of Agricultural Research). The objectives of main project are:

- To study the tolerance limits of few selected culture fish species in relation to acute and chronic changes in abiotic climate change stresses like salinity and temperature.
- To develop climate-resilient aquaculture strategies for better adaptation to conditions brought about through climate change, notably increased salinity for sustainable production.
- To strengthen the capacity of fish farmers and supporting institutions to prepare and respond effectively to future climate-induced emergencies.

The purpose of the survey is to benchmark the socio-economic profile, current aquaculture practices, climate change pattern, various constrains and challenges faced in relation to climate change and coping measures prevailing among the fish farmers of Sagar & Basanti blocks of Indian Sundarban. The study is designed to highlight the existing environment of small-scale fish farmers with emphasis on freshwater culture along with productivity, farmers' perception on impacts of climate changes affecting aquaculture and biodiversity in above two blocks of Indian Sundarban.

The outcome of the survey will be utilized in designing the experiments for developing climate-resilient aquaculture strategies for better adaptation to conditions brought about through climate change, notably increased salinity for sustainable production and to strengthen the capacity of fish farmers and supporting institutions to prepare and respond effectively to future climate-induced emergencies.



4. SURVEY METHODOLOGY

4.1 Study area and sample size

A cross-sectional interview-based survey was carried out at two climate change sensitive and aquaculture dominated island blocks namely Basanti & Sagar in South 24 Parganas district of West Bengal. This survey was conducted during the months of September to December 2011, using random sampling technique. Two reputed local NGOs were engaged for this survey (Paribesh Unnayan Parishad for Sagar block and Joygopalpur Gram Vikash Kendra for Basanti block). Total 20 Gram Panchayats in the 2 blocks were covered during in the survey (9 Gram Panchayats in Sagar block, 11 Gram Panchayats in Basanti block). Total 451 households (244 households in Sagar and 207 households in Basanti) were surveyed. Farmers were interviewed directly at his/her house/farm. For entire data collection process, 20 numbers of surveyors and 4 numbers of reviewers were engaged. In few cases, essential pond water parameters like pH & salinity were recorded by surveyors. The filled-up questionnaires were checked by reviewers for entry and recording errors, missing data, and consistency before analysis.

4.2 Survey Questionnaire

A multilayer survey questionnaire was developed covering all aqua farming characteristics (Annexure: 1).The survey instrument used both closed and open-ended questions depending on the type of information desired. The survey questionnaire was consist of four major categories, *i.e.* (a) general information on farmers, (b) information on aquaculture, (c) pond management practices and (d) climate change / environmental issues. General information includes farmer's name, age, sex, caste, village, gram panchayat, block, educational qualification, family size and income source. Information on aquaculture includes type of aquaculture practised and type of ponds. Pond management practices include pond preparation steps followed by farmers, stocking, supplementary feeding, health management, harvesting, marketing, water quality and source of knowledge on aquaculture. Climate change / environmental issues include pre and post cyclone *(Aila)* scenario in aquaculture, frequency of cyclone (in last 20 years), problems encountered in aquaculture due to cyclone, measures taken in case of influx of saline water into freshwater pond, knowledge about possible impacts of climate change on Sundarban, presence of invasive-alien species (if any) in the locality, name of few threatened fish species, awareness on possible environmental impacts of shrimp seed catch from river, observation on natural adaptation of fish to climate change, and status of natural breeding of small indigenous fish.

Data base software was developed in-house using *Microsoft Access 2007*. The collected data were recorded and analysed and reports on socio-economic profile, aquaculture practices, and farmers' opinions about impact of climate change on productivity, coping measures, biodiversity *etc*. were generated.

Photo sheet V: Survey activity

Prof. C. S. Chakrabarti, Hon'ble V.C., WBUAFS intracting with fish farmers of Jharkhali, Basanti

Survey at Bharatgarh, Basanti block

Recording of pond water parameters at Mandirtala village, Sagar block

Orientation of Surveyors before survey at Sagar field station

Survey team at *Aila* affected area of Hiranmoypur, Basanti block

Dr. B. Venkateswarlu, Director, CRIDA, inspecting field wet labortory, Jharkhali, Basanti

5. BRIEF DESCRIPTIONS ABOUT STUDY AREA

Fig 5: Map showing details of the study area (Sagar & Basanti blocks are encircled by red line)

Photo sheet IV: Survey activity

Survey team at Joygopalpur village, Basanti block

Survey at Nafargung village, Basanti block

Discussion with farmers at Charabidya village, Basanti block

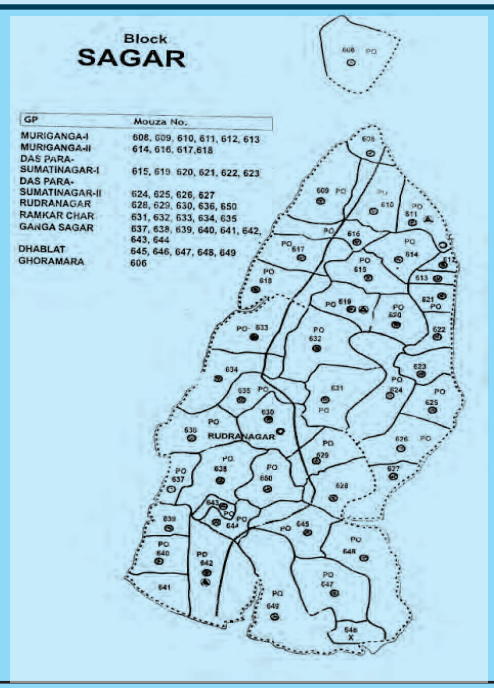
Vehicle used for Survey, Sagar block

Post-Survey Review at Sagar field station

Dr. B. Venkateswarlu, Director, CRIDA, interacting with fish farmers of Basanti Block

Table 5a: List of GP covered under survey including map of the area

Name of Gram Panchayat	
Amjhara	Chunakhali
Kanthalberia	Uttar Mokamberia
Basanti	Foolmalancha
Maszidbati	Bharatgarh
Jharkhali	Nafarganj
Charabidya	Jyotishpur
Ramchandrakhali	



Name of Gram Panchayat	
MuriGanga - I	MuriGanga –II
Ramkarchar	Rudranagar
Dhablat	Ghoramara
Gangasagar	Daspara Sumati
Daspara Sumati	Nagar II
Nagar I	

Table 5b: Administrative Profile of Sundarban Region

Districts	Sub Divisions	Police Stations	Blocks/Panchayat Samities	No. of G.P.
South 24 Parganas	Kakdwip	Sagar,Namkhana, Kakdwip, Patharpratima	Sagar,Namkhana, Kakdwip, Patharpratima	42
	Diamond Harbar	Mathutrapur, Roydighi	Mathurapur-I Mathurapur-II	21
	Baruipur	Kultali, Joynagar	Kultali,Joynagar-I, Joynagar-II	31
	Canning	Canning, Basanti, Gosaba	Canning-I, Canning-II, Basanti Gosaba	46
North 24 Parganas	Bashirhat	Hingalganj, Hasnabad, Sandeshkhali, Haroa, Minakhan.	Hingalganj, Hasnabad, Sandeshkhali -I, Sandeskhali - II Haroa, Minakhan.	50
Total		**16**	**19**	**190**

5.1 Sagar Block

Sagar island, the largest delta block is located in the extreme western sector of Sundarban lies between 21° to 21°53' N and 88°02' to 88°15' E. This island is surrounded by two rivers, *i.e.* Hoogly and Muriganga. Both the rivers meet Bay of Bengal on either side of the Sagar island. The entire island is channelled like vein with numerous brackish water creeks which act as spill channels for the tidal water and makes the island more suitable for aquaculture. Sagar Island is with an area of around 300 km² and totally disconnected from mainland by tidal river and can be reached only by water transport. The block consists of 11 gram Panchayets *viz.* Daspara Sumati Nagar - I, Daspara Sumati Nagar – II, Gangasagar, Dhablat, Ramkarchar, MuriGanga - I, MuriGanga –II, Rudranagar and Ghoramara covering 43 villages. Ghoramara Island is a separate island under sagar block which is roughly five square kilometres in area. This small island in river Hoogly is very much vulnerable and sensitive to coastal erosion and sea level rise.

Table 5.1: Sagar Block : Demographic profile (Source: Census of India 2001)

Block: SAGAR							
District : 24 Parganas (S)							
State : WEST BENGAL							
Number of Households: 31,461							
Geographical Location: 21°37′21″N to 21° 52′28″N & 88°02′17″E to 88°10′25″E							
	Male	**Female**	**Total**	Household size	6.0		
Population (Total)	95,547	90,097	185,644	Sex Ratio (females per 1000 males)	943		
Population (Rural)	95,547	90,097	185,644	Sex Ratio (0-6 Years)	962		
Population (Urban)	0	0	0	Sex Ratio (SC)	944		
Population (0-6 years)	14,771	14,216	28,987	Sex Ratio (ST)	804		
				Proportion	**Total**	**Male**	**Female**
SC Population	26,543	25,045	51,588	SC Population (%)	27.8	27.8	27.8
ST Population	383	308	691	ST population (%)	0.4	0.4	0.3
Number of literates	71,051	50,931	121,982	Literacy Rate (%)	77.9	88.0	67.1
Number of illiterates	24,496	39,166	63,662	Illiteracy Rate (%)	40.6	30.3	51.6
Total workers	50,371	24,924	75,295	Work Participation Rate (%)	52.7	40.6	27.7
Main workers	39,040	4,059	43,099	Main Workers (%)	23.2	40.9	4.5
Marginal workers	11,331	20,865	32,196	Marginal Workers (%)	17.3	11.9	23.2
Non workers	45,176	65,173	110,349	Non Workers (%)	59.4	47.3	72.3
Cultivators	17,948	10,054	28,002	Cultivators to total workers (%)	37.2	35.6	40.3
Agricultural labourers	18,029	9,652	27,681	Agricultural labourers to total workers (%)	35.8	36.8	38.7
Workers in household	637	800	1,437	Workers in household Industries to total workers (%)	1.9	1.3	3.2
Industries / Other workers	13,757	4,418	18,175	Percentage of Other Workers to total workers (%)	24.1	27.3	17.7

5.2 Basanti Block

Basanti is located at 22°11′21″N and 88°40′14″E is one of the main aquaculture dominated deltaic island in the eastern part of Indian Sundarban region, bounded by the Matla and Vidyadhari rivers and numerous creeks. Rural area under Basanti block consists of 13 gram panchayats, *viz*. Amjhara, Chunakhali, Kanthalberia, Uttar Mokamberia, Basanti, Foolmalancha, Maszidbati, Bharatgarh, Jharkhali, Nafarganj, Charabidya, Jyotishpur and Ramchandrakhali. Basanti police station serves this block. Headquarters of this block is in Sonakhali. Basanti Island is connected with Road Transport with main land since last few years.

Table 5.2: Basanti Block: Demographic profile (Source: Census of India 2001)

Block : BASANTI District : 24 Parganas (S) State : WEST BENGAL Number of Households: 50,751 Geographical Location: 22°11′21″N & 88°40′14″E							
	Male	**Female**	**Total**	Household size	6.0		
Population (Total)	142,705	135,887	278,592	Sex Ratio (females per 1000 males)	952		
Population (Rural)	142,705	135,887	278,592	Sex Ratio (0-6 Years)	981		
Population (Urban)	0	0	0	Sex Ratio (SC)	928		
Population (0-6 years)	26,265	25,770	52,035	Sex Ratio (ST)	946		
				Proportion	**Total**	**Male**	**Female**
SC Population	55,820	51,782	107,602	SC Population (%)	38.6	39.1	38.1
ST Population	8,973	8,489	17,462	ST population (%)	6.3	6.3	6.2
Number of literates	80,288	48,811	129,099	Literacy Rate (%)	57.0	69.0	44.3
Number of illiterates	62,417	87,076	149,493	Illiteracy Rate (%)	66.0	53.6	79.1
Total workers	72,391	16,783	89,174	Work Participation Rate (%)	32.0	50.7	12.4
Main workers	55,931	5,389	61,320	Main Workers (%)	22.0	39.2	4.0
Marginal workers	16,460	11,394	27,854	Marginal Workers (%)	10.0	11.5	8.4
Non workers	70,314	119,104	189,418	Non Workers (%)	68.0	49.3	87.6
Cultivators	20,910	2,345	23,255	Cultivators to total workers (%)	26.1	28.9	14.0
Agricultural labourers	34,011	8,738	42,749	Agricultural labourers to total workers (%)	47.9	47.0	52.1
Workers in household	954	1,162	2,116	Workers in household Industries to total workers (%)	2.4	1.3	6.9
Industries / Other workers	16,516	4,538	21,054	Percentage of Other Workers to total workers (%)	23.6	22.8	27.0

6. OVERVIEW OF THE NGO INVOLVED IN THE STUDY

6.1 Paribesh Unnayan Parishad (PUPA)

PUPA is a well known NGO in Sundarban region actively engaged with various socio economic and environmental activities centring Sagar Island of Sundarban. The main objectives of the PUPA is the conservation of local biodiversity, prevention of land degradation, building an environmentally literate community, income generation through sustainable use of local resources, improving the quality of life through community ownership, community institution building and capacity building of local fisher folk and fish farmers.

6.2 Joygopalpur Gram Vikash Kendra (JGVK)

JGVK is another reputed NGO with multiple activities. It is actively engaged in rural livelihood programmes through agricultural development and social security. It undertakes various developmental projects in education, public health, agriculture, animal husbandry and fishery in deltaic Sundarban in general and Basanti block in particular. It runs a carp seed hatchery and distributes quality fish seed to the local farmers. It also conducts regular skill development training programmes and renders technical assistance to the farmers.

Table 6: Team Structure engaged for survey

<table>
<tr><th colspan="2">Sagar Block</th><th colspan="2">Basanti Block</th></tr>
<tr><td colspan="2"><u>Name of NGO & Address</u>
Paribesh Unnayan Parishad (PUPA),
Council for Environmental Development.
Address: 8/1B, Raipur Road (E), Kolkata 700 032
Rural unit: Amargram, Vill: Phulbari, P.O: Sagar Phulbari, Sagar Island, Dist: South 24 Parganas, Pin: 743373 Tel: (+91) 9433578792
E mail: amargram_pupa@rediffmail.com
(Dr. A Mishra, Secretary)</td><td colspan="2"><u>Name of NGO & Address</u>
Joygopalpur Gram Vikash Kendra (JGVK),
Address: Vill: Joygopalpur, P.O: J.N. Hat, P.S: Basanti, Dist: South 24 Parganas, West Bengal, Tel: (+91) 3218203-020,
Mobile: (+91) 97325-22848
E mail: jgvksundarban@gmail.com
(Mr. Biswajit Mahakur, Secretary)</td></tr>
<tr><th>Name of Surveyor</th><th>Name of Reviewer</th><th>Name of Surveyor</th><th>Name of Reviewer</th></tr>
<tr><td>1. Anupam Jana
2. Debasis Debnath
3. Kamal Bera
4. Subrata Bera
5. Tapas Manna
6. Dinesh Jana
7. Subhendu Das
8. Milan Shit
9. Debabrata Mandal
10. Bimal Das Adhikari</td><td>1. Asit Das
2. Kriti Sundar Misra
3. Tapasi Jana</td><td>1.Bishnupada Mridha
2.Amit Das
3.Kalidas Naskar
4. Sampa Misra
5. Sukumar Maity
6. Bapi Mondal
7. Tamal Haldar
8. Meer Amirul
9. Sankar Mandal
10.Ramprasad Sarkar</td><td>1. Ramprasad Pramanik</td></tr>
</table>

7. ANALYSIS AND RESULT

The collected data were entered through specially designed database software. Based on entered data, various reports were generated pertaining to relevant aspects of aquaculture and climate change impact through the help of the software. Data are presented both in tabular and graphical forms. Inferences were drawn after thorough analysis of data and are presented below.

7.1 Socioeconomic profile

7.1.1 Caste wise distribution

Sagar Block : Among the respondents, 59% farmers of Sagar block belong to general category, followed by 21% in SC category, 10% in OBC category and 9% in Muslim category. Only 1 % belongs to ST category.

Basanti Block : In Basanti Block, 50% respondent farmers belong to SC category, followed by 19% each in general and Muslim categories. 7% farmers belong to ST whereas 5 % belong to OBC category.

Overall : The combined data of the two blocks revealed that majority of farmers belong to general category (41%). 35% of farmers belong to SC and 13% belong to Muslim category. Few farmers are of OBC and ST categories (8% & 3% respectively).

7.1.2 Educational Status

Sagar Block : Most of the fish farmers (37%) in Sagar island have education between class VI and IX. The percentage of farmers having education upto class 10 is 18. 13% farmers are 12 pass whereas 12% farmers have education upto class V. Few farmers have also received higher education (9% graduate & 1% post-graduate). The number of illiterate farmers is 10%.

Basanti Block : In Basanti Block, the percentage of farmers having qualification of class VI to IX is 38%, followed by 23% farmers, who are class X pass. 12% farmers have education upto class V. 11% farmers are graduate and only 1% farmers are post-graduate. 10% farmers are class VII pass. The number of illiterate farmers is 5%.

Overall : Combined illiterate rate in both the blocks is 8%. From this, it is evident that aquaculture is being carried out mostly by literate farmers (92%).

7.1.3 Family income

Farmers were categorised into three groups based on total family income *i.e.* low income group (annual income below Rs. 50,000/-), medium income group (annual income Rs. 50,000 – 1,00,000/-) and high income group (annual income above Rs. 1,00,000/-)

Sagar Block : Among the respondents involved in aquaculture, 56% farmers belong to

low income group, 32% farmers belong to medium income group and rest 12% farmers have high income.

Basanti Block: Compared to Sagar block, in Basanti block more farmers (84%) belong to low income group. Only 14% farmers belong to medium income group while 2% belong to high income group.

Overall: Survey data revealed that irrespective of block, majority of the fish farmers (69%) belong to low income group. Due to the low income status this group is more vulnerable to risk associated with fish crop loss / failure. The percentages of farmers belonging to medium and high income groups are 24% & 7% respectively.

7.1.4 Family size

The farmers were categorised into three groups based on number of members in their family *i.e.* farmers having small family (members ≤ 4), medium family (members between 5 & 8) and large family (members > 8).

Sagar Block: In Sagar island, 60% farmers have medium family, 25% farmers have small family and 15% farmers have large family.

Basanti Block: Similarly in Basanti Block, 61% have medium family, 29% have small family and 10% belong to large family.

Overall: Majority of fish farmers (60%) have medium size family, whereas 13% have large family and 27% have small family.

7.1.5 Source of income

Survey result reveals that the fish farmers of Sundarban practise agriculture, animal husbandry, fishing, business, service etc. as additional source of income along-with aquaculture.

Sagar Block: Survey data indicates that among the respondents for 67% fish farmers agriculture is the main source of income. Only 13% farmers are involved with animal husbandry and 14% farmers have small business. 3% respondents are engaged in fishing and same percentage of farmers has some kind of service.

Basanti Block: In Basanti Block, 59% farmers have taken up agriculture as an additional source of income. 24% farmers are engaged with animal husbandry and 3% respondents are involved in fishing. Only 2% respondents are service holder.

Overall: Irrespective of blocks, majority of fish farmers are involved in agriculture (63%). Animal husbandry comes as second option for the fish farmers as additional source of income (18%). Fewer farmers (13%) operate aquaculture farms alongwith business. Only a very few (3%) are engaged in fishing and service.

7.1.6 Knowledge source on aquaculture

Though aquaculture is an age-old practice in Sundarban, scientific farming method is relatively new to the farmers. This is possible due to dissemination of modern technologies among the farmers through training, demonstration, mass media etc.

Sagar Block : Among the respondents of Sagar Island, 69% farmers learnt aquaculture through their daily experience. 18% farmers got aquaculture related knowledge through friends and neighbours. For 9% farmers, mass media was the main source of knowledge. Only 2% farmers received Govt. and NGO training.

Basanti Block : In case of Basanti Block, 81% farmers learnt aquaculture through their daily experience, whereas 16% farmers depended upon friends and neighbours for gaining knowledge on aquaculture. 2% farmers learnt aquaculture through mass media. Only few farmers (1%) had the opportunity for Govt. and NGO training.

Overall : The data indicated that the maximum farmers practised aquaculture in their own ponds and as fish farmer, acquired their aquaculture property from their ancestors and learnt traditional aquaculture on their own way through day to day experience (69%). Information & technology transfer and advice were also collected from other farmers, friends and neighbours (18%). Very few respondents (9%) depend upon mass media for their information source. The involvement of Government sector (2%) and NGO's (2%) in imparting knowledge on aquaculture and related activities to the farmers was negligible. The outcome of the survey reveals the partial failure of Govt. agencies, educational institutions and NGOs in efficient communication and extending technical assistance to the farmers on different aspects of aquaculture development which may be due to lack of proper coordination among them. For gathering knowledge on aquaculture, most of the farmers adapted technology either from their own ideas or depended on other local farmers, friends and neighbours.

7.2 Farm operation and management

7.2.1 Culture type (Fish / shellfish)

Sagar Block : Among the respondents of Sagar Island, 58% farmers were found to exclusively culture finfish and 8% farmers were found to culture shellfish exclusively. Good numbers of farmers (34%) culture both finfish and shellfish.

Basanti Block : Among the respondents of Basanti Block, 29% farmers exclusively culture finfish and 4% farmers culture shellfish. 67% farmers culture both the types.

Overall : The culture characteristics are quite different in the two blocks. The overall data indicates that maximum farmers (49%) prefer the both (polyculture of finfish and shellfish). Basanti block is dominated by *bhery* culture. 45% of farmers exclusively culture finfish. Few respondents (6%) are involved exclusively in shellfish monoculture.

7.2.2 Water type in culture (Freshwater / Brackishwater)

Sagar Block: Among the respondents of Sagar Island, 62% fish farmers exclusively practise freshwater culture and only 9% farmers practise brackishwater culture. 29% farmers prefer both type of culture.

Basanti Block: 82% farmers in this block exclusively use freshwater as medium for pisciculture. Only 3% farmers practise brackishwater aquaculture exclusively. 15% farmers do fish farming both in freshwater and brackishwater.

Overall: The combined data of the two blocks indicate that fish culture is mainly dominated in freshwater (71%), followed by both types of water (22%). Very few farmers exclusively culture in brackish water (7%).

7.2.3 Farming practice (traditional / modifies extensive / semi-intensive)

Sagar Block: Commercial freshwater finfish culture of traditional and modified extensive type is dominant in Sagar block. The data reveal that 68% respondent farmers culture in traditional way and 26% farmers adopted modified extensive farming. Few farmers (6%) practise Semi intensive farming.

Basanti Block: In Basanti block, 79% of farmers operate their farms in traditional way while 20% farmers culture in modified extensive ways. Only 1% farmers adopt semi intensive farming.

Overall: Combined data of two blocks reveal that majority of farmers (74%) operate their farms in traditional way. 23% farmers adopt modified extensive farming and few farmers (3%) practise semi intensive farming.

7.2.4 Type of culture practice (Monoculture / Polyculture / Integrated)

Sagar Block: Among the respondents of Sagar island, 90% farmers are doing polyculture, whereas 8% farmers are involved in monoculture. Only few farmers (2%) follow integrated fish farming with livestock or crop.

Basanti Block: Among the respondents of Basanti block, 83% farmers are found to practise polyculture, whereas only 1% farmers are involved in monoculture. 6% farmers culture fish with integrated approach.

Overall: Altogether cultivation approach of the two blocks indicates that polyculture is very popular among the farmers (87%). Few farmers (5%) practiced integrated farming and surprisingly it is noticed that farmers ventured into integrated farming without knowing the actual benefit. Polyculture of Indian major carps, with fresh water prawn and other fishes is most common among the farmers (87%). Small numbers of farmers (5%) are involved in shellfish monoculture.

7.2.5 Pond type (Perennial / Seasonal)

Sagar Block: Among the respondent farmers of Sagar Island, 75% farmers are having perennial pond and 25% farmers have seasonal pond.

Basanti Block: In Basanti block, 67% farmers are found to possess perennial pond and 33% farmers have seasonal pond.

Overall: Over all data reveal that majority of farmers (73%) possess perennial pond and the percentage of farmers having seasonal pond is 27.

7.2.6 Pond design (Inlet / Outlet)

Sagar Block: In Sagar Island, 66% respondent farmers maintained inlet and outlet in their ponds and 34% respondent farmers do not have proper inlet and outlet in their ponds.

Basanti Block: In Basanti block, the picture is quite different. 77% respondent farmers do not have proper inlet and outlet in their ponds and only 23% farmers do maintain inlet and outlet in their ponds.

Overall: The overall data indicate that 46% farmers maintained inlet and outlet in their ponds and 54% farmers do not have proper inlet and outlet in their ponds. From this it is evident that ponds in the region are not scientifically designed.

7.2.7 Nursery pond

Sagar Block: Among the farmers of Sagar island, only 13 numbers of farmers (out of total 244) have nursery pond. Among them, 62% farmers have one nursery pond and 38% farmers have two nursery ponds.

Basanti Block: Among the all respondent farmers of Basanti Block, 50 numbers of farmers (out of total 207) have nursery pond. Among them, 74% respondents have one nursery pond and 18% farmers have two nursery ponds. 2% farmers maintained three nursery ponds while 4% farmers maintained four nursery ponds. Only 2% farmers have more than five nursery ponds.

Overall: The combined data of the two blocks reveal that 71% farmers have only one nursery pond and 23% have two nursery ponds. Moreover, 2% farmers maintained three nursery ponds and 3% farmers maintained four nursery ponds. Even 2% farmers have more than five nursery ponds.

7.2.8 Grow-out pond

Sagar Block: In Sagar island, 37% farmers have one grow-out pond and 32% respondents have two grow-out ponds. 19% farmers maintained three and 8% farmers maintained four grow-out ponds. 3% respondents have five grow-out ponds and 1% respondents even have more than five grow-out ponds.

Basanti Block: 27% respondents of Basanti block have one grow-out pond and 43% respondents have two grow-out ponds. 21% farmers maintained three and 7% farmers maintained four grow-out ponds. Only 1% respondents have five grow-out ponds and the same percentage of farmers have more than five grow-out ponds.

Overall: The result of the survey indicates that most of the farmers do not practise nursery rearing separately and use the grow-out ponds for growing spawn / fry size fish to table size. Such type of culture (culturing all stages of fish - fry, fingerlings, juveniles and sub-adults) in the same pond probably is a unique characteristic of West Bengal polyculture. Altogether data of the two blocks revealed that majority of farmers (37%) have two grow-out ponds. 32% farmers have one grow-out pond, 20% farmers have three grow-out ponds and 8% farmers have four grow-out ponds. Numbers of Farmer having five or more grow-out ponds are very less (1-2 %).

7.2.9 Pond area of individual farmer

Based upon the total pond area the farmers were divided into five categories, *i.e.* farmers having total Pond area of ≤ 0.5 *bigha*, > 0.5 - 1.0 *bigha*, >1.0 - 3.0 *bigha*, >3.0 - 5.0 *bigha*, and > 5.0 *bigha*. 1 *bigha* of land is equal to 0.13 ha.

Sagar Block: 10% farmers of Sagar island have total pond area of ≤ 0.5 *bigha* and 34% farmers have pond area of > 0.5 - 1.0 *bigha*. 45% farmers have total pond area of >1.0 - 3.0 *bighas* and 8% farmers have total pond area of >3.0 - 5.0 *bighas*. 5% respondents are having total pond area of > 5.0 *bighas*.

Basanti Block: 15% farmers of Basanti block have total pond area of ≤ 0.5 *bigha* whereas 25% farmers have pond area of > 0.5 - 1.0 *bigha*. 46% farmers have pond size of >1.0 - 3.0 *bighas* and 8% farmers have pond size of >3.0 - 5.0 *bighas*. 6% farmers maintained large pond area of > 5.0 *bighas.*

Overall: Data of the two blocks reveal that the majority farmers maintain total pond area of >1.0 - 3.0 *bighas*. 29% farmers have total pond area of > 0.5 - 1.0 *bigha* and 13% farmers have pond area of ≤ 0.5 *bigha*. Farmers having pond area of >3.0 - 5.0 *bigha* and > 5.0 *bighas* are very less (8% and 5% respectively).

7.2.10 Source of water

Sagar Block: 54% of respondents of Sagar island depend exclusively upon rain water for aquaculture. 36% farmers depend on rain as well as creek water whereas 7% farmers depend on rain and ground water. No farmer exclusively depends upon ground water. Equal numbers of farmers (1% in each category) use rain, ground & creek water, and creek water exclusively for aquaculture.

Basanti Block: 87% of farmers in Basanti block depend exclusively upon rain water as water source for aquaculture. 9% farmers depend on rain as well as creek water while 2% farmers depend on rain as well as ground water for their aquaculture. No farmer exclusively uses ground water for aquaculture. Like Sagar block, here also equal numbers of farmers (1% in each category) use rain, ground & creek water, and creek water exclusively for aquaculture.

Overall: The combined data of the two blocks reveal that aquaculture in two blocks is mostly rain-fed. 69% farmers use rain water for aquaculture while 24% farmers use both rain & creek water. Only 5% farmers depend on rain & ground water for aquaculture. No farmer exclusively depends on only ground water, which is environmentally good.

7.2.11 Use of pond water other than aquaculture

Sagar Block: Among the farmers of Sagar island, 7% and 11% farmers use pond water for household and irrigation purpose respectively. 10%, 14% and 32% farmers use pond water household & irrigation; household & bathing; household, irrigation & bathing respectively. 26% respondents do not use pond water for any purpose other than pisciculture.

Basanti Block: Among the farmers of Basanti Block, 5% use pond water for household purpose and 2% for irrigation. 2%, 35% and 52% farmers use pond water for multiple purpose like household & irrigation; household & bathing; household, irrigation & bathing respectively. 3% respondents do not use pond water for any purpose other than aquaculture.

Overall: Based on combined data of both the blocks, it can be concluded that majority of farmers (42%) use pond water for multiple purposes like household, irrigation & bathing; followed 24% who use for household & irrigation purpose. About 15% farmers do not use pond water for any purpose other than aquaculture.

7.2.12 Pond preparation method

Pond preparation process includes steps like dewatering, bottom soil removal, liming, manuring, de-weeding etc. to ensure that suitable environment is maintained in the pond just before the start of fish culture. Proper pond preparation allows natural fish food organisms to grow in sufficient quantity and helps in maintaining right water quality parameters.

Sagar Block: Among the respondents of Sagar Island, 39% farmers were found to follow liming, 19% practise dewatering, 16 % follow manuring, 12% remove bottom sediment, 9% do de-weeding and 5% eradicate predators.

Basanti Block: Among the respondents of Basanti Block, 4% do not follow any type of pond preparation practice. 41% farmers follow liming, 31% farmers practise dewatering, 9 % follow manuring, 7% do de-weeding, 5% remove bottom sediment and 3% eradicate predators.

Overall: The combined data of the two blocks indicates that maximum farmers (40%) practise liming before stocking fish seed. 24% farmers follow dewatering followed by manuring (13%). The less preferred steps followed by farmers are bottom sediment removal (9%), de-weeding (8%) and eradication of predator (4%). Very few farmers (2%) do not follow any type of pond preparation.

7.3 Stocking and stock management

7.3.1 Seed source

Seed is the most critical input for aquaculture. The success in aquaculture depends largely on quality seed. There is no established commercial fish / shrimp hatchery in Indian Sundarban region. For Indian major carps, the farmers depend on hatchery produced seeds which are being transported from other parts of the state. For other seed species, farmers depend on the natural wild catch from Sundarban.

Sagar Block: Among the surveyed farmers of Sagar island, 90% respondents prefer hatchery produced seed and only 2% depend upon natural seed. 8% farmers procure seed from both the sources.

Basanti Block: Among the farmers of Basanti Block, 84% respondents prefer hatchery produced seed and only 2% depend on natural seed. However, 14% farmers use seed from both the sources.

Overall: In West Bengal fish seed markets and agents play a vital role in aquaculture. The analysis of the combined data indicate that majority of the fish farmers (87%) bring seeds directly from hatcheries. Few farmers (10%) prefer seed from either source. Very few farmers (3%) use wild or natural seed.

7.3.2 Seed stocking

Sagar Block: Among the surveyed farmers of Sagar Island, 30% respondents prefer single stocking whereas 70% prefer multiple stocking.

Basanti Block: The farmers of Basanti Block follow the similar trend with 30% respondents preferring single stocking while 70% prefer multiple stocking.

Overall: The overall data indicate that maximum farmers (70%) prefer multiple stocking than single stocking.

7.3.3 Finfish stocking rate

Based on the collected information, finfish stocking rates have been grouped into seven categories such as:- up to 1000 pieces/ *bigha*, 1001-3000 pieces/ *bigha*, 3001-5000 pieces/ *bigha*, 5001-10000 pieces/ *bigha*, 10001-50000 pieces/ *bigha*, 50001-100000 pieces/ *bigha*, and above 100000 pieces/ *bigha*. Normally the farmers who stock small size seed like spawn or fry; the stocking rate is high as compared to farmers who stock fingerling. Because larger the seed size, lower is the survival rate and the vice versa.

Sagar Block: In Sagar island, 55% farmers preferred stocking rate up to 1000 pieces/ *bigha*, 25% farmers @ 1001-3000 pieces/ *bigha*, 15% farmers @ 3001-5000 pieces/ *bigha*, 3% farmers @ 5001-10000 pieces/ *bigha.* 2% farmers preferred stocking rate 10001-50000 pieces/ *bigha*.

Basanti Block: In Basanti Block, the stocking rate is quite different from Sagar island.

61% farmers preferred stocking rate of 1001-3000 pieces/ *bigha*, 17% farmers @ 3001-5000 pieces/ *bigha*. 11% farmers preferred stocking rate up to 1000 pieces/ *bigha*. 7% farmers stocked seed at the rate of 5001-10000 pieces/ *bigha*. 2% farmers preferred stocking rate of 10001-50000 pieces/ *bigha*. Equal numbers of farmers (2% in each category) were found to have stocked seed @ 50001-100000 pieces/ *bigha* and >100000 pieces/ *bigha*.

Overall: Based on the overall data, finfish stocking rate in the decreasing order of preference are presented below:

42% farmers preferred stocking rate up to 1000 pieces/ *bigha*, 34% farmers @ 1001-3000 pieces/ *bigha*, 16% farmers @ 3001-5000 pieces/ *bigha*, 5% farmers @5001-10000 pieces/ *bigha*, 2% farmers @10001-50000 pieces/ *bigha* & 50001-100000 pieces/ *bigha*, and 1% farmers @ 50001-100000 pieces / *bigha* & >100000 pieces / *bigha*.

7.3.4 Shellfish stocking rate

For the analysis, shellfish stocking rates have been categorised as follows- up to 500 pieces/ *bigha*, 501-1000 pieces/ *bigha*, 1001-3000 pieces/ *bigha*, 3001-5000 pieces/ *bigha*, 5001-10000 pieces/ *bigha*, 10001-30000 pieces/ *bigha* and 30001-40000 pieces/ *bigha*.

Sagar Block: Among the farmers of Sagar island, 28% farmers preferred stocking of shellfish at a rate of 1001-3000 pieces/ *bigha*, 21% farmer stocked at a rate of 501-1000 pieces/ *bigha*. 14% respondents preferred stocking rate of 3001-5000 pieces/ *bigha*, and 10001-30000 pieces/ *bigha*. 11% farmers stocked 5001-10000 pieces/ *bigha*. 9% farmers stocked at low density of up to 500 piece/ *bigha* only. 3% preferred high stocking rate of 30001-40000 pieces/ *bigha*.

Basanti Block: In Basanti block 44% farmers preferred low stocking rate up to 500 pieces/ *bigha*, 19% preferred 501-1000 pieces/ *bigha*. 24% farmers preferred stocking of shellfish at the rate of 1001-3000 pieces/ *bigha*, and 5% farmers stocked at the rate of 5001-10000 pieces/ *bigha*. Only 4% preferred stocking rate of 3001-5000 pieces/ *bigha* and 10001-30000 pieces/ *bigha*.

Overall: Altogether the data on stocking rate of the two blocks indicate that majority of farmers (27%) preferred low stocking rate up to 500 pieces/ *bigha*, followed by 1001-3000 pieces/ *bigha* (26%) and 501-1000 pieces/ *bigha* (20%). Small numbers of respondent preferred medium stocking rate of 3001-5000 pieces/ *bigha* (9%) and 5001-10000 pieces/ *bigha* (8%) respectively. Very small numbers of farmers (1%) preferred high stocking rate of 30001-40000 pieces/ *bigha*.

7.3.5 Cultivated fish species

There have been a total number of 19 fish species under aquaculture as reported by the

farmers during survey. Freshwater carp species being cultured are Rohu *(Labeo rohita),*Catla (*Catla catla)*, Mrigal (*Cirrhinus mrigala),*Bata *(Labeo bata),* Kalbaus *(Labeo calbasu).* Exotic fish species are Silver carp (*Hypophthalmichthys molitrix)*, Grass carp *(Ctenopharyngodon idella)*, Common carp *(Cyprinus carpio),* Bighead *(Aristichthys nobilis)*, Japani punti *(Puntius javanicus),* Pangus *(Pangasius hypothalamus)*, Rupchanda *(Pygocentrus nattereri)*, Tilapia *(Oreochromis mossambicus).*The *brackishwater* fish species are Bhetki *(Lates calcerifer)*, Parse (*Liza parsia),* Bhangan *(Liza tade)*, Chitol *(Notopterus chitala)* Tangra *(Mystus sp.)* and Pearl spot *(Etroplus suratensis)*

Sagar Block: The respondent farmers of Sagar Island, preferred freshwater carp species and preference in decreasing order are as follows - Rohu, Catla, Mrigal, Bata and Kalbaus. Exotic species widely cultured are Japani punti, Silver carp, Rupchanda, Tilapia, Common carp, Grass carp, Pangus and Bighead carp respectively. Among brackishwater species, the preferred species in decreasing order are Parse, Bhetki, Bhangan Chitol, Tangra and Pearl spot respectively.

Basanti Block: The fishes under culture system in Basanti block as per the survey are as follows- IMC - Rohu, Catla, Mrigal, Bata and Kalbaus. Widely cultured exotic species are Silver carp, Japani punti, Tilapia, Common carp, Grass carp, Bighead carp and Rupchanda. Among brackishwater species, preferred fishes are Parse, Bhetki, Bhangan Chitol, Tangra, Pearl spot respectively.

Overall: At the time of field survey it was observed that, six species of fishes having different habits and habitats mainly in the composite form were preferred for culture. Among these six species, three are major indigenous carp species (*L. rohita*, *C. catla* and *C. mrigala*) while remaining three are exotic carp species (*H. molitrix, C. idella*, and *C. carpio*). In composite fish culture, species Tilapia were widely cultured because of their high proliferation rate. During the course of survey it was found that 65% respondent farmers maintained stock manipulation properly, but remaining 35% households did not proper stock manipulation. Popular invasive fish species like Rupchanda, Pangas and bighead carp were also cultured along with carps in same pond. Among brackish water finfishes *Lates calcerifer, Liza tade, Liza parsia,* and *Etroplus suratensis* were cultured in both fresh as well as brackishwater. Among Small Indigenous Fishes (SIF's), many species were reported to be cultivated throughout the Island. These are *Amblypharyngdon mola*, *Notopterus sp*, *Puntius sarana*, *Puntius ticto*, *Cirrhinus reba*, *Nandus nandus*, *Anabas testudineus*, *Puntius chola*, *Glossogobius giuris*, *Chanda nama* etc. Besides these, air breathing catfishes and murrels are also cultured naturally in same pond. During the course of survey, it is noticed that, in Sagar Island, Rupchanda is a very popular introduced species and is widely cultured.

7.3.6 Stocking combination of finfish

Based upon survey results the following stocking combination are summarised as follows- 1.Catla, Rohu, Mrigal+ Silver carp, Grass carp, Common carp *(IMC+ Exotic Carp)*, 2. Catla, Rohu, Mrigal + Bata, Japani Punti, Kalbaus *(IMC + Medium & Minor Carp)*. 3. Catla, Rohu, Mrigal + Rupchanda, Pangus, Tilapia *(IMC + Other Exotic sp.)* 4. Catla, Rohu, Mrigal+ Silver Carp, Grass carp, Common carp, Japani Punti, Tilapia *(IMC+ Exotic Carp+ Tilapia)* 5. Bhetki, Parse, Bhangan, Chitol, Pearl spot *(Brackish water Fish)* 6. Catla, Rohu, Mrigal+Bhetki, Parse, Bhangan*(IMC+ Brackishwater fish)*

Sagar Block: Among the respondent farmers of Sagar Island, 35% farmers preferred combination of IMC and Exotic Carps with Tilapia. 26% farmers preferred combination of IMC, Medium and Minor Carp and 18% preferred combination of IMC & other Exotic species. 13% farmers preferred IMC and Exotic Carp combination only. 10% farmers were found to prefer combination of IMC & brackishwater fish. Only 1% farmers culture exclusively brackishwater fish.

Basanti Block: Among the respondent farmers of Basanti Block, 48% farmers preferred combination of IMC and Exotic Carps with Tilapia. 30% farmers preferred combination of IMC, Medium & Minor Carp and 16% preferred combination of IMC and Exotic species. 3% farmer preferred IMC and other Exotic Carp combination. 2% farmers were found to be practice combination of IMC & brackishwater fish. Only 1% farmers are cultured exclusively brackishwater fish.

Overall: Altogether data of the two blocks indicates that most preferred stocking combination is IMC and Exotic Carp with Tilapia (39%), followed by IMC, Medium & Minor Carp (28%) and IMC & Exotic species (14%). A small number of farmers (7%) cultured IMC with brackishwater fish. Culture with brackishwater fish is very negligible (1%).

7.3.7 Cultivated shellfish species

Two species are widely cultured throughout two blocks viz, Golda (*Macrobrachium rosenbergii*) and Bagda (*Penaeus monodon*).

7.3.8 Stages of finfish seed stocked

Sagar Block: Among the respondent farmers of Sagar Island, 49% farmers prefer fry stocking, 44% prefer fingerling stocking and 7% of the surveyed farmers practiced stocking with spawn.

Basanti Block: Among the respondent farmers of Basanti Block, 76% were found to stock in their ponds with fingerling, 21% farmers preferred fry stocking, and 3% preferred spawn stocking.

Overall: Data of the survey indicated that maximum (59%) farmers preferred for pond stocking fingerling (59%), followed by fry (36%) and spawn (5%).

7.3.9 Stage of shellfish seed stocked

Sagar Block: Among the respondent farmers of Sagar Island, who stocked shellfish, 58% farmer preferred Post Larva (PL) stocking and 42% preferred juveniles stocking.

Basanti Block: Shellfish stocking scenario is quite different in Basanti Block from Sagar Island. 94% preferred juveniles stocking and 6% farmer preferred Post Larva (PL) stocking.

Overall: Overall shellfish stocking choice are juveniles (71%) followed by Post Larva (PL) stocking (29%).

7.3.10 Seed disinfection

Sagar Block: Among the respondent farmers of Sagar Island, 18% farmers disinfect seed before stocking and 82% farmers did not done seed disinfection.

Basanti Block: Among the respondent farmers of Basanti Block, only 2% farmers disinfect seed before stocking and 98% farmers did not practice seed disinfection.

Overall: The overall data predicts that 10% farmers disinfect seed before stocking and 90% farmers are very much reluctant about seed disinfection.

7.3.11 Seed acclimatization

Sagar Block: Among the respondent farmers of Sagar Island, 24% farmer acclimatised seed before stocking and 76% farmers did not do seed acclimatization.

Basanti Block: Among the respondent farmers of Basanti Block, only 7% farmers acclimatised seed before stocking and 93% farmers did not do seed acclimatization.

Overall: The overall data indicated that 16% farmers acclimatized seed before stocking and 84% farmers are very much reluctant about seed acclimatization.

7.4 Feed and feeding management

7.4.1 Feeding status

Sagar Block: Among the respondent farmers of Sagar Island, 86% farmers used supplementary feed in their ponds and 14% farmers did not do any feeding and entirely depended on natural feed.

Basanti Block: In Basanti Block, 75% of surveyed farmers used supplementary feed in their ponds and 25% farmers did not use any supplementary feed.

Overall: The combined data of the two blocks indicates that 81% of respondent farmers used supplementary feed into their pond and 19% farmers continued their culture without any supplementary feed.

7.4.2 Type of supplementary feed used

During the survey of the two blocks, three types of supplementary feed materials being used by the farmers were noticed. These were rice bran & oil cake, farm made feeds and branded feed.

Sagar Block: Among the respondent farmers of Sagar Island, 62% farmers were found to prefer branded feed, 27% farmers used rice bran & oil cake and 11% farmers preferred farm made feed.

Basanti Block: The feeding practices noticed in Basanti Block are quite different from Sagar Island. 83% respondent farmers used rice bran & oil cake and 13% farmers preferred farm made feed, and 4% respondent farmers preferred branded feed

Over all Among the feed used, the combination of rice bran and oil cake were most preferable (51%) because of its easy availability and nutritional quality. Moderate number (12%) of farmers preferred farm made feed, especially those who followed polyculture of carps and fresh water prawns. The farm made feed supplements mainly comprised mixture of rice or wheat bran husk, poultry litter along with dry fish. Farmers are culturing prawn monoculture preferred branded feed (37%). Besides feed, farmers used different types of organic and inorganic fertilizers to promote the growth of natural food organisms. Applications of organic fertilizers like cow dung and poultry litter were most common. The inorganic fertilizers like urea and super phosphate were used by the farmers to augment primary productivity.

7.4.3 Frequency of feeding

Sagar Block: Among the respondent farmers of Sagar Island, 38% farmers were found to feed daily, 29% farmers gave feed once per week and 18% farmers fed the fish twice per week. 9% respondents gave feed four times per week and 5% of respondents were found to feed thrice per week. Only 1% among farmers gave feed five times per week.

Basanti Block: Among the respondent farmers of Sagar Island, 39% farmers gave feed once per week, 30% farmers gave twice per week and 16% farmers were found to feed the fishes thrice per week. 13% respondent gives feed daily and 2% respondent gives feed four times per week.

Overall : Altogether feeding frequency data of two blocks predicts that 33% farmers preferred to give feed once per week followed by 27% respondents giving feed daily and 23% farmers preferring to give feed twice per week. 10% farmers used to give feed thrice in a week and 6% respondents fed four times the fishes per week.

7.4.4 Nature of feeding

Sagar Block : Among the respondent farmers of Sagar Island 83% farmer use broadcasting method feeding 6% farmers preferred bag feeding and only 1% farmers used tray for feeding 7% famers were found to prefer broadcasting & tray feeding together and 3% respondents reported to use broadcasting & bag feeding in combination.

Basanti Block: 82% farmers of Basanti Block preferred broadcasting method, 8% farmers preferred bag feeding & broadcasting respectively. 2% farmers were noticed to be using both broadcasting ~~as~~ & tray feeding methods.

Overall: Over all data of the two blocks indicate that the main methods of feeding was the broadcasting (83%) followed by a unique technique for feeding mainly of carps known as "bag feeding" (7%). In this empty polythene or jute bags are usually used and at the bottom of these bags, 2-3 rows of perforations are made. The bags hold 15-20kg of feedstuff. The feed mixtures are placed into these bags and then immersed into pond through bamboo poles erected of various locations inside the pond (Abraham *et. al.,* 2010). Through the bag feeding method, the farmers were able to save feed and measure the quantum of feed consumed. Trey feeding was widely used at shrimp farms that have adapted scientific shrimp farming but are very minimal (1%). Few farmers are also found to have adopted to broadcasting & bag feeding and broadcasting & tray feeding (5%).

7.5 Disease and health management

7.5.1 Common occurrence of diseases in finfish

Sagar Block: Among the respondents of Sagar Island, the fish farms of 55% farmers are not affected by diseases. The pattern of diseases and affected rate of farmers are- 17% Body Ulcer (EUS), 7% fin & tail rot, 1% fish lice- *Argulus,* 8% mal-nutrition only. 5% EUS, fin & tail rot; 2%EUS, fish lice; 2%EUS, mal-nutrition; 2% fin & tail rot, fish lice; 2% fin & tail rot, mal-nutrition ;1% fish lice, mal-nutrition; 1% EUS, Fin & tail rot, fish lice.

Basanti Block: Among the respondents of Basanti Block, the farms of 22% farmers were found to be not affected by any kind of diseases. The pattern of diseases and affected rate of farmers are- 21% Body Ulcer-EUS, 19% fin & tail rot, 1% fish lice- *Argulus,* 3% mal-nutrition only. 7% EUS, fin & tail rot; 3% EUS, fish lice; 8% EUS, mal-nutrition; 1% fin & tail rot, fish lice; 5% fin & tail rot, mal-nutrition; and 1% EUS, fin & tail rot, fish lice, mal-nutrition.

Overall: Based upon interview that was conducted in two blocks, the reported finfish diseases are Epizootic Ulcerative Syndrome (EUS) outbreak, Fin & tail rot, Fish lice- *Argulus* and Mal-nutrition leading to poor growth with large head and slender body.

7.5.2 Seasonal occurrence of finfish diseases

Sagar Block : Based upon interview that was conducted in Sagar Island, the farms of 67% farmers got affected by disease in winter, where as the farms of 19% farmers in monsoon and 2% farmers were affected by disease in summer. However, 1% farmers reported to have encountered dieseas both in summer & monsoon; 2% farmers were affected in summer & winter, whereas, 9% farmers were affected both in monsoon and winter.

Basanti Block: Among the farmers of Basanti Block, the farms of 58% farmers were reported the occurance of disease in winter, whereas, 5% farmers in monsoon and 20% farmers got affected by diseases in summer. 12% farmers were affected in summer & winter and 5% farmers were affected both in monsoon & winter.

Overall: The combined data of the two blocks revealed that the seasonal occurrence of diseases are maximum in winter (62%) followed by summer (12%) and monsoon (11%). occurrences of disease both in summer & winter (8%), and monsoon & winter (7%) were also reported. No seasonal occurrences of disease were found in summer & monsoon and summer, monsoon & winter combined.

7.5.3 Occurrence of disease in growth phase

Sagar Block: Among the respondent of Sagar Island, 86% farms got affected by diseases in their mid crop phase, 8% farms affected diseases in their mid & end crop phase. 4% farms got affected by diseases ~~in~~ just after stocking and 2% farm were found to be affected by diseases in their & after stocking & mid crop phase. No occurrences of disease were reported in during end crop and all crop phases.

Basanti Block: Among the respondents of Basanti Block, the farms of 73% farmers were affected by diseases in their mid crop phases and 15% farmers encountered diseases in their farms during mid & end crop phases. Farms of 10% farmers were affected by diseases in their end crop phases and farms of 2% farmers were affected by diseases during just after stocking phases. Farms of 4% farmers got affected by diseases after stocking.

Overall: Altogether data of the two blocks reveal that occurrence of disease in is maximum during mid crop phase (78%) followed by mid & end crop phase (12%). Few farmers (6%) encountered diseases in end crop and just after stocking (3%).

7.5.4 Common occurrence of diseases in shell fish

Sagar Block: Among the respondents, 55% farmer's farms are not affected by shellfish diseases**.** The pattern of diseases and affected rate of farmers are- 11% blackening of gill, 17% black lesion on shell & fail,3% white spot virus and 3%, fungus outgrowth on shell only. 4% blackening of gill & black lesion on shell & tail; 3% white spot virus & blackening of gill, white spot virus & Fungus outgrowth on shell respectively. 1% white spot virus & Black lesion on shell & tail, blackening of gill & Fungus outgrowth on shell respectively.

Basanti Block: Among the respondents, 17% farmer's farms were not affected by shellfish diseases**.** The pattern of diseases and affected rate of farmers are- 17% blackening of gill, 33% black lesion on shell & tail,10% white spot virus and 14%, Fungus outgrowth on shell only. 4% blackening of gill & Black lesion on shell & tail and white spot virus & blackening of gill respectively; 1% white spot virus & Fungus outgrowth on shell respectively. 1% white spot virus & Black lesion on shell & tail, blackening of gill & Fungus outgrowth on shell respectively.

Overall : Based upon interview that was conducted in two blocks, the major reported shellfish diseases are found to be white spot virus, blackening of gill, black lesion on shell & tail and fungus outgrowth on shell.

7.5.5 Seasonal occurrence of shellfish diseases

Sagar Block: 65% farms were affected by diseases during winter, 26% farms during monsoon and 2% farms during summer. 2% farms summer. However 2% farms were affected both in summer & winter and 5% farms were affected both in monsoon & winter.

Basanti Block: In Basanti Block, 49% farms were affected by diseases during winter, 11% farms in monsoon and 26% farms were affected by disease in summer. 8% farmers also reported to have affected by diseases both in summer & winter; 4% farms were found to be affected during monsoon & winter; and both in 2% farms during summer & monsoon.

Overall : Survey data indicated that irrespective of blocks, the seasonal occurrence of disease was maximum during winter (53%) followed by summer (20%) and monsoon (15%). occurrences of disease with in summer & winter (7%), and both monsoon & winter (4%) and summer & monsoon(1%) were also reported by the farmers during interview.

7.5.6 Occurrence of disease in growth phase

Sagar Block: 74% farms were affected by diseases during mid crop phase, 11% during end crop phase, 5% farms during mid & end crop phase. 4% farms affected diseases during after stocking and after stocking & mid crop phase respectively.

Basanti Block : 58% farmers encountered diseases in mid crop phase, 25% in end crop phase, 10% in both mid & end crop phase and 3% farmers encountered diseases in their farms after stocking phase and after stocking & mid crop phase respectively.

Overall: Survey data revealed that irrespective of blocks, occurrence of disease was maximum in mid crop phase (62%) followed by end crop (22%) phases and mid & end crop phase (9%). Few farmers also encountered diseases during just after stocking (3%) and after stocking & mid-crop phases (3%).

7.5.7 Treatments against disease

Sagar Block: Among the respondent of Sagar block, 99% farmers were found to take prophylactic measures against diseases.

Basanti Block: Among the respondents of Basanti block, 67% farmers reported to take up prophylactic measures, where as 33% farmers were not taking any measures against diseases.

Overall: The overall data indicate that irrespective of blocks, 80% of the interviewed farmers practice treatment against diseases and rest 20% farmers do not taken any measure against diseases.

7.5.8 Nature of treatment

Sagar Block : Among the respondents, 67% farmers preferred liming as a treatment against diseases, followed by liming & water exchange (14%), and liming & chemical application (11%). 4% famers used only antibiotics as protective measures against diseases. About 3% farmers preferred liming, water exchange & chemical application in case of disease attack.

Basanti Block: In Basanti block, farmers to some extent were reluctant towards disease treatment. Among those serious farmers, 84% preferred liming, 11% both lime and chemicals together and 2% preferred only chemicals.

Overall: The data analysis of two blocks indicates that liming is the most preferable choice (76%) in case of disease attack and followed by lime and chemicals conjugated (11%) and liming and water exchange (8%). Very few farmers (2%) preferred antibiotics and chemical application exclusively.

7.6 Harvesting and marketing

7.6.1 Mode of harvesting

Sagar Block: Among the respondent of Sagar block, 60% farmers preferred single harvesting and rest 40% preferred multiple harvesting.

Basanti Block: In Basanti block, the scenario is quite reverse. 37% farmers preferred single harvesting and rest 63% preferred multiple harvesting.

Overall: Irrespective of block, the survey data revealed that altogether 51% farmers preferred multiple stocking and 49% preferred single stocking.

7.6.2 Mode of marketing

Sagar Block: Among the respondents of Sagar block, 71% farmers preferred to sale their product directly in local market and 11% farmers preferred to sale at the harvesting site itself. 8% farmers sold at local market through middle man or agent. About 3% farmers preferred to sell fish both at harvesting site and a part at local market also.

Basanti Block : Among the respondent of Basanti block, 91% farmers preferred to sale their fish directly in local market and only , 4% farmers preferred to sale their product at the harvesting site itself. 2% farmers preferred to sell at local market through middle man or agent. About 2% from the total respondent preferred to sale their crop both at harvesting site and through middle man or agent.

Overall : The combined survey data reveals that, the direct marketing in the local market is the most preferred (80%) mode of marketing followed by the sale at harvesting site (6%), local market through middle man (5%), directly to middle man (4%), through middleman from the harvesting site (3%) and both at harvesting site and local market (2%).

7.7 Productivity

7.7.1 Total finfish production (Kg/*bigha*)

Based on total finfish production, farmers' were categories into six groups viz., a) < 70 Kg / *bigha* b) 70 - 100 Kg / *bigha* c) 101 - 200 Kg / *bigha* d) 201 - 300 Kg / *bigha* e) 301 - 400 Kg/ *bigha* and f) > 400 Kg/ *bigha*.

Sagar Block : As reported by the farmers of Sagar block 43% of them produced fish @ 101 - 200 Kg / *bigha*; 17% @ 201 - 300 Kg / *bigha*; 16% farmers produced fish @ > 400 Kg/ *bigha*; 14% @ 70 - 100 Kg / *bigha*; and 5% @ < 70 Kg / *bigha* & 301 - 400 Kg/ *bigha* respectively.

Basanti Block: Among the respondents of Basanti block, 64% farmers produced fish @ 101 - 200 Kg / *bigha* ; 24% @ 70 - 100 Kg / *bigha*; 7% @ 201 - 300 Kg / *bigha* ; 3% @ < 70 Kg / *bigha* and 1% farmers produced fish @ > 400 Kg/ *bigha* ; 301 - 400 Kg/ *bigha* respectively.

Overall: Irrespective of blocks the survey data revealed that, finfish productivity as per orderwise is as following 101 - 200 Kg / *bigha* (53%) followed by 70 - 100 Kg / *bigha* (19%), 201 - 300 Kg / *bigha* (12%), > 400 Kg/ *bigha* (9%), < 70 Kg / *bigha* (4%) and 301 - 400 Kg// *bigha* (3%).

7.7.2 Total shellfish production (Kg/ *bigha*)

Based on total shellfish production, farmers' were categorized as a) having a production of < 20 Kg/ *bigha* b) 20 - 50 Kg/ *bigha* c) 51 - 100 Kg/ *bigha* d) 101 - 200 Kg/ *bigha*

Sagar Block: Among the respondents of Sagar block, 36% farmers reported a production of 20 - 50 Kg / *bigha*; 32% farmers produced @ 51 - 100 Kg / *bigha*; 26% farmers @ > 101-200Kg/ *bigha* and; 6% farmers produced @ < 20 Kg/ *bigha*.

Basanti Block: In Basanti block, 62% farmers achieved to produced 20 - 50 Kg / *bigha*; 36% farmers produced @ < 20 Kg/ *bigha*. 1% farmers produced @ 51 - 100 Kg / *bigha* and @ 101-200Kg/ *bigha* respectively.

Overall: The combined data of the two blocks revealed that, 52% farmers produced 20 - 50 Kg/ *bigha* whereas 25% could get production of below 20 kg/ *bigha*, 13% between 51-100 Kg/ *bigha* and 10% could get production between 101 - 200 kg/ *bigha*.

7.8 Water quality monitoring

7.8.1 Water pH measurement

Sagar Block: Among the respondent, 47% farmers measured pond water pH and rest 53% farmers did not measure water pH.

Basanti Block: In Basanti blocks 71% of the farmers measured pond water pH and rest 29% farmers did not measure water pH.

Overall: Irrespective of blocks, 42% farmers were found to measure pond water pH and rest 58% farmers did not measure water pH.

7.8.2 pH range

Based on pH values collected from the farmers, water pH range are categorized viz., a) pH range < 7.5 b) pH range 7.5 - 8.5 and c) pH range > 8.5

Sagar Block : The ponds of 58% farmers were in the pH range of 7.5 - 8.5, 33% farmers were having pond pH range above 8.5 and rest 9% belong to pH range < 7.5 category.

Basanti Block : 40% farmers were having ponds within the pH range to 7.5 - 8.5, 34% farmers were having pond pH range above 8.5 and rest 26% belong to pH range < 7.5 category.

Overall: After the analysis of pH values it is predicted that normal pH range *i.e.,* 7.5 - 8.5 were noticed in maximum ponds (48%), followed by above 8.5 (33%) and < 7.5 (19%).

7.8.3 Water salinity measurement

Sagar Block: Among the respondents, 40% farmers measured pond water salinity and rest 60% farmers did not measure water salinity.

Basanti Block: 37% farmers measured pond water salinity and rest 63% farmers did not measured pond water salinity.

Overall: Irrespective of block, overall data indicate that 39% farmers measured pond water salinity and the rest (61%) farmers did not measure water salinity.

7.8.4 Water salinity range

Based on water salinity value collected from the farmers, water salinity range is categorized viz., a) 0 ppt b) < 2 ppt c) 2-5 ppt and > 5 ppt

Sagar Block: 40% farmers reported to have the pond salinity of 2 ppt, where as 14% farmers having pond salinity range between 2 to 5 ppt and 4% farmers were having salinity of more than 5 ppt in their freshwater ponds. 42% farmers having 0 ppt salinity in their pond.

Basanti Block : Similarly in Basanti Blocks 36% farmers having pond salinity of 2 ppt, whereas 30% farmers were having pond salinity range between 2 to 5 ppt and 7% farmers having salinity of more than 5 ppt in their freshwater ponds. 27% farmers having 0 ppt salinity in their ponds

Overall: overall observed salinity data predicted that majority (38%) of ponds were having salinity of 2 ppt, 21% between salinity of 2 & 5 ppt and above 5% farm head salinity of above 5 ppt. 36% farms were of fresh water with no salinity.

7.9 Climate change impact on aquaculture

7.9. 1 Pre cyclonic *(Aila)* culture scenario

All attributes of pre cyclonic culture practices are collected on the basis of farmers' opinion. The major characters are high stocking density, presence of few species of fishes, freshwater pond, no water quality problem in freshwater ponds, disease less culture, better growth, and good pond dyke condition.

Sagar Block: In farmers' opinion common prevailing aquaculture characters during pre *Aila* were *high stocking density* (22%), *presence of few species of fishes* (13%), *Normal pond environment* (13%), better *growth* (9%), *freshwater* (7%) and *good pond dyke condition* (7%).

Basanti Block: According to the opinion of the fairness during Pre-*Aila period* common aquaculture characters were like *freshwater pond* (26%), *high stocking density* (26%), *good pond dyke condition* (19%), *presence of few species of fishes* (12%), *Normal pond environment* (6%) and better *growth* (5%).

Overall: On the basis of farmers' opinion of the two blocks, the most common, pre cyclonic (*Aila)* culture practices have been high stocking density; freshwater pond; good pond dyke condition; presence of few species of fishes; normal pond environment;, no water quality problem in freshwater pond, better growth; less damage; and disease less culture (ranked from first to ninth in declining order respectively.)

7.9.2 Post cyclonic (*Aila*) effect in aquaculture

The attributes of post cyclonic scenario have been finalised on the basis of survey conducted among farmers'. The major issue reported by the farmers after cyclone are escape of fish; ingression of saline water into pond ; entry of various other species of fish; breach of pond dyke; loss/damage of pond environment ; mortality of fish ; retardation of growth *etc.*

Sagar Block: Among the respondents, 5% were not affected by cyclone. In Sagar Block, the major and common post cyclonic effect like *escape of fish* (20%) are ranked first, *breach of pond dyke* (11%) ranked second, *loss/damage of water quality and pond environment* (11%) ranked third, *ingression of saline water into pond* (8%) ranked fourth, *entry of various other species of fish* (6%) ranked fifth, and *mortality of fish* (4%) ranked sixth.

Basanti block: Among the respondents 21% were not affected by cyclone. In Basanti block, major post cyclonic effect on aquaculture have been *escape of fish* (19%), *ingression of saline water into pond* (19%), *breach of pond dyke* (14%), entry *of various other species of fish* (10%), *loss/damage of water quality and pond environment* (5%), *mortality of fish* (4%). The figure 7.9.2b is showing all post cyclonic effect on culture practice.

Overall: In the basis of farmers' opinion, the overall major post cyclonic (*aila*) effect on culture practices rank have been as escape of fish (rank 1); ingression of saline water into pond (rank 2); entry of various other species of fish (rank 3); breach of pond dyke (rank 4) ; growth retardation (rank 5); and mass mortality of fishes (rank 6).

7.9.3 Major problems due to cyclone

Sagar Block: Based on the farmer opinion regarding the major problems faced by them, the problems have been ranked. Accordingly, the maximum number (34%) of farmers reported the breach of pond dyke as a major problem during cyclone hence rank as first followed by ingression of saline water into pond (34%) ranked second, escape of fish stock from pond (23%) ranked third and entry of other (unwanted) fish species (9%) ranked fourth.

Basanti Block: Basanti block encountered similar problems like breach of pond dyke (33%) which ranked first followed by, ingression of saline water into pond (30%) ranked second, escape of fish stock from the pond (28%) ranked third and entry of other (unwanted) fish species (9%) ranked fourth.

Overall: Islands of Sundarban are vulnerable to climate change impacts like sea level rise, soil erosion, saline water inundation as well as extreme climatic events like cyclones, storm and tidal surges. These events bring about following changes in aquaculture scenario of the region.

- ❖ Breach of pond dyke due to storm /tidal surge will cause ingression of saline water into the freshwater ponds, thus affecting the productivity of the region.
- ❖ Potential shifts in tidal patterns and salinity regimes may have implications on brackish water aquaculture prevailing in this region.
- ❖ In the changed situation, the salination of land and water in the inhabited areas of Sundarban may bring more areas under brackish water aquaculture decreasing area for agriculture, thus offering an opportunity for aquaculture to capitalize on the changes posed by climate change.

7.9.4 Coping measures taken by farmers against cyclone

Farmers have taken coping measures as a protection against cyclonic events which are as follows- application of lime, addition of fresh/rain water, addition of fresh/rain water into pond, application of chemicals/fertilizers, dewatering, repair of pond dyke with earth/polythene, addition of tree branches in the pond for fish aggregation, increase of pond dyke height to prevent entry of saline water, plantation on pond dyke, and application of cow dung for saline water treatment *etc.*

Sagar block: Among the respondents about 9% could not take any coping measures against cyclonic events., Major coping measures to battle against cyclones taken up by the farmers of sagar block have been ranked and accordingly increase of *pond dyke*

height to prevent entry of saline water (26%) ranked first, *repair of pond dyke with earth/polythene* (20%) ranked second, *plantation in pond dyke* (14%) ranked third, *application of lime after saline water ingression* (10%) ranked fourth, addition *of fresh water in case of saline water inundation and dewatering* (7%) ranked fifth and *application of chemicals and fertilizers after saline water inundation* (5%) ranked sixth.

Basanti Block: Among the respondents about 18% could not take any coping measures against cyclonic events. In farmers' opinion of Basanti block, major coping measures taken up against cyclones are *repair of pond dyke with earth/polythene* (35%) ranked first, *dewatering* (19%) ranked second, *increase of pond dyke height to prevent entry of saline water* (12%) ranked third, *addition of fresh water in case of saline water inundation* (5%) ranked fourth, *plantation in pond dyke* (5%) ranked fifth and *application of chemicals and fertilizers after saline water inundation* (4%) ranked sixth.

Overall: Cyclonic and climatic adverse events are major problems faced by aqua farmers in the two blocks. Farmers have naturally adapted to various mode of strategies to cope up with the climatic events and try to sustain their production. The nature of coping measures to minimize the cyclonic effects are repair of pond dyke with earth/polythene, increase of pond dyke height to prevent entry of saline water, addition of fresh water in case of saline water inundation and dewatering, plantation in pond periphery for strengthening pond dyke, application of lime *etc*. These are the maximum action taken by farmers.

7.9.5 Biogenic changes observed in fish due to climate change

Climate change has adverse effect in regional fish ecobiology in particular and aquaculture in general. Various biogenic changes have been reported by farmers' during their observations during last thirty years.

Sagar Block: According to the farmers opinion of Sagar block, following changes have been observed in fish with climate change. Among these, *survival of freshwater fish in low saline water* (25%) ranked first, *survival of brackishwater fish & shell fish in fresh water* (24%) ranked second, *reduction in fish growth* (20%) ranked third, *emerging disease occurrence* (13%) ranked fourth and *irregularity of egg laying & spawning capacity* (12%) ranked fifth. The figure below show as the changes noticed in fish with changing climate.

Basanti Block: Similar changes are noticed in Basanti block, but percentages of opinions varied. Among these, *survival of freshwater fish in low saline water* ranked first (47%), *survival of brackishwater fish & shell fish in fresh water* ranked second (46%), *reduction in fish growth* ranked third (3%), *emerging disease occurrence* are ranked fourth (1%) and *irregularity of egg laying & spawning capacity* (1%) are ranked fifth.

Overall: Irrespective of blocks, regional ecobiological changes in fishes noticed during last thirty years are like survival of freshwater fish in low saline water; survival of brackishwater fish & shell fish in fresh water; reduction in fish growth; emerging disease occurrence; and irregularity of egg laying & spawning capacity.

7.9.6: Farmers view on frequency of cyclone

Sagar Block: Among the respondents, 80% farmers told that the frequency of cyclones has increased during last twenty years. However, few (17%) farmers also told that frequency of cyclones decreased in last twenty years. Only 3% farmers opined that frequency of cyclone has been consistent in last twenty years.

Basanti Block : Among the respondents, 96% farmers told that the frequency of cyclones have increased during last twenty years, and 3% farmers told that the frequency of cyclones have decreased during last twenty years. Only 1% farmers viewed that frequency of cyclone has been consistent over last twenty years.

Overall : The combined data of the two blocks indicates that 87% respondent viewed about increasing tendency of cyclone in last twenty years and 11% expressed about viewed a decreasing tendency of cyclone in last twenty years. Rest 3% respondents viewed about consistent nature of cyclone in last twenty years.

7.10 Environmental threats to Sundarban Biome

Sundarban mangrove ecosystem is under threat today. Quantum of problems and challenges are working together to push this very fragile ecosystems on the verge of death. As important reservoirs of species of plants and animals, bound together over a long evolutionary time, mangrove ecosystem is still imperfectly known and understood. At the land sea interface these intertidal wetlands, a basic life sustaining ecosystem are 'very fragile and being marginal'. Anticipated threats to this ecosystem will be analyzed and measures to be undertaken for its conservation, fruitful utilization and sustained use, are to be framed to protect Indian Sundarban.

7.10.1 Farmers view on climate change impact on Sundarban

As per the on farmers opinion the following are the anticipated impact of climate change over Sundarban irregularities in season change, rises in temperature & hot summer, erratic monsoon / low rainfall, more cyclone & heavy downpour during cyclone, shortening of monsoon & winter period, increase in river salinity, loss in agriculture, aquaculture and animal husbandry, flood, drought, pH fluctuation in pond, loss of land due to erosion, loss of mangrove & wild life, migration of people and increase in human diseases.

Sagar Block: As per the opinion of the farmers' of Sagar Block, major impact of climate change over Sundarban have been ranked and accordingly *rises in temperature & hot summer* (27%) ranked first, *irregularities in season change* are (25%) ranked second, *erratic monsoon / low rainfall* (13%) ranked third, *loss of mangrove & wild life* (10%)

ranked fourth, *more cyclone & heavy downpour during cyclone* (6%) ranked fifth, *shortening of monsoon & winter period* (5%) ranked sixth, *loss in agriculture, aquaculture and animal husbandry* (4%) ranked seventh, and *loss of land due to erosion* (4%) ranked eighth.

Basanti Block: On the basis of farmers opinion of Sagar Block, major impact of climate change over Sundarban are *rise in temperature & hot summer* (42%) ranked first, *irregularities in season change* are (16%) ranked second, *erratic monsoon / low rainfall* (14%) ranked third, *more cyclone & heavy downpour during cyclone* (12%) ranked fourth, *flood* (4%) ranked fifth, *drought* (3%) ranked sixth, *shortening of monsoon & winter period* (3%) ranked seventh.

Overall: During interview almost all the farmers complained about extreme and extended summers, short winters, and erratic monsoons. The main contributing factors of atmospheric changes have been found to be ambient temperature change over land and change in rainfall pattern. Almost all of those interviewed agreed that rainfall has decreased during a certain phase of season, and pattern of rainfall has changed, making conventional cultivation of crops difficult for aqua farmers. While rising sea levels raise the threat of the sea inundating valuable farmland, the erosion reduces landholdings physically, leading to loss of livelihood and food security. Due to anthropogenic pressure and migration from other island, mangroves are reclaimed for human settlement and as well as destruction of wild habitat.

7.10.2 Farmers view on environmental impact on wild shrimp seed catch

Another major problem of the mangrove ecosystem and adjoining riverine system is the mass collection of wild prawn seeds. This destroys numerous quantum of benthic animals like fish larvae, eggs, plankton and others fauna which maintain the critical food chain and food web. The farmers categorised the possible impact of wild shrimp seed catch like loss of riverine ecosystem & biodiversity; killing of seed of miscellaneous shellfish and finfish; strong Govt. rule to stop shrimp seed catch; air pollution due to bad odour by dead seeds thrown on the dyke; damage of river bund due to constant shrimp seed catching activitie and destruction of mangrove seedlings.

Sagar Block: In farmers' opinion of Sagar Block, the major affect of wild shrimp seed catches are like *killing of seed of miscellaneous shellfish and finfish* (52%) ranked first, *loss of riverine ecosystem & biodiversity* (33%) ranked second, *strong Govt. rule to stop shrimp seed catch* (9%) ranked third, *air pollution due to bad odour by dead seeds thrown on the dyke* (2%) ranked fourth, *destruction of mangrove seedlings* (2%) ranked fifth and *damage of river bund due to constant shrimp seed catching activities* (2%) ranked sixth.

Basanti Block: In Sagar Block, major problem due to wild shrimp seed catches are like *killing of seed of miscellaneous shellfish and finfish* (47%) ranked first, *damage of river bund due to constant shrimp seed catching activities* (19%) ranked second, *loss of riverine ecosystem & biodiversity* (16%) ranked third, *destruction of mangrove*

seedlings (13%) ranked fourth, *strong Govt. rule to stop shrimp seed catch* (4%) ranked fifth and *air pollution due to bad odour by dead seeds thrown on the dyke* (1%) ranked sixth.

7.10.3 Farmers view on fish species under threat

Based on survey, some regional fish species, whose population are drastically reducing since last thirty years have been listed. These fishes are Pabda (*Ompok pabda),* Boal (*Wallago attu),* Catfishes- Singi (*Heteropneustes fossilis*), Magur (*Clarias batrachus*), Koi (*Anabas testudineus*), Bele (*Glossogobius sp.),* Nuna Bele (*G.giuris)* Ban (*Anguilla bengalensis*), Mourala (*Amblypharyngodon mola),* Kholse (*Colisa fasciata)*, Chitol (*Chitala chitala),* Pholui (*Notopterus notopterus),* Sutafuli Tangra (*M.vittatus),* Akash Tengra (*Mystus guilo*) , Murrels- Sall (*C.marulius*), Soll (*C.striata*), Lata *(Channa Punctata)*, Cheng (*Channa gachua*) , Pakal *(Mastacembelus armatus/ Macrognathus pancalus),* Saral Punti (*Puntius sarana),* Tint Punti (*Ticto ticto*) Chanda *(Chanda nama),* Nadosh (*Nandus nandus) etc.* Blockwise threat ranking of these fish species are represented as follows-

Table7.10.3: Regional fish showing low population density in last 30 years based on farmer opinion

Sagar		Basanti	
Name of Fish	**Threat Rank**	**Name of Fish**	**Threat Rank**
Chang (*Channa gachua*)	**I**	Nadosh (*Nandus nandus)*	**I**
Boal (*Wallago attu)*	**II**	Boal (*Wallago attu)*	**II**
Catfishes (*Clarias batrachus, Heteropneustes fossilis*)	**III**	Murrel *(Channa marulius, C.striata, C. punctata*	**III**
Saral Punti (*Puntius sarana)*	**IV**	Koi (*Anabas testudineus*)	**IV**
Pabda (*Ompok pabda)*	**V**	Chang (*Channa gachua*)	**V**
Murrel *(Channa marulius, C.striata, C. punctata)*	**VI**	Ban(*Anguilla bengalensis*)	**VI**
Nadosh (*Nandus nandus)*	**VII**	Chanda *(Chanda nama)*	**VII**
Ban (*Anguilla bengalensis*)	**VIII**	Catfishes (*Clarias batrachus, Heteropneustes fossilis*)	**VIII**
Koi (*Anabas testudineus*)	**IX**	Saral Punti (*Puntius sarana)*	**IX**
Mourala (*Amblypharyngodon mola)*	**X**	Kholse(*Colisa fasciata)*	**X**

7.10.4 Farmers view on exotic fish species introduced in locality

Sagar Block: As per the respondents view on exotic species, the first three fish species widely cultured throughout the Sagar block are Rupchanda (51%), Hybrid magur (40%) and Pangus (4%) respectively.

Basanti Block: Basanti block showed the similar trends on exotic species like Sagar block. The cultured exotic fishes are Rupchanda (49%), Hybrid magur (23%) and Pangus (17%).

Overall: Some exotic fish species which were recorded during survey period have been found to be cultured throughout the islands. These fish species are profitable to the farmers but in some cases it alters the environment of other indigenous fish species. These fish species are- Rupchanda (*Pygocentrus nattereri),* Hybrid Magur (*Clarias gariepinus*), Bighead Carp (*Aristichthys nobilis*), Golden Carp (Cyprinus sp), Pangus (*Pangasius sutchi*), Nilotica (*Oreochromis niloticus*), Silver Carp (*Hypophthalmichthys molitrix*) and Grass Carp (*Ctenopharyngodon idella*).

7.10.5 Farmers view on natural breeding status of Murrels, Catfishes and SIS

Very interesting facts have come out from farmer opinion which is the main causes for natural breeding reduction and species destruction. Among the fish groups, catfishes include *Clarias batrachus, Heteropneustes fossilis, and Anabas testudineus.* Murrels includes *Channa marulius, Channa striatus, and Channa punctatus.* SIS includes *Ticto ticto, Puntius puntius, and Amblypharyngodon mola.*

Sagar Block: Most respondents agreed that natural breeding status is very poor at present and show a reducing trend during last thirty years. Majority of farmers of Sagar block complained about breeding habitat destruction (32%). The second ranking problem is the huge application of chemicals and pesticides in paddy fields which lowers the natural breeding activity (27%). The third ranking problem focused by farmers is inadequate water availability in low lying area and paddy field & due to crop rotation (19%). In the fourth problem, farmers complained against climate change as a cause for natural breeding reduction and species destruction (10%). The fifth and sixth ranked problems are diseases and anthropogenic stress respectively which lowers the fish population drastically.

Basanti Block: in Basanti block also, farmers were found to be worried about very poor natural breeding trend in last three decades. Majority of farmers complained about breeding habitat destruction as a first ranked problem (44%). The second ranking problem is the huge application of chemicals and pesticides in paddy fields (31%). The third ranking problem focused by farmers is inadequate water availability in low lying area and paddy field & due to crop rotation (13%). In the fourth problem, farmers complained against climate change as a cause for natural breeding reduction and species destruction (9%). The fifth and sixth ranked problems are diseases and anthropogenic stresses respectively which lowers the fish population drastically.

7B. GRAPHICAL ANALYSIS

7.1: Socio economic profile

Table 7.1.1 CASTE WISE DISTRIBUTION OF FARMERS (n = 451)

No. of respondent farmers →	Sagar	Basanti	Overall
General	144	39	183
SC	52	104	156
ST	1	15	16
OBC	25	10	35
Muslim	22	39	61
TOTAL	244	207	451

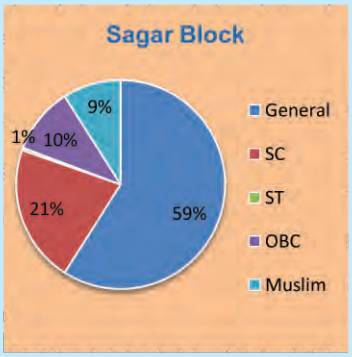


Fig 7.1.1a: Caste distribution of Farmers (Sagar Block)

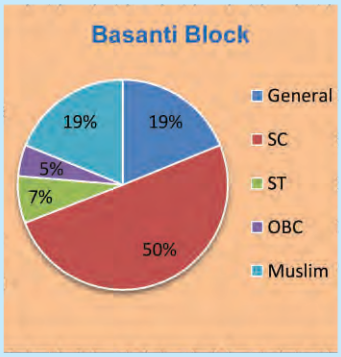


Fig 7.1.1b: Caste distribution of Farmers (Basanti Block)

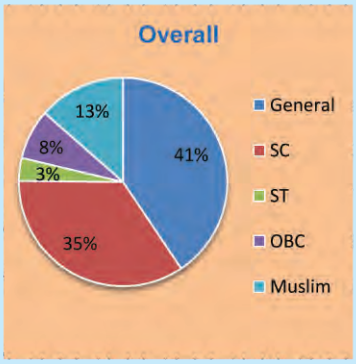


Fig 7.1.1c: Caste distribution of Farmers (overall)

Table 7.1.2 EDUCATIONAL STATUS OF FARMERS (n = 451)

No. of respondent farmers →	Sagar	Basanti	Overall
Illiterate	24	11	35
Literate - I - V	30	25	55
Literate - VI - IX	91	79	170
Literate - Madhyamik	43	47	90
Literate - H.S.	31	20	51
Literate - Graduate	22	22	44
Literate - P.G.	3	3	6
TOTAL	244	207	451

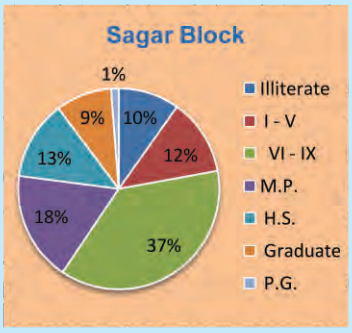


Fig 7.1.2a: Educational status of Farmers (Sagar Block)

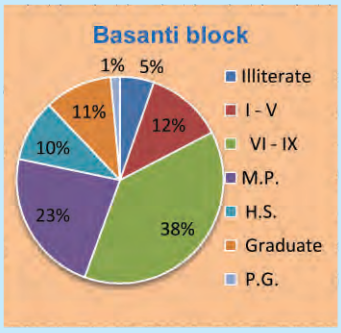


Fig 7.1.2b: Educational status of Farmers (Basanti Block)

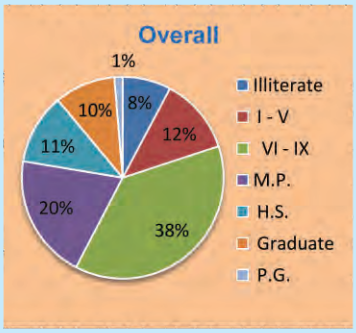


Fig 7.1.2c: Educational status of Farmers (overall)

Table 7.1.3 FAMILY INCOME STATUS OF FARMERS (n = 451)

No. of respondent farmers →	Sagar	Basanti	Overall
Low Income (Annual Income below Rs. 50,000/-)	137	173	310
Medium Income Group (Annual Income Rs. 50,000-1,00,000/-)	79	29	108
High Income Group (Annual Income above Rs. 1,00,000/-)	28	5	33
TOTAL	244	207	451

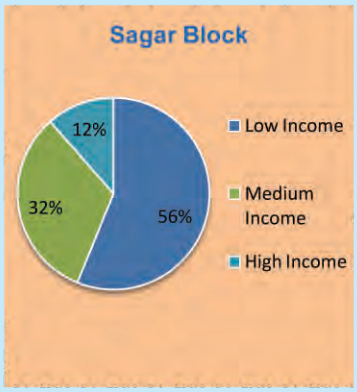


Fig 7.1.3a: Annual family income of farmers (Sagar Block)

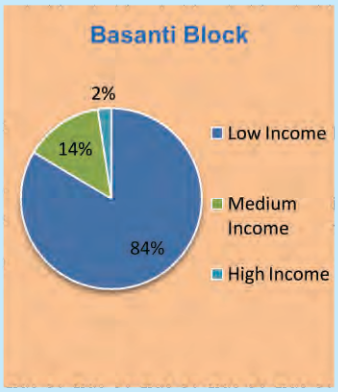


Fig 7.1.3b: Annual family income of farmers (Basanti Block)

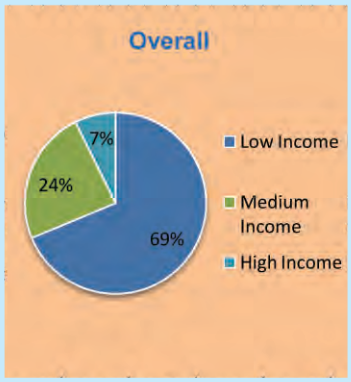


Fig 7.1.3c: Annual family income of farmers (overall)

Table 7.1.4 FAMILY SIZE OF FARMERS (n = 451)

No. of respondent farmers →	Sagar	Basanti	Overall
Small Family (Members ≤ 4)	61	61	122
Medium Family (Members between 5 & 8)	146	126	272
Large Family (Members > 8)	37	20	57
TOTAL	244	207	451

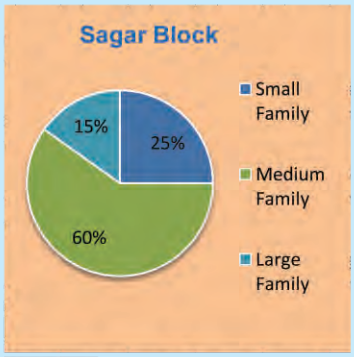


Fig 7.1.4a: Farmer family size based on family member (Sagar Block)

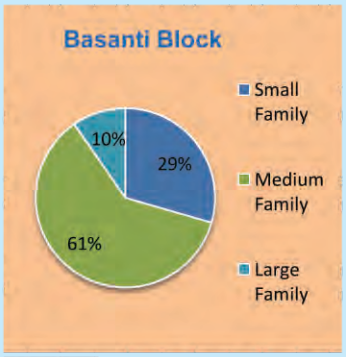


Fig 7.1.4b: Farmer family size based on family member (Basanti Block)

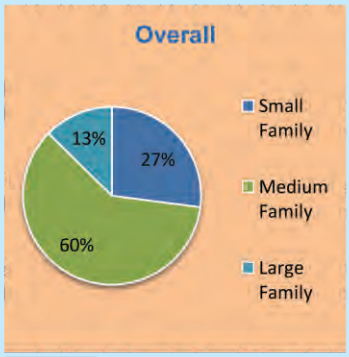


Fig 7.1.4c: Farmer family size based on family member (overall)

Table 7.1.5 INCOME SOURCE ALONG WITH AQUACULTURE (n = 451)

No. of respondent farmers →	Sagar	Basanti	Overall
Aquaculture and Agriculture	208	187	395
Aquaculture and Animal Husbandry	40	74	114
Aquaculture and Fishing	9	10	19
Aquaculture and Service	10	6	16
Aquaculture and Business	42	39	81

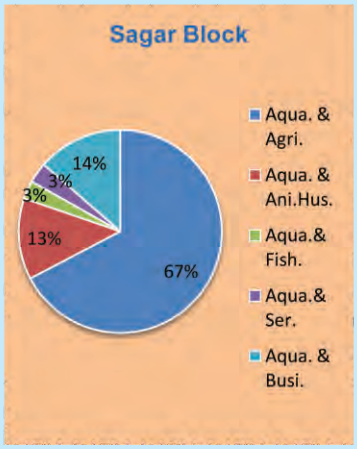


Fig 7.1.5a: Income source of farmers (Sagar Block)

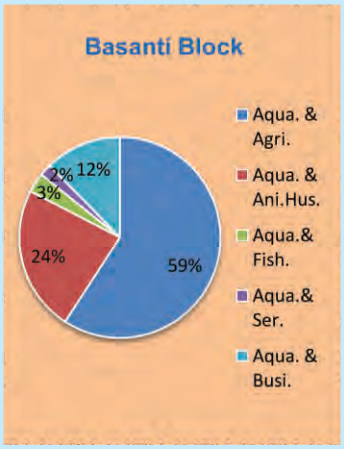


Fig 7.1.5b: Income source of farmers (Basanti Block)

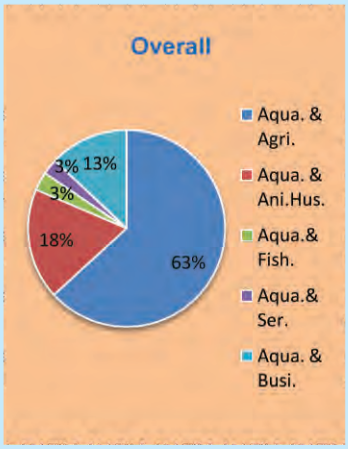


Fig 7.1.5c: Income source of farmers (overall)

Table 7.1.6 SOURCES OF KNOWLEDGE ON AQUACULTURE (n = 451)

No. of respondent farmers →	Sagar	Basanti	Overall
Govt. training	7	1	8
NGO training	7	2	9
From other farmers	57	35	92
Self taught	222	183	405
From mass media	28	5	33

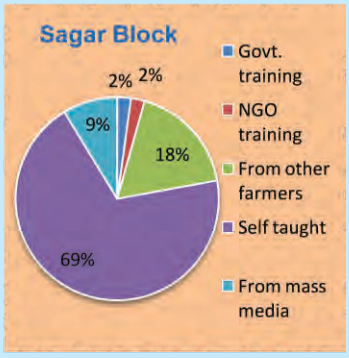


Fig 7.1.6a: Source of farmers' knowledge on aquaculture (Sagar Block)

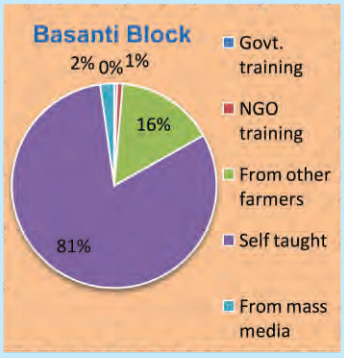


Fig 7.1.6b: Source of farmers' knowledge on aquaculture (Basanti Block)

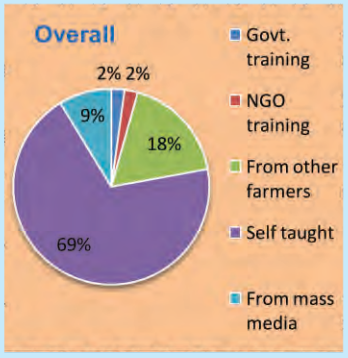


Fig 7.1.6c: Source of farmers' knowledge on aquaculture (overall)

7.2: Farm operation and management:

Table 7.2.1 FISH /SHELLFISH CULTURED (n = 451)

No. of respondent farmers →	Sagar	Basanti	Overall
Fin Fish	142	60	202
Shell Fish	20	8	28
Both	82	139	221
TOTAL	244	207	451

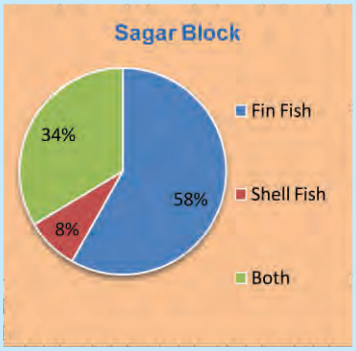


Fig 7.2.1a: Fish /Shellfish cultured (Sagar Block)

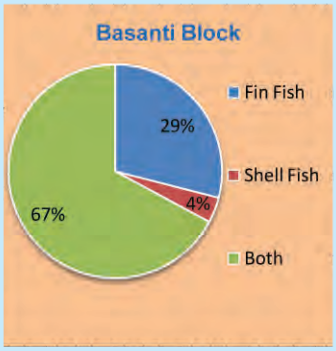


Fig7.2.1b: Fish /Shellfish cultured (Basanti Block)

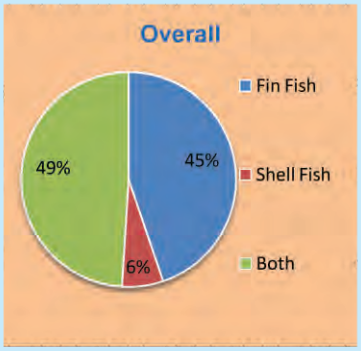


Fig 7.2.1c: Fish /Shellfish cultured (overall)

Table 7.2.2 WATER TYPE USED IN AQUACULTURE (n = 451)

No. of respondent farmers →	Sagar	Basanti	Overall
Freshwater	151	170	321
Brackishwater	23	7	30
Both	70	30	100
TOTAL	244	207	451

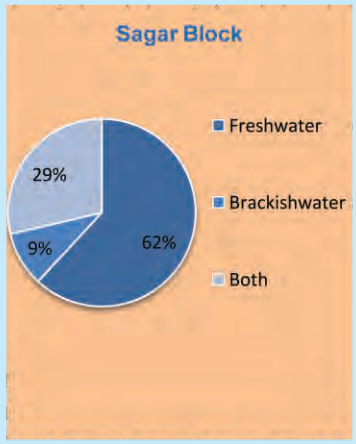


Fig 7.2.2a: Water type used in aquaculture(Sagar Block)

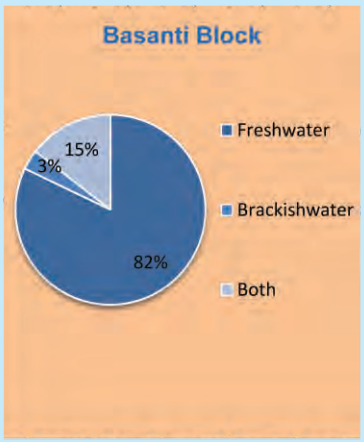


Fig 7.2.2b: Water type used in aquaculture (Basanti Block)

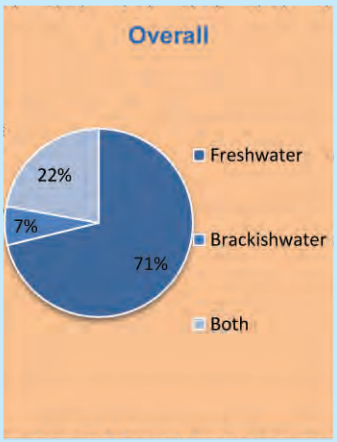


Fig 7.2.2c: Water type used in aquaculture (overall)

Table 7.2.3 TYPE OF FARMING PRACTISED BY FARMERS (n = 451)

No. of respondent farmers →	Sagar	Basanti	Overall
Traditional	167	165	332
Modified Extensive	63	40	103
Semi-intensive	14	2	16
TOTAL	244	207	451

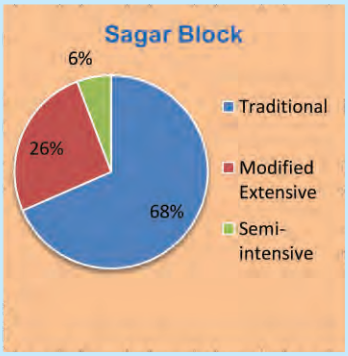


Fig 7.2.3a: Farming type practised (Sagar Block)

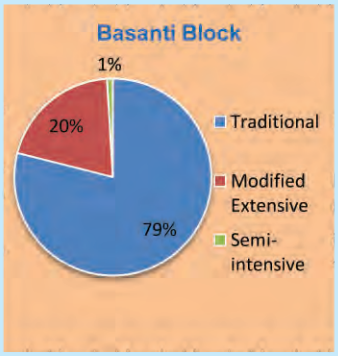


Fig 7.2.3b: Farming practised (Basanti Block)

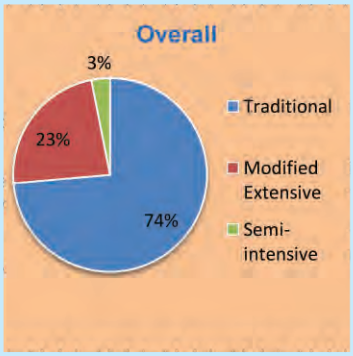


Fig 7.2.3c: Farming type practised (overall)

Table7.2.4 TYPE OF CULTIVATION PRACTISED BY FARMERS (n = 451)

No. of respondent farmers →	Sagar	Basanti	Overall
Monoculture	19	3	22
Polyculture	221	171	392
Integrated	4	33	37
TOTAL	244	207	451

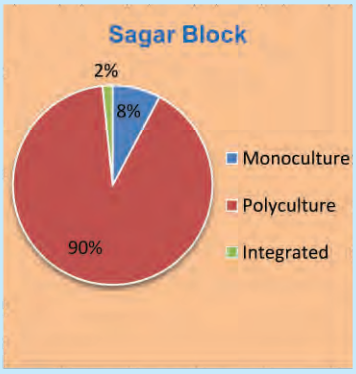


Fig 7.2.4a: Cultivation type practised (Sagar Block)

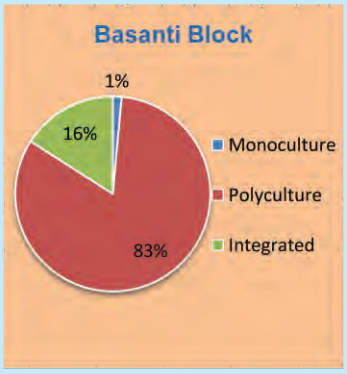


Fig 7.2.4b: Cultivation type practised (Basanti Block)

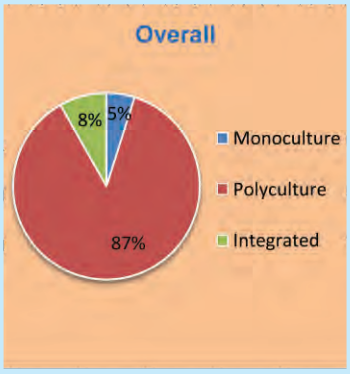


Fig 7.2.4c: Cultivation type practised (overall)

Table 7.2.5 POND TYPE USED BY FARMER (n = 451)

No. of respondent farmers →	Sagar	Basanti	Overall
Seasonal	61	69	130
Perennial	183	138	321
TOTAL	244	207	451

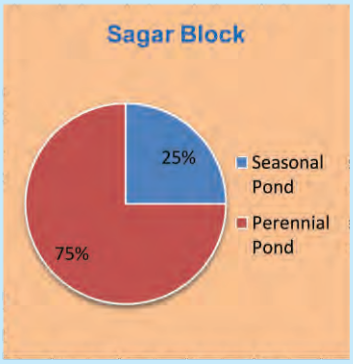


Fig 7.2.5a: Pond type used by Farmers (Sagar Block)

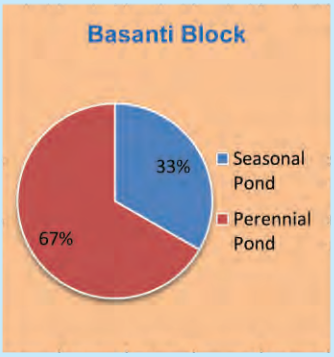


Fig 7.2.5b: Pond type used by Farmers (Basanti Block)

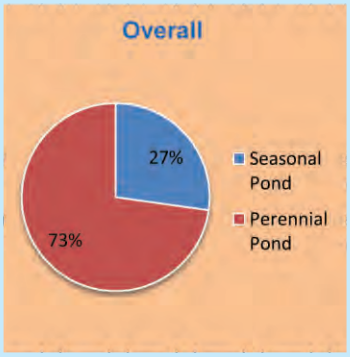


Fig 7.2.5c: Pond type used by Farmers (overall)

Table 7.2.6 PRESENCE OF INLET AND OUTLET IN THE PONDS OF FARMERS (n = 451)

No. of respondent farmers →	Sagar	Basanti	Overall
Inlet & out let present in Pond	161	47	208
Inlet & out let absent in Pond	83	160	243
TOTAL	244	207	451

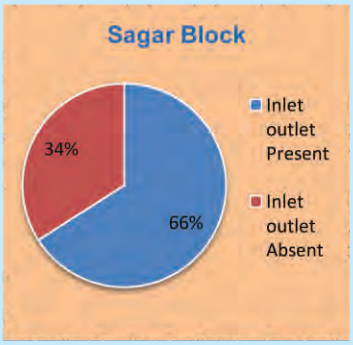


Fig 7.2.6a: Ponds having inlet & outlet (Sagar Block)

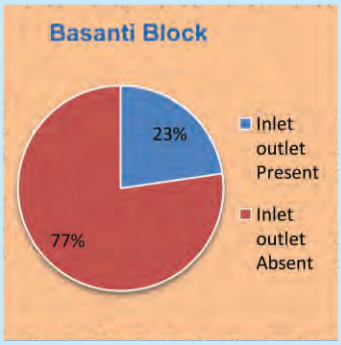


Fig 7.2.6b: Ponds having inlet & outlet (Basanti Block)

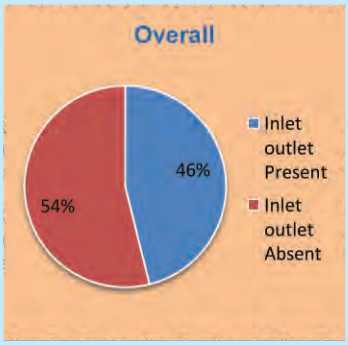


Fig 7.2.6c: Ponds having inlet & outlet (overall)

Table 7.2.7 DISTRIBUTION OF NURSERY POND

No. of respondent farmers →	Sagar	Basanti	Overall
Total Nursery Pond	13	50	63
Farmer having 1 Nursery Pond	8	37	45
Farmer having 2 Nursery Pond	5	9	14
Farmer having 3 Nursery Pond	0	1	1
Farmer having 4 Nursery Pond	0	2	2
Farmer having 5 Nursery Pond	0	0	0
Farmer having > 5 Nursery Pond	0	1	1

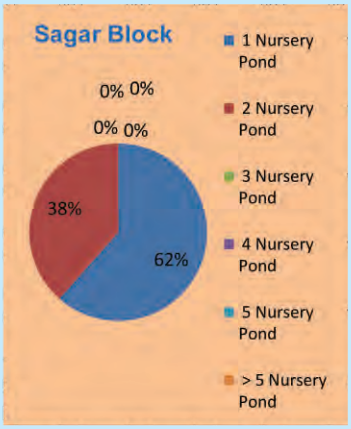


Fig 7.2.7a: Distribution of nursery pond (Sagar Block)

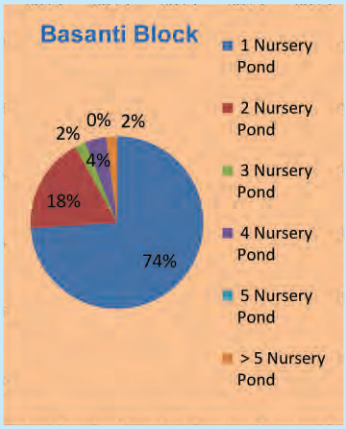


Fig 7.2.7b Distribution of nursery pond (Basanti Block)

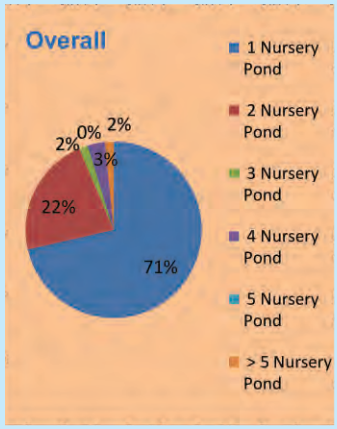


Fig 7.2.7c: Distribution of nursery pond (overall)

Table 7.2.8 DISTRIBUTION OF GROW OUT POND (n= 451)

No. of respondent farmers →	Sagar	Basanti	Overall
Total Grow Out Pond	244	207	451
Farmer having 1 Grow Out Pond	89	56	145
Farmer having 2 Grow Out Pond	79	89	168
Farmer having 3 Grow Out Pond	46	43	89
Farmer having 4 Grow Out Pond	20	14	34
Farmer having 5 Grow Out Pond	7	3	10
Farmer having >5 Grow Out Pond	3	2	5

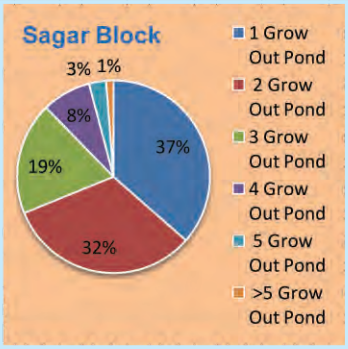


Fig 7.2.8a: Distribution of Grow out pond (Sagar Block)

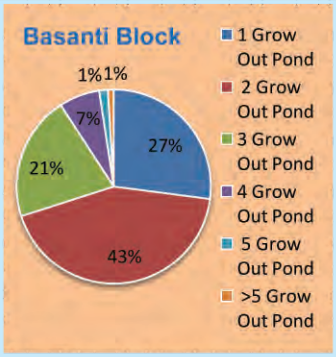


Fig 7.2.8b: Distribution of Grow out pond (Basanti Block)

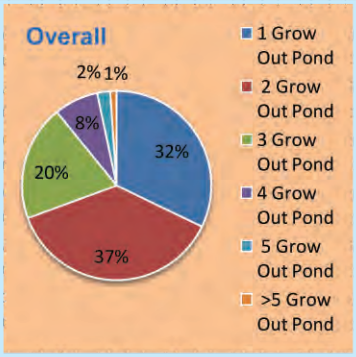


Fig 7.2.8c: Distribution of Grow out pond (overall)

Table 7.2.9 TOTAL POND AREA OF INDIVIDUAL FARMER : (n = 451)

No. of respondent farmers →	Basanti	Sagar	Overall
Pond area ≤ 0.5 Bigha	20	38	58
Pond area > 0.5 to 1.0 Bigha	70	60	130
Pond area >1.0 to 3.0 Bigha	90	112	202
Pond area >3.0 to 5.0 Bigha	16	20	36
Pond area > 5.0 Bigha	11	14	25
TOTAL	207	244	451

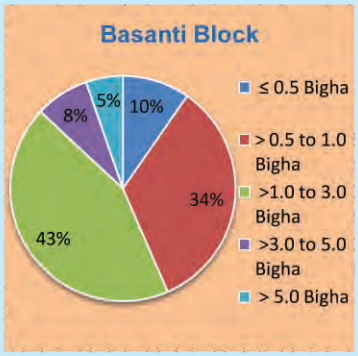


Fig 7.2.9a: Different pond size of farmers (Basanti Block)

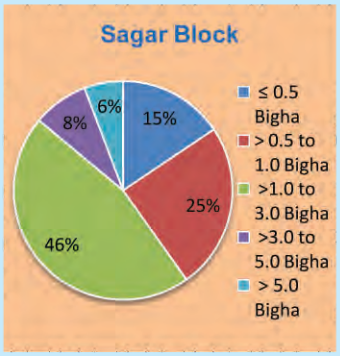


Fig 7.2.9b: Different pond size of farmers (Sagar Block)

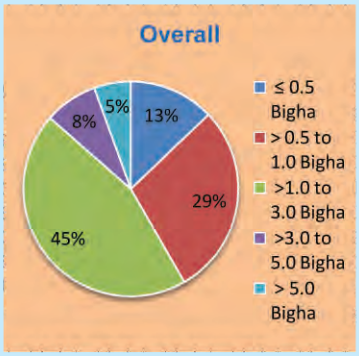


Fig 7.2.9c: Different pond size of farmers (overall)

Table 7.2.10 SOURCE OF WATER FOR AQUACULTURE :(n = 451)

No. of respondent farmers →	Sagar	Basanti	Overall
Rain water Only	132	181	313
Ground water Only	0	0	0
Creek water Only	5	1	6
Rain water and Ground water	17	4	21
Rain water and Creek Water	87	19	108
Rain , Ground and Creek water	3	2	3
TOTAL	244	207	451

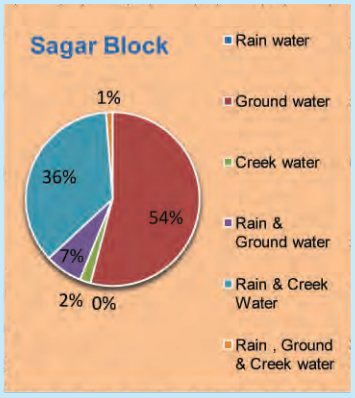


Fig 7.2.10a: Source of water for Aquaculture (Sagar Block)

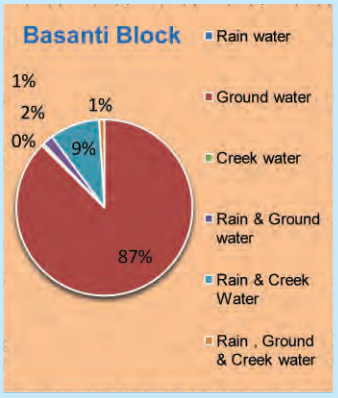


Fig 7.2.10b: Source of water for Aquaculture (Basanti Block)

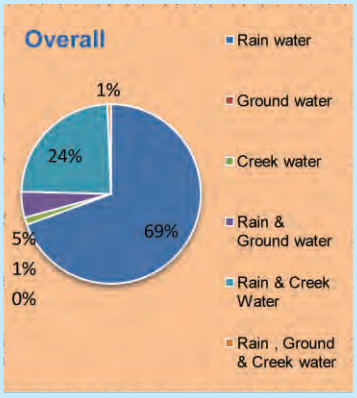


Fig 7.2.10c: Source of water for Aquaculture (overall)

Table 7.2.11 OTHER USAGE OF POND WATER (n = 451)

No. of respondent farmers →	Sagar	Basanti	Overall
Household only	18	11	29
Irrigation only	26	5	31
Bathing only	0	1	1
Household and Irrigation	23	4	27
Household and Bathing	34	72	106
Irrigation and Bathing	1	0	1
Household, Irrigation and Bathing	79	108	187
No use	63	6	69
TOTAL	244	207	451

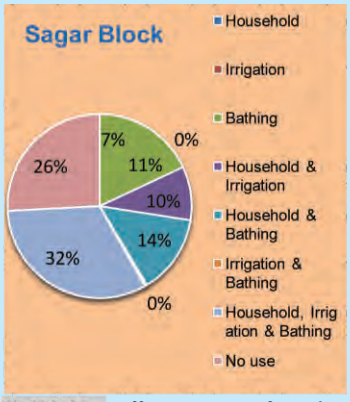


Fig 7.2.11a: Different usage of pond water (Sagar Block)

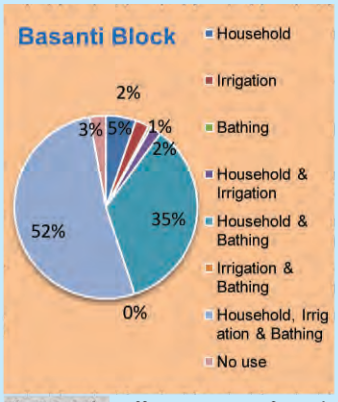


Fig 7.2.11b: Different usage of pond water (Basanti Block)

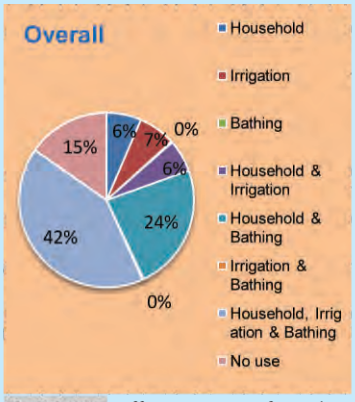


Fig 7.2.11c: Different usage of pond water (overall)

Table 7.2.12 POND PREPARATION STEPS FOLLOWED BY THE FARMERS (n = 451)

No. of respondent farmers →	Sagar	Basanti	Overall
Dewatering	111	123	234
Bottom Sediment removal	73	22	95
De-weeding	56	26	82
Eradication of predator	27	13	40
Liming	231	163	394
Manuring	96	35	131
No preparation	0	16	16

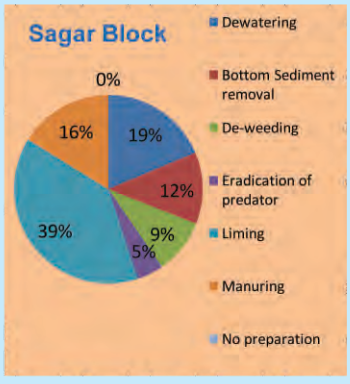


Fig 7.2.12a: Pond preparation steps followed by farmers (Sagar Block)

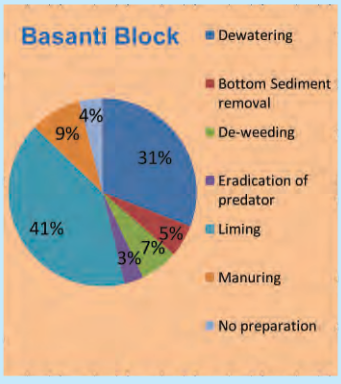


Fig 7.2.12b: Pond preparation steps followed by farmers (Basanti Block)

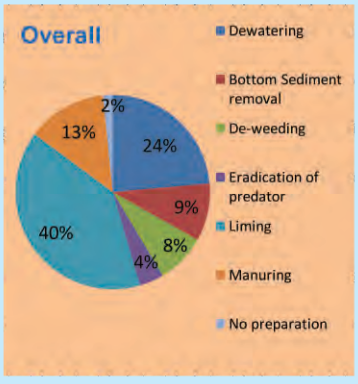


Fig 7.2.12c: Pond preparation steps followed by farmers (overall)

7.3: Stocking and stock management

Table 7.3.1 SEED SOURCE (n = 451)

No. of respondent farmers →	Sagar	Basanti	Overall
Hatchery	219	174	393
Natural	6	5	11
Both	19	28	47
TOTAL	244	207	451

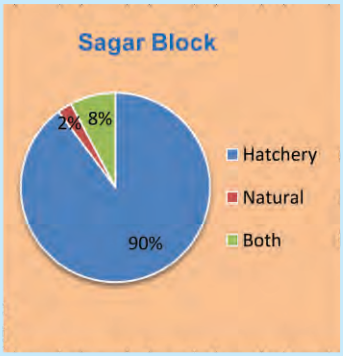


Fig 7.3.1: Seed source (Sagar Block)

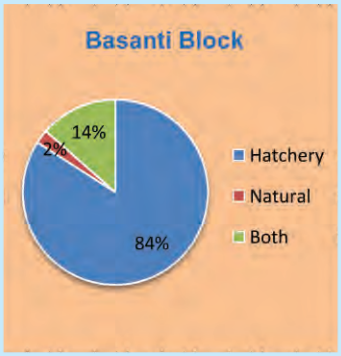


Fig 7.3.1b: Seed source (Basanti Block)

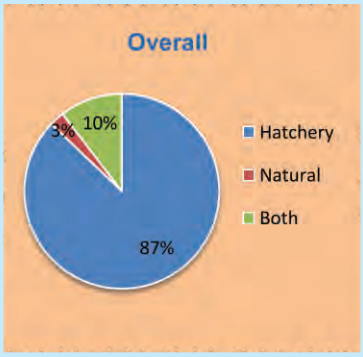


Fig 7.3.1c: seed source (overall)

Table7.3.2 NATURE OF SEED STOCKING (n = 451)

No. of respondent farmers →	Sagar	Basanti	Overall
Single stocking	63	72	135
Multiple stocking	144	172	316
TOTAL	207	244	451

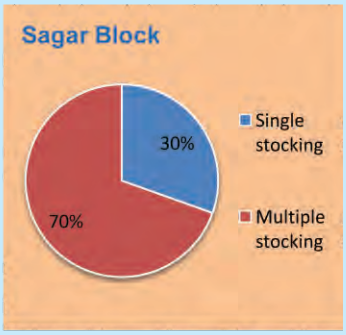


Fig 7.3.2a: Nature of seed stocking (Sagar Block)

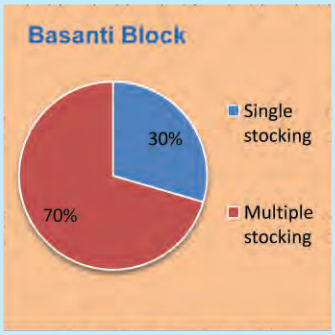


Fig 7.3.2b: Nature of seed stocking (Basanti Block)

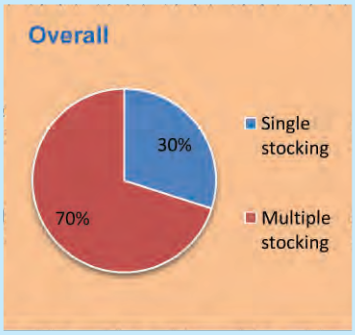


Fig 7.3.2c: Nature of seed stocking (overall)

Table 7.3.3 FIN FISH STOCKING RATE

No. of respondent farmers →	Sagar	Basanti	Overall
Up to 1000 piece / Bigha	122	22	144
1001-3000 piece / Bigha	56	126	182
3001-5000 piece / Bigha	33	36	69
5001-10000 piece / Bigha	6	14	20
10001-50000 piece/ Bigha	5	4	9
50001-100000 piece / Bigha	0	0	0
Above 100000 piece / Bigha	0	5	5

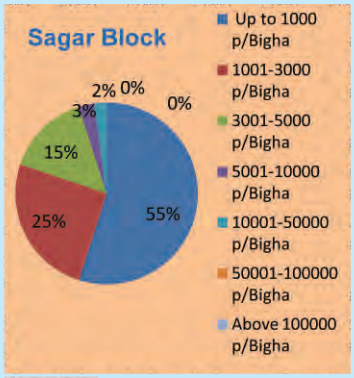


Fig 7.3.3a: Fin fish stocking rate (Sagar Block)

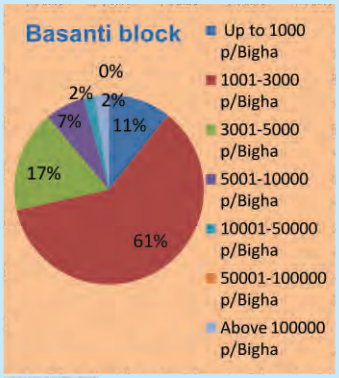


Fig 7.3.3b: Fin fish stocking rate (Basanti Block)

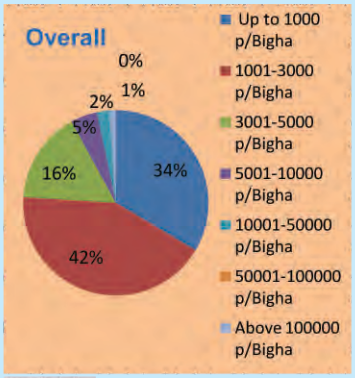


Fig 7.3.3c: Fin fish stocking rate (overall)

Table 7.3.4 SHELL FISH STOCKING RATE

No. of respondent farmers →	Sagar	Basanti	Overall
Up to 500 piece / Bigha	9	49	58
501-1000 piece / Bigha	21	21	42
1001-3000 piece / Bigha	28	27	55
3001-5000 piece / Bigha	14	5	19
5001-10000 piece / Bigha	11	6	17
10001-30000 piece / Bigha	14	4	18
30001-40000 piece / Bigha	3	0	3

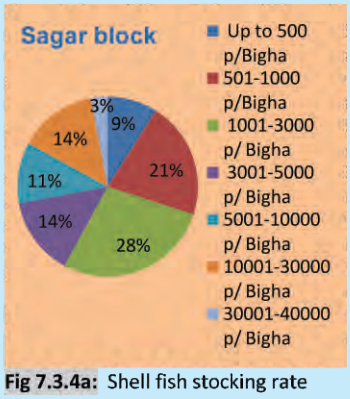


Fig 7.3.4a: Shell fish stocking rate (Sagar Block)

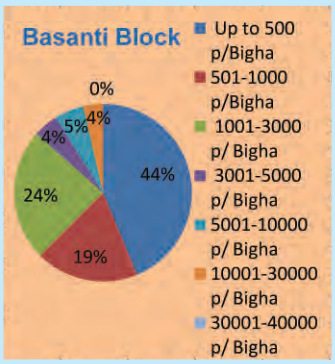


Fig 7.3.4b: Shell fish stocking rate (Basanti Block)

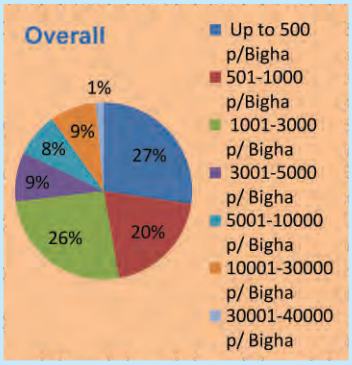


Fig 7.3.4 Shell fish stocking rate (overall)

Table 7.3.5 CULTIVATED FISH SPECIES (n = 451)

No. of respondent farmers →	Sagar	Basanti	Overall
Catla (*Catla catla*)	200	196	396
Rohu (*Labeo rohita*)	205	199	404
Mrigal (*Cirrhinus mrigala*)	93	172	265
Silver carp (*Hypophthalmichthys molitrix*)	53	133	186
Grass carp (*Ctenopharyngodon idella*)	9	6	15
Big Head (*Aristichthys nobilis*)	3	2	5
Common carp (*Cyprinus carpio*)	8	5	13
Japani punti (*Puntius javanicus*)	101	75	176
Pangus (*Pangasius sutchi*)	7	5	7
Rupchanda (*Pygocentrus nattereri*)	70	3	73
Bhetki (*Lates calcerifer*)	19	14	33
Parse (*Liza parsia*)	24	8	32
Bhangan (*Liza tade*)	4	3	7
Tilapia (*Oreochromis mossambicus*)	44	26	70
Bata (*Labeo bata*)	51	98	149
Chitol (*Notopterus chitala*)	4	3	7
Tangra (*Mystus cavasius*)	4	4	8
Kalbaus (*Labeo calbasu*)	9	4	13
Pearl spot (*Etroplus suratensis*)	4	2	6

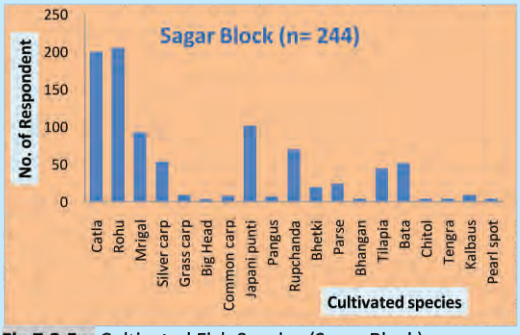


Fig 7.3.5a: Cultivated Fish Species (Sagar Block)

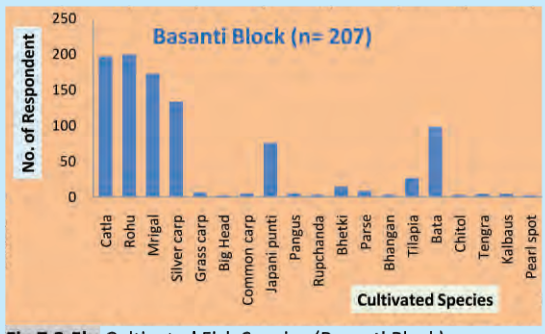


Fig 7.3.5b: Cultivated Fish Species (Basanti Block)

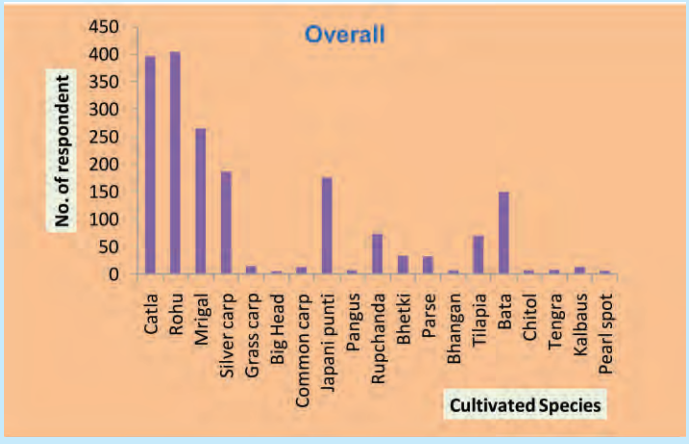


Fig. 7.3.5c: Cultivated Fish Species (Overall)

Table 7.3.6 STOCKING COMBINATION

No. of respondent farmers →	Sagar	Basanti	Overall
Catla, Rohu, Mrigal+ Silver carp, Grass carp, Common carp (IMC+ Exotic Carp)	32	29	61
Catla, Rohu, Mrigal+ Bata, Japani Punti, Kalbaus (IMC + Med & Min Carp)	65	54	119
Catla, Rohu, Mrigal+ Rupchanda, Pangus, Tilapia (IMC + Other Exotic sp.)	45	6	51
Bhetki, Parse, Bhangan, Chitol, Pearl spot (Brackish water Fish +Chitol)	1	1	2
Catla, Rohu, Mrigal+ Silver Carp, Grass carp, Common carp, Japani Punti, Tilapia (IMC+ Exotic Carp+ Tilapia)	81	88	169
Catla, Rohu, Mrigal+Bhetki, Parse, Bhangan(IMC+ Brackishwater fish)	25	4	29

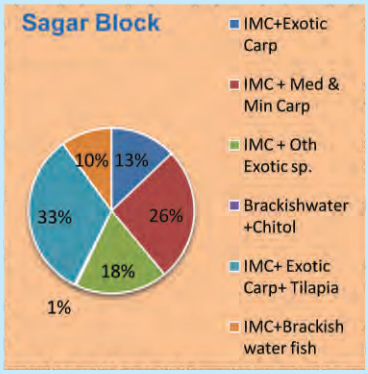


Fig 7.3.6a: Stocking Combination (Sagar Block)

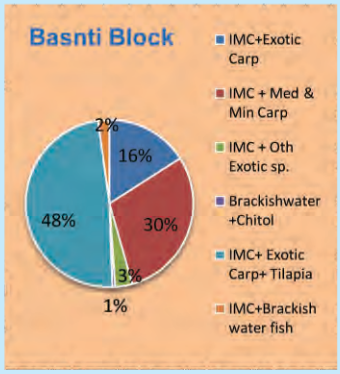


Fig7.3.6b: Stocking Combination (Basnti Block)

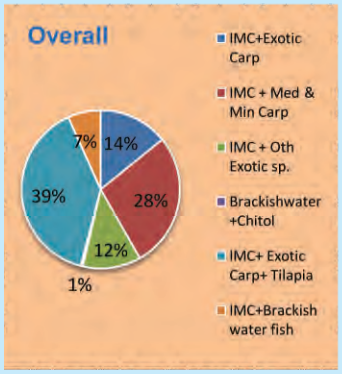


Fig 7.3.6c: Stocking Combination (Overall)

Table 7.3.7 CULTIVATED SHELLFISH SPECIES

No. of respondent farmers →	Sagar	Basanti	Overall
Bagda (*Penaeus monodon*)	46	6	52
Galda (*Macrobrachium rosenbergii*)	27	117	144
Both	31	20	51

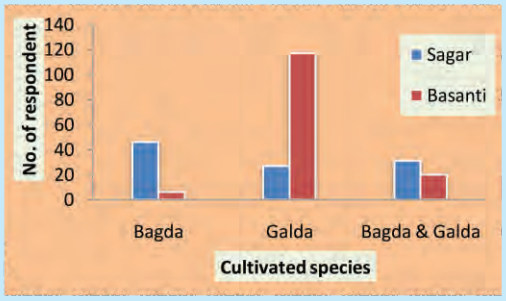


Fig 7.3.7a: Cultivated finfish Species (Sagar & Basanti Block)

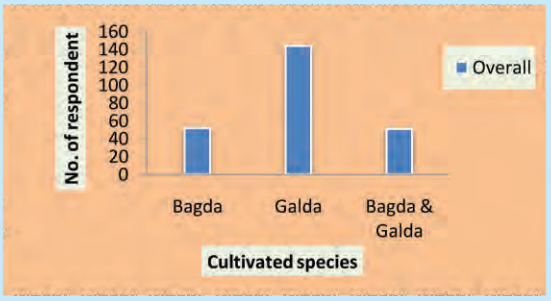


Fig 7.3.7a: Cultivated finfish Species (Overall)

Table 7.3.8 STAGE OF SEED (FINFISH) STOCKED

No. of respondent farmers →	Sagar	Basanti	Overall
Spawn	19	7	26
Fry	135	49	184
Fingerling	121	180	301

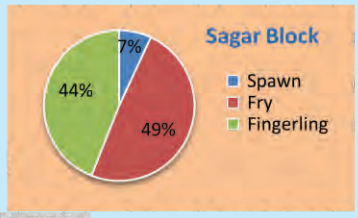


Fig 7.3.8a: Finfish stocking (Sagar Block)

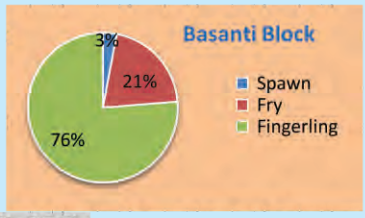


Fig 7.3.8b: Finfish stocking(Basanti Block)

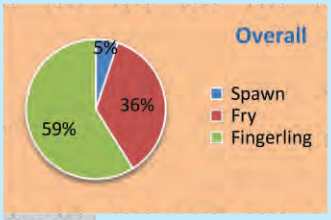


Fig 7.3.8c: Finfish stocking (Overall)

Table 7.3.9 STAGE OF SEED (SHELLFISH) STOCKED

No. of respondent farmers →	Sagar	Basanti	Overall
Post Larvae (PL)	67	9	76
Juvenile	49	134	183

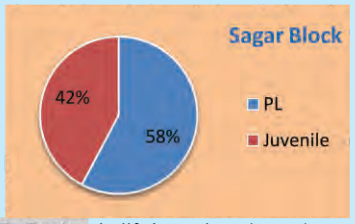


Fig 7.3.9a: Shellfish stocking (Sagar)

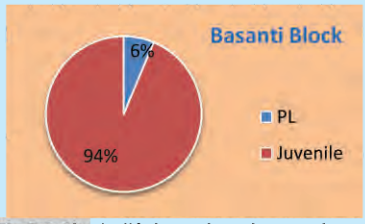


Fig 7.3.9b: Shellfish stocking (Basanti)

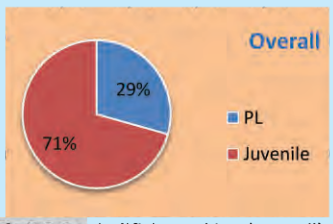


Fig 7.3.9c: Shellfish stocking (Overall)

Table 7.3.10 SEED DISINFECTION (n=451)

No. of respondent farmers →	Sagar	Basanti	Overall
Seed disinfection done	43	4	47
Seed disinfection not done	201	203	404

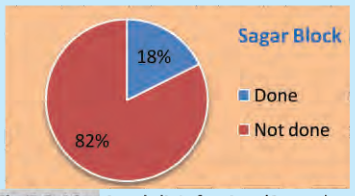


Fig 7.3.10a: Seed disinfection (Sagar)

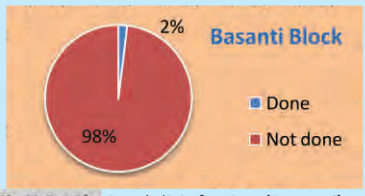


Fig 7.3.10b: Seed disinfection (Basanti)

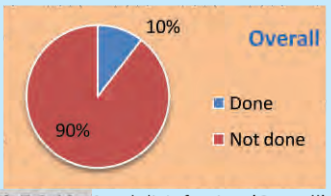


Fig7.3.10c: Seed disinfection (Overall)

Table 7.3.11 SEED ACCLIMATIZATION (n=451)

No. of respondent farmers →	Sagar	Basanti	Overall
Seed acclimatization done	58	15	73
Seed acclimatization not done	186	192	378

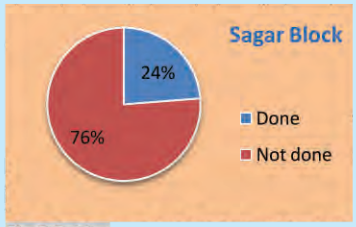


Fig 7.3.11a: Seed acclimatization (Sagar Block)

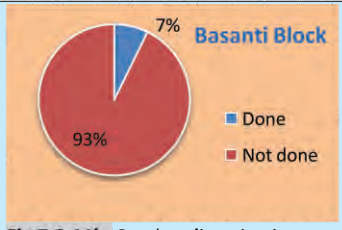


Fig 7.3.11b: Seed acclimatization (Basanti Block)

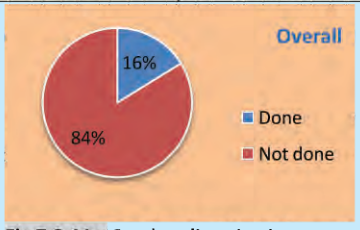


Fig 7.3.11c: Seed acclimatization (Overall)

7.4: Feed and feeding management

Table 7.4.1 FEEDING STATUS (n = 451)

No. of respondent farmers →	Sagar	Basanti	Overall
Supplementary Feed used	209	155	364
Supplementary Feed not used	34	53	87
TOTAL	244	207	451

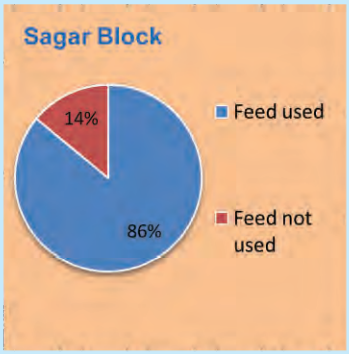


Fig 7.4.1a: Farmers using supplementary feed (Sagar Block)

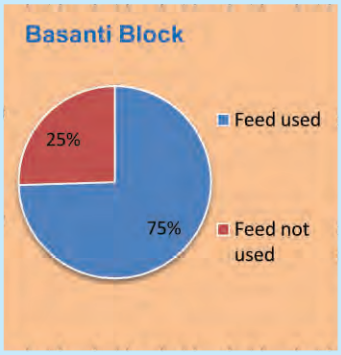


Fig 7.4.1b: Farmers using supplementary feed (Basanti Block)

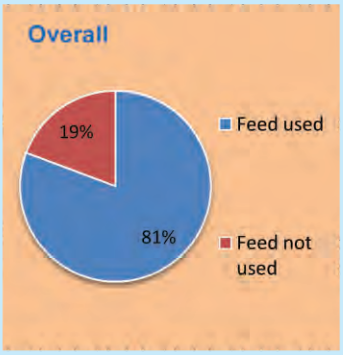


Fig 7.4.1c: Farmers using feed during supplementary culture (Overall)

Table 7.4.2 TYPE OF SUPPLEMENTARY FEED

No. of respondent farmers →	Sagar	Basanti	Overall
Rice bran & oil cake	57	128	185
Farm made	23	21	44
Branded Feed	129	6	135
TOTAL	209	155	364

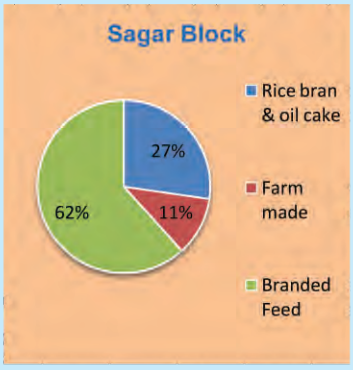


Fig 7.4.2a: Type of feed used by farmers (Sagar Block)

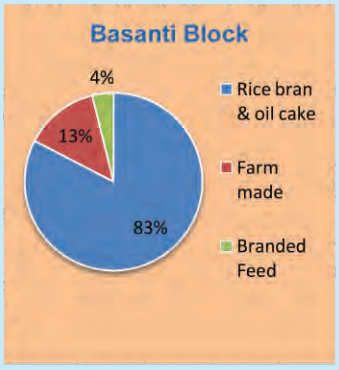


Fig 7.4.2b: Type of feed used by farmers (Basanti Block)

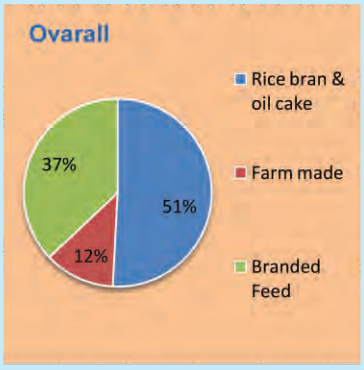


Fig 7.4.2c: Type of feed used by farmers (overall)

Table 7.4.3 FREQUENCY OF FEEDING

No. of respondent farmers →	Sagar	Basanti	Overall
Daily	80	20	100
Once per week	60	60	120
Twice per week	37	47	84
Thrice per week	10	25	35
Four times per week	20	3	23
Five times per week	2	0	2
Six times per week	0	0	0
TOTAL	155	209	364

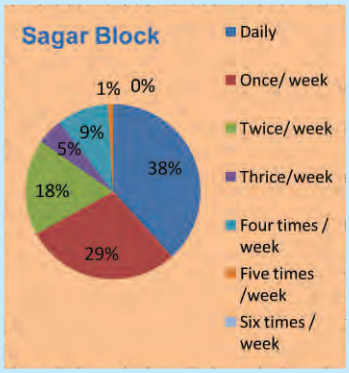


Fig7.4.3a: Frequency of feed given by farmers (Sagar Block)

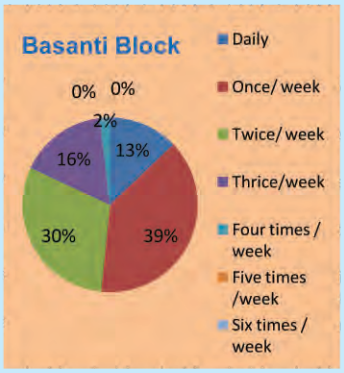


Fig7.4.3b: Frequency of feed given by farmers (Basanti Block)

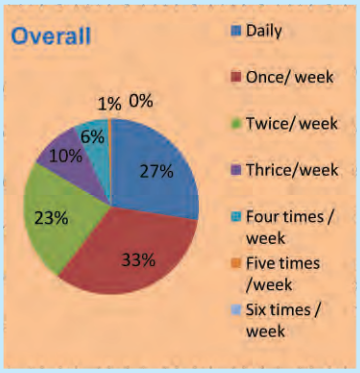


Fig7.4.3c: Frequency of feed given by farmers (Overall)

Table 7.4.4 NATURE OF FEEDING

No. of respondent farmers →	Sagar	Basanti	Overall
Broadcasting only	173	128	301
Tray feeding only	3	0	3
Bag feeding only	13	12	25
Broadcasting, tray feeding	14	3	17
Broadcasting, Bag feeding	6	12	18
Tray feeding, Bag Feeding	0	0	0
Broadcasting, tray & Bag Feeding	0	0	0
TOTAL	209	155	364

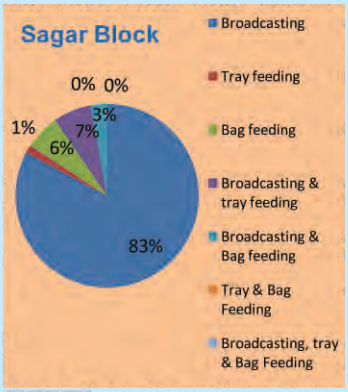


Fig7.4.4a: Feeding method adopted by farmers (sagar Block)

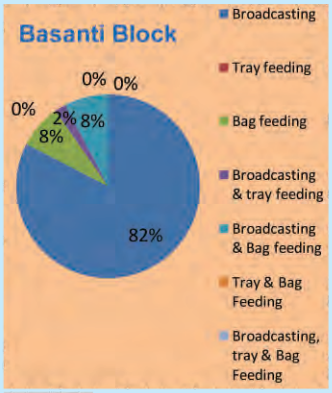


Fig7.4.4b: Feeding method adopted by farmers (Basanti Block)

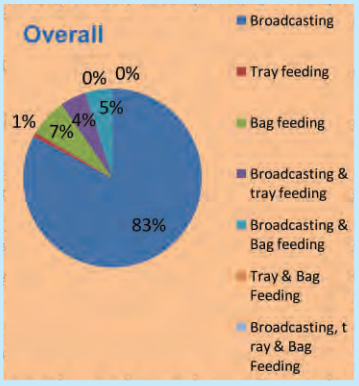


Fig7.4.4c: Feeding method adopted by farmers (overall)

7.5: Disease and health management:

Table 7.5.1 COMMON OCCURRENCE OF DISEASES IN FISH (n = 451)

No. of respondent farmers →	Sagar	Basanti	Overall
No occurrence of disease	135	46	181
Disease affected farmers	109	161	270
TOTAL	244	207	451
Type & Pattern of diseases			
Body Ulcer-EUS	42	43	85
Fin & tail rot	16	39	55
Fish lice- Argulus	2	0	2
Mal-nutrition	20	25	45
EUS, Fin & tail rot	11	15	26
EUS, Fish lice	4	6	10
EUS, Mal-nutrition	4	17	21
Fin & tail rot, Fish lice	3	3	6
Fin & tail rot, Mal-nutrition	5	11	16
Fish lice, Mal-nutrition	1	0	1
EUS, Fin & tail rot, Fish lice	1	0	1
EUS, Fin & tail rot, Mal-nutrition	0	2	2
EUS, Fish lice, Mal-nutrition	0	0	0
Fin & tail rot, Fish lice, Mal-nutrition	0	0	0

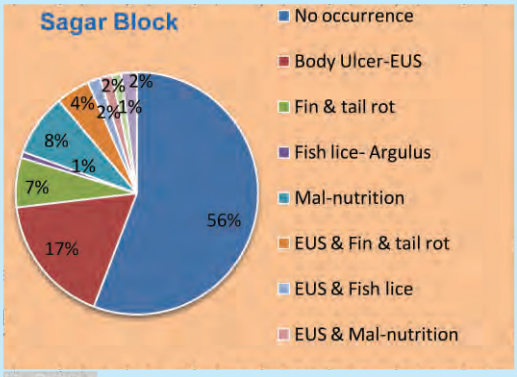


Fig 7.5.1a: Occurrence of disease in fin fish (Sagar Block)

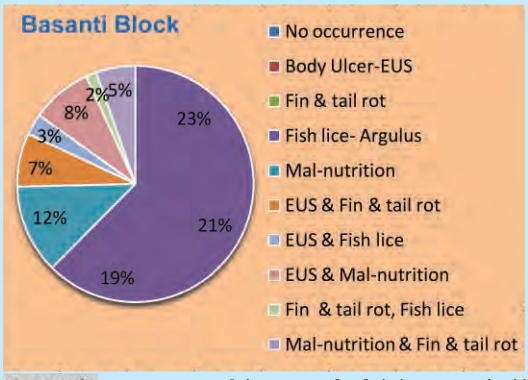


Fig 7.5.1b: Occurrence of disease in fin fish (Basanti Block)

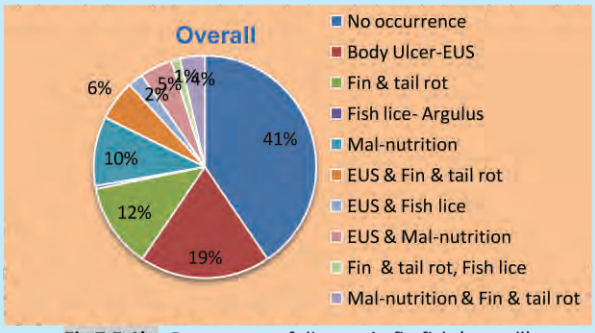


Fig 7.5.1b: Occurrence of disease in fin fish (overall)

Table 7.5.2 SEASONAL OCCURRENCE OF FIN FISH DISEASES

No. of respondent farmers →	Sagar	Basanti	Overall
Summer only	2	32	34
Monsoon only	21	8	29
Winter only	73	94	167
Summer & Monsoon	1	0	1
Summer & Winter	2	19	21
Monsoon & Winter	10	8	18
Summer, Monsoon & Winter	0	0	0
TOTAL	109	161	270

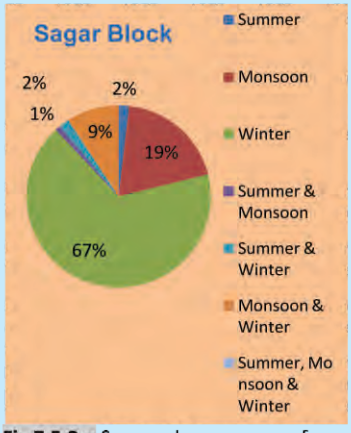


Fig 7.5.2a: Seasonal occurrence of disease (Sagar Block)

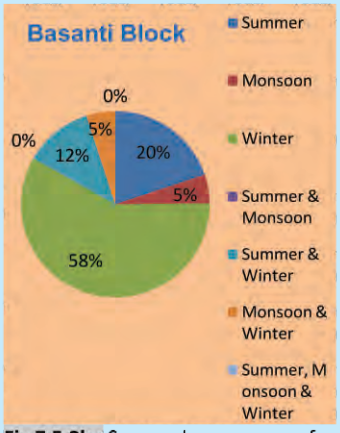


Fig 7.5.2b : Seasonal occurrence of disease (Basanti Block)

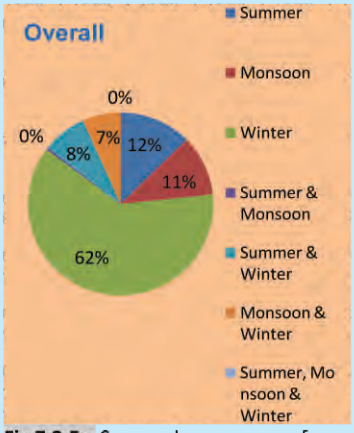


Fig 7.2.5c: Seasonal occurrence of disease (Overall)

Table 7.5.3 OCCURRENCE OF DISEASE IN GROWTH PHASE

No. of respondent farmers →	Sagar	Basanti	Overall
After stocking only	4	4	8
Mid-crop only	94	117	211
End-crop only	0	16	16
After stocking, Mid-crop	2	0	2
After stocking, End-crop	0	0	0
Mid-crop, End-crop	9	24	33
After stocking, Mid-crop, End-crop	0	0	0
TOTAL	109	161	270

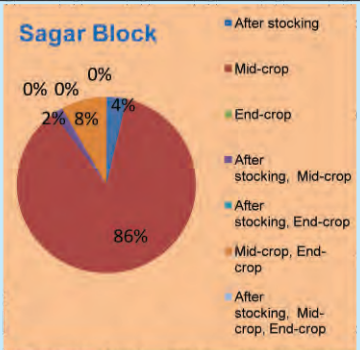


Fig 7.5.3a: Disease occurrence in growth phase (Sagar Block)

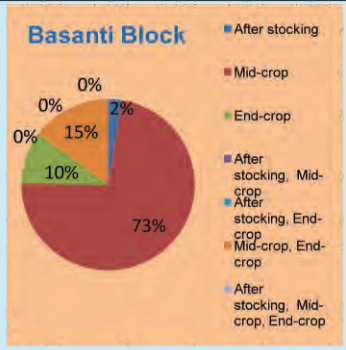


Fig 7.5.3b: Disease occurrence in growth phase (Basanti Block)

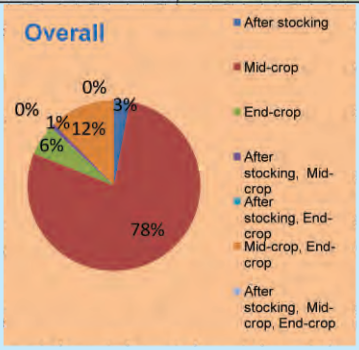


Fig 7.5.3c: Disease occurrence in growth phase (Overall)

Table 7.5.4 COMMON OCCURRENCE OF DISEASES IN SHELL FISH

No. of respondent farmers →	Sagar	Basanti	Overall
No occurrence of disease	57	39	96
Disease affected farmers	46	143	189
TOTAL	103	182	285
Type & Pattern of diseases			
White spot virus	4	22	22
blackening of gill	12	39	39
Black lesion on shell & tail	18	76	76
Fungus outgrowth on shell	3	31	31
White spot virus, blackening of gill	3	8	8
White spot virus, Black lesion on shell & tail	1	3	3
White spot virus, Fungus outgrowth on shell	3	2	5
Blackening of gill, Black lesion on shell & tail	4	8	8
Blackening of gill, Fungus outgrowth on shell	1	1	1

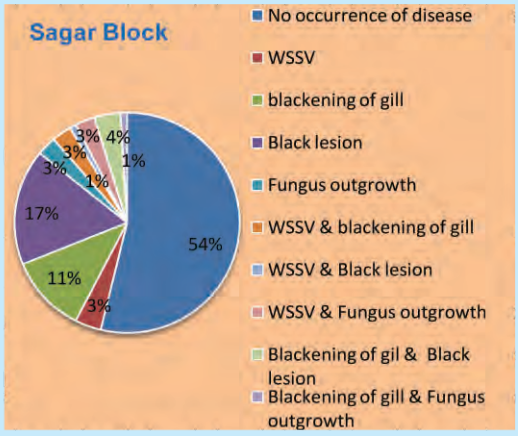


Fig 7.5.4a: Common disease in Shell fish (Sagar Block)

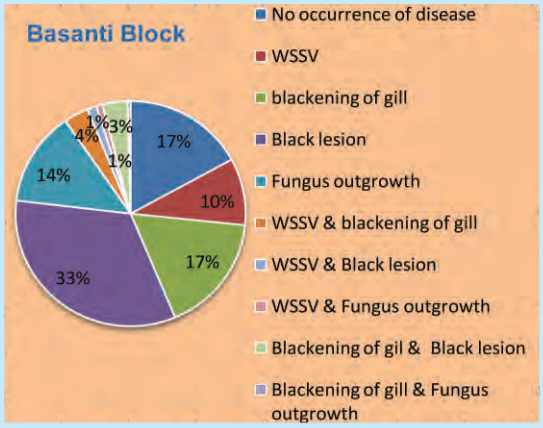


Fig 7.5.4b: Common of disease in Shell fish (Basanti Block)

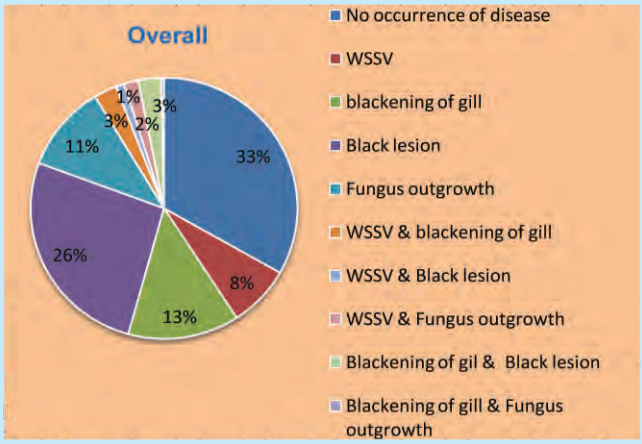


Fig 7.5.4c: Common of disease in Shell fish (Overall)

Table 7.5.5 SEASONAL OCCURRENCE OF SHELL FISH DISEASES

No. of respondent farmers →	Sagar	Basanti	Overall
Summer only	1	37	38
Monsoon only	12	16	28
Winter only	30	70	100
Summer & Monsoon	0	2	2
Summer & Winter	1	12	13
Monsoon & Winter	2	6	8
Summer, Monsoon & Winter	0	0	0
TOTAL	46	143	189

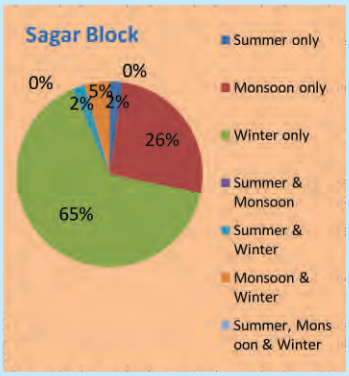


Fig 7.5.5a: Seasonal occurrence of disease (Sagar Block)

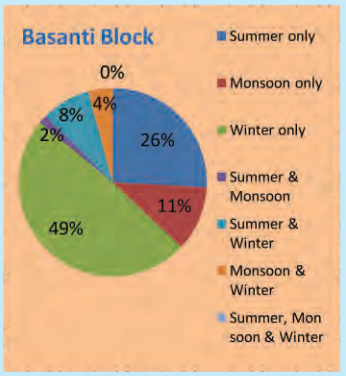


Fig 7.5.5b: Seasonal occurrence of disease (Basanti Block)

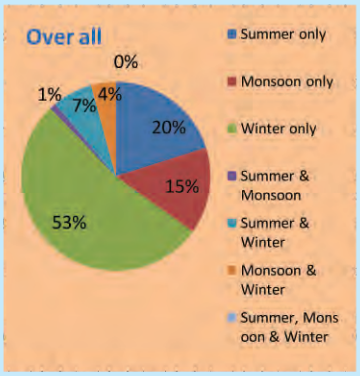


Fig 7.5.5c: Seasonal occurrence of disease (Overall)

Table 7.5.6 OCCURRENCE OF DISEASE IN GROWTH PHASE

No. of respondent farmers →	Sagar	Basanti	Overall
After stocking only	2	4	6
Mid-crop only	34	83	117
End-crop only	5	36	41
After stocking, Mid-crop	2	4	6
After stocking, End-crop	1	1	2
Mid-crop, End-crop	3	15	18
After stocking, Mid-crop, End-crop	0	0	0
TOTAL	46	143	189

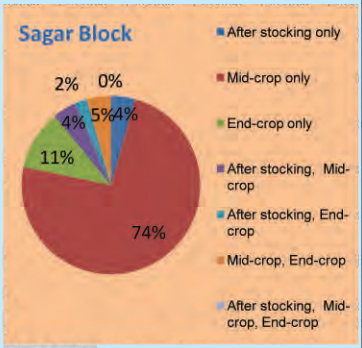


Fig 7.5.6a: Disease occurrence in growth phase (Sagar Block)

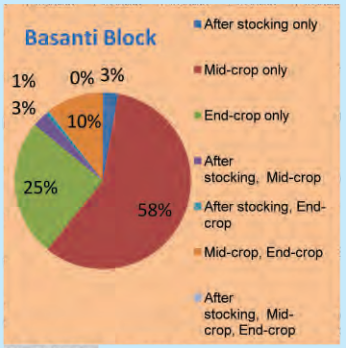


Fig 7.5.6b: Disease occurrence in growth phase (Basanti Block)

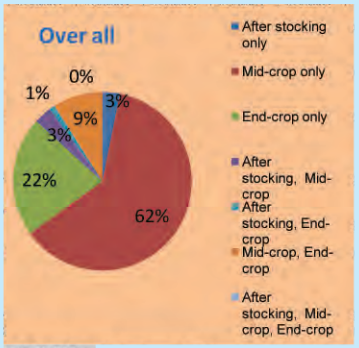


Fig 7.5.6c: Disease occurrence in growth phase (Overall)

Table 7.5.7 TREATMENT AGAINST DISEASES

No. of respondent farmers →	Sagar	Basanti	Overall
Action taken against diseases	108	112	220
No action taken	1	55	56

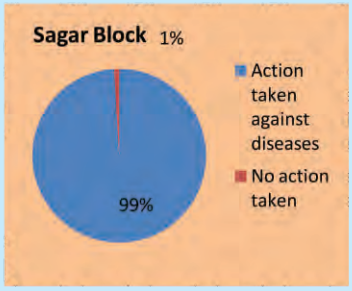


Fig 7.5.7a: Action against disease taken by farmers (Sagar Block)

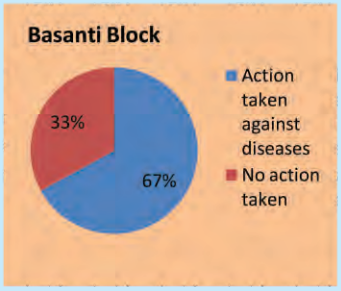


Fig 7.5.7b: Action against disease taken by farmers (Basanti Block)

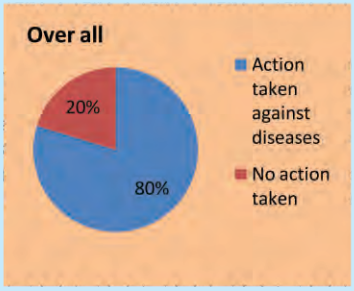


Fig 7.5.7c: Action against disease taken by farmers (Overall)

Table 7.5.8 NATURE OF TREATMENT

No. of respondent farmers →	Sagar	Basanti	Overall
Liming	73	94	167
Water exchange	0	0	0
Use of chemicals	1	2	3
Antibiotics	4	1	5
Liming, Water exchange	15	3	18
Liming, Use of chemicals	12	12	24
Liming, Antibiotics	0	0	0
Liming, Water exchange, Use of chemicals	3	0	3
Liming, Water exchange, Use of chemicals, Antibiotics	0	0	0
TOTAL	108	112	220

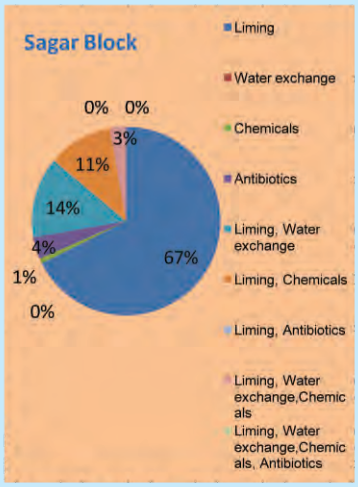


Fig 7.5.8a: Nature of treatment (Sagar Block)

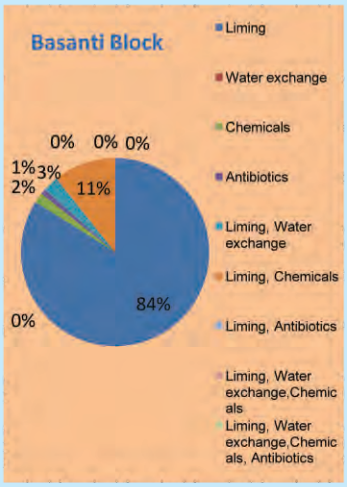


Fig 7.5.8b: Nature of treatment (Basanti Block)

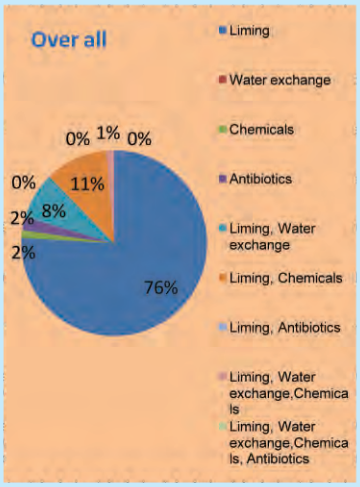


Fig 7.5.8c: Nature of treatment (Overall)

7.6: Harvesting and marketing

Table 7.6.1 MODE OF HARVESTING (n = 451)

No. of respondent farmers →	Sagar	Basanti	Overall
Single	146	76	222
Multiple	98	131	229
TOTAL	207	244	451

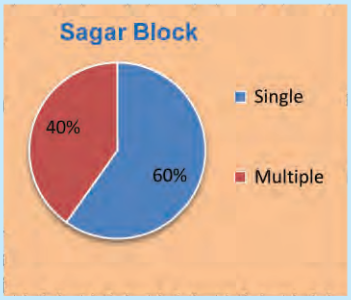


Fig 7.6.1a: Mode of harvesting (Sagar Block)

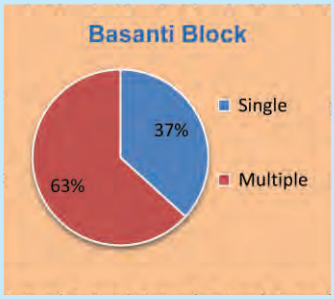


Fig 7.6.1b: Mode of harvesting (Basanti Block)

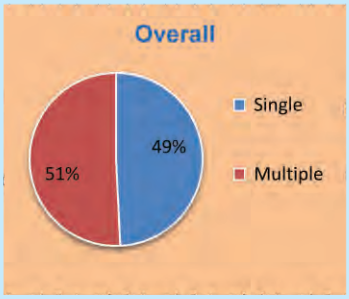


Fig 7.6.1c: Mode of harvesting (Overall)

Table 7.6.2 MODE OF MARKETING (n = 451)

No. of respondent farmers →	Sagar	Basanti	Overall
At pond site	26	2	28
Local market	173	193	366
through middle man	12	6	18
At pond site , Local market	7	0	7
Local market , through middle man	21	3	24
At pond site, through middle man	5	3	8
TOTAL	244	207	451

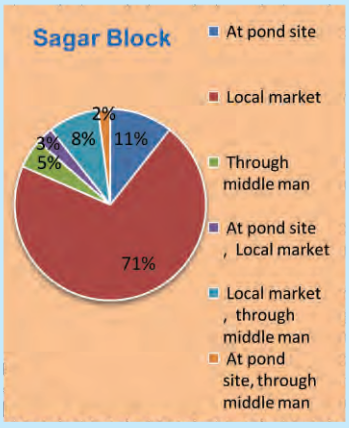


Fig 7.6.2a: Mode of marketing (Sagar Block)

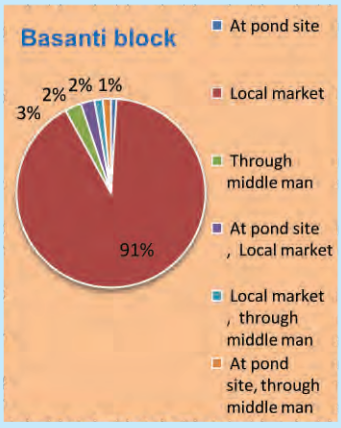


Fig 7.6.2b: Mode of marketing (Basanti Block)

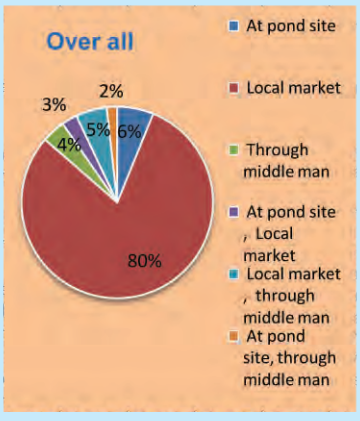


Fig 7.6.2c: Mode of marketing (Overall)

7.7: Productivity

Table 7.7.1 TOTAL FINFISH PRODUCTION (Kg/ Bigha)

No. of respondent farmers →	Sagar	Basanti	Overall
< 70 Kg / Bigha	10	6	16
70 - 100 Kg / Bigha	32	48	80
101 - 200 Kg / Bigha	94	126	220
201 - 300 Kg / Bigha	38	14	52
301 - 400 Kg/ Bigha	11	1	12
> 400 Kg /Bigha	35	2	37

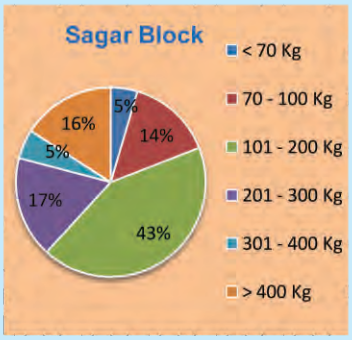


Fig 7.7.1a: Total fish production (Kg/Bigha) (Sagar Block)

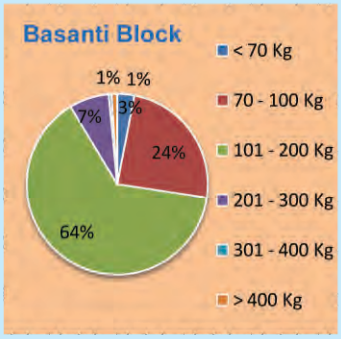


Fig 7.7.1b: Total fish production (Kg/Bigha) (Basanti Block)

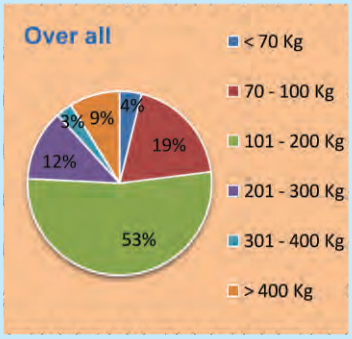


Fig 7.7.1c: Total fish production (Kg/Bigha) (Overall)

Table 7.7.2 TOTAL SHELLFISH PRODUCTION (Kg/ Bigha)

No. of respondent farmers →	Sagar	Basanti	Overall
< 20 Kg / Bigha	5	52	57
20 - 50 Kg / Bigha	31	89	120
51 - 100 Kg / Bigha	28	1	29
101 - 200 Kg / Bigha	23	1	24

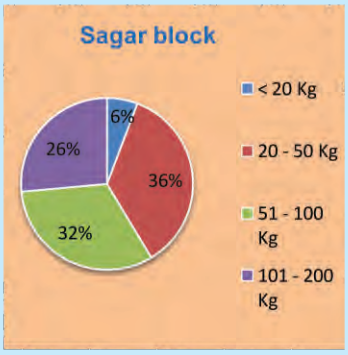


Fig 7.7.2a: Total shellfish production (Kg/Bigha) (Sagar Block)

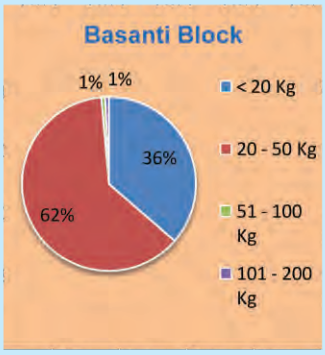


Fig 7.7.2b: Total shellfish production (Kg/Bigha) (Basanti Block)

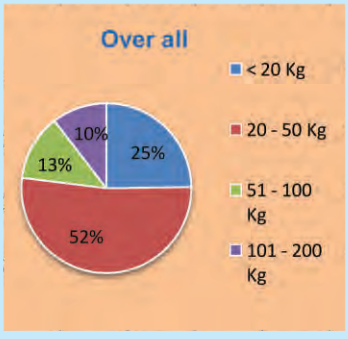


Fig 7.7.2c: Total shellfish production (overall)

7.8: Water quality monitoring

Table 7.8.1 WATER pH MEASUREMENT (n = 451)

No. of respondent farmers →	Sagar	Basanti	Overall
Water pH measured	114	148	262
Water pH not measured	130	59	189
TOTAL	244	207	451

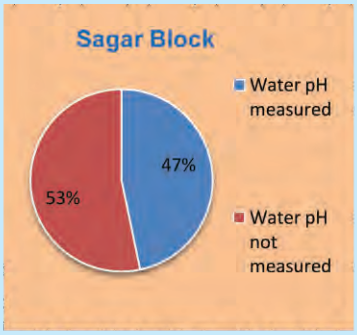


Fig 7.8.1a: Pond pH monitoring (Sagar Block)

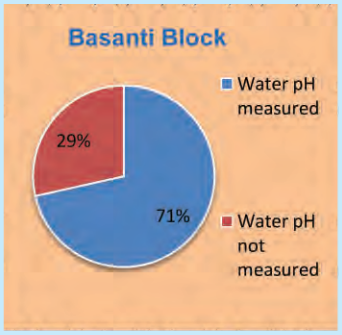


Fig 7.8.1b: Pond pH monitoring (Basanti Block)

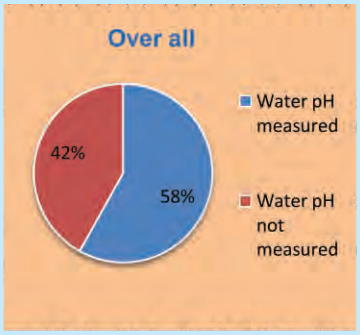


Fig 7.8.1c: Pond pH monitoring (Overall)

Table 7.8.2 WATER pH RANGE

No. of respondent farmers →	Sagar	Basanti	Overall
pH range < 7.5	10	39	49
pH range 7.5 - 8.5	66	59	125
pH range > 8.5	38	50	88
TOTAL	114	148	262
pH Maximum value	9.9	10	10
pH Minimum value	5.5	5.8	5.5

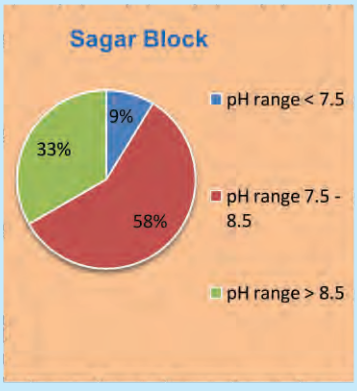


Fig 7.8.2a: pH range in aqua farm (Sagar Block)

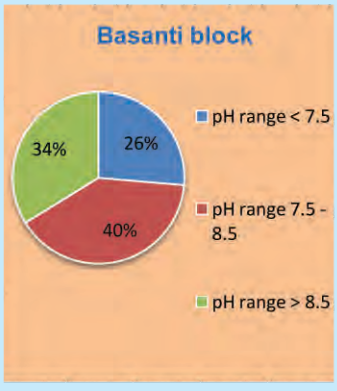


Fig 7.8.2b: pH range in aqua farm (Basanti Block)

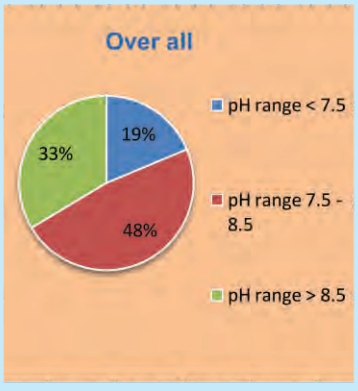


Fig 7.8.2c: pH range in aqua farm (Overall)

Table 7.8.3 WATER SALINITY MEASUREMENT (n = 451)

No. of respondent farmers →	Sagar	Basanti	Overall
Water salinity measured	98	77	175
Water salinity not measured	146	130	276
TOTAL	244	207	451

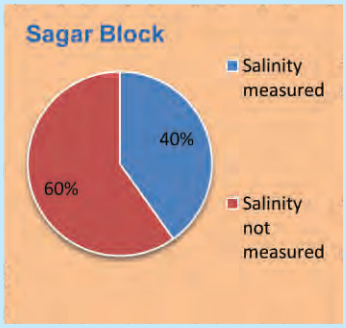


Fig 7.8.3a: Pond salinity monitoring (Sagar Block)

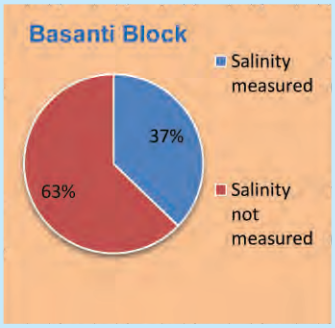


Fig 7.8.3b: Pond salinity monitoring (Basanti Block)

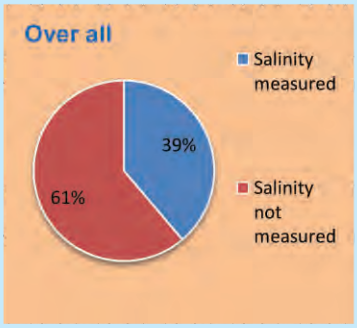


Fig 7.8.3c: Pond salinity monitoring (Overall)

Table 7.8.4 WATER SALINITY RANGE

No. of respondent farmers →	Sagar	Basanti	Overall
Salinity range-0 ppt	41	21	62
Salinity range < 2 ppt	39	28	67
Salinity range 2-5 ppt	14	23	37
Salinity range > 5 ppt	4	5	9
TOTAL	98	77	175
Salinity Maximum value (ppt)	3	9.5	9.5
Salinity Minimum value (ppt)	0	0	0

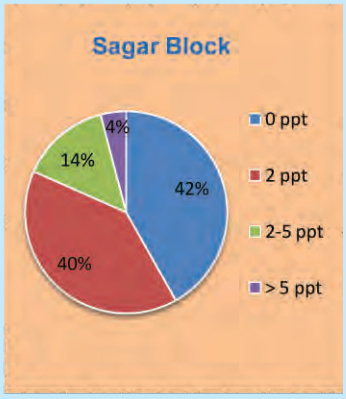


Fig 7.8.4a: Salinity range in aqua farm (Sagar Block)

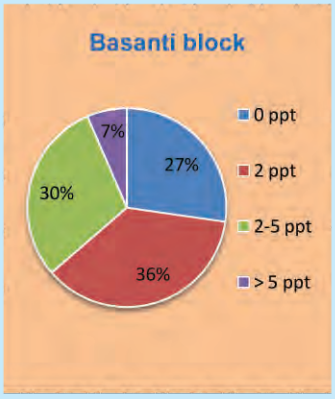


Fig 7.8.4b: Salinity range in aqua farm (Basanti Block)

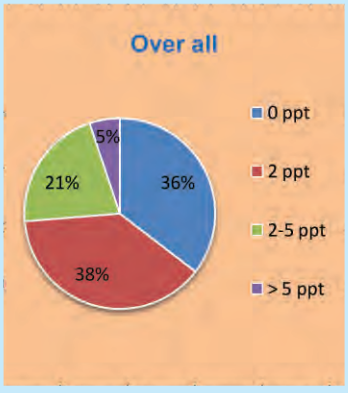


Fig 7.8.4c: Salinity range in aqua farm (Overall)

7.9 Climate change impact on aquaculture

Table 7.9.1 PRE CYCLONIC *(AILA)* SCENARIO

No. of respondent farmers →	Sagar	Basanti	Overall
High stocking	101	89	190
Poor managed	47	2	49
Less damage	31	1	32
Presence of few species	58	41	99
No water quality problem	19	22	41
Fresh water pond	38	90	128
No fish disease	21	7	28
Better growth	42	17	59
Normal pond environment	57	8	65
Pond dyke intact	33	64	97
High risk of disease	5	3	8
Not affected in cyclone	27	92	119
Normal aquaculture practice	35	7	42

Table 7.9.2 PRE CYCLONIC *(AILA)* EFFECT (n = 451)

No. of respondent farmers →	Sagar	Basanti	Overall
Escape of fish	101	85	186
Well managed	47	2	49
More damage to stock	32	1	33
Entry of various other species of fish	58	44	102
Detoriation of water quality	20	21	41
Ingression of saline water into pond	38	87	125
Mortality of fish	21	18	39
Retardation of growth	42	16	58
Loss/damage of pond environment	54	7	61
Breach of pond dyke	32	64	96
Low disease due to high salinity	5	3	8
Not affected in cyclone	27	92	119
Aquaculture increases after "Aila"	35	7	42

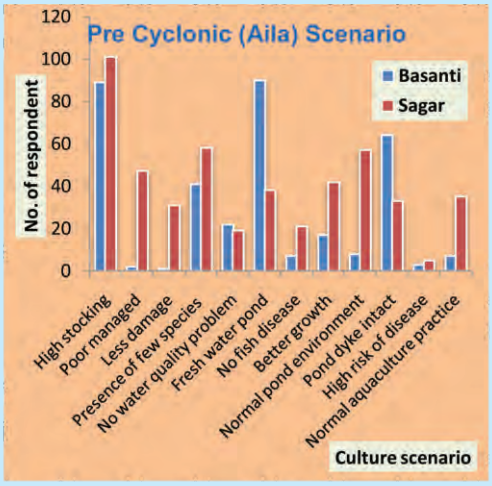


Fig 7.9.1c: Pre cyclonic culture scenario

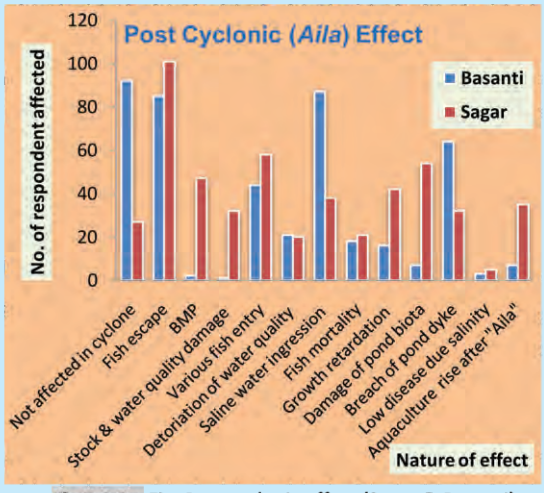


Fig 7.9.2c: Fig: Post cyclonic effect (Sagar & Basanti)

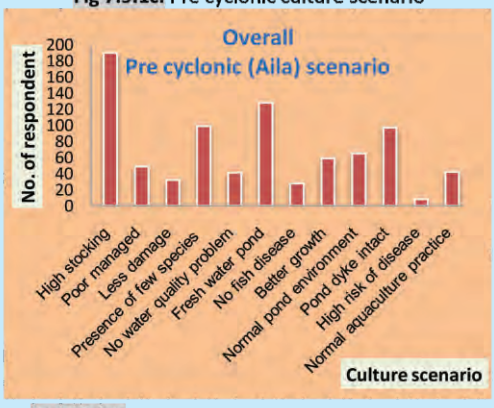


Fig 7.9.1d: Pre cyclonic culture scenario (Overall)

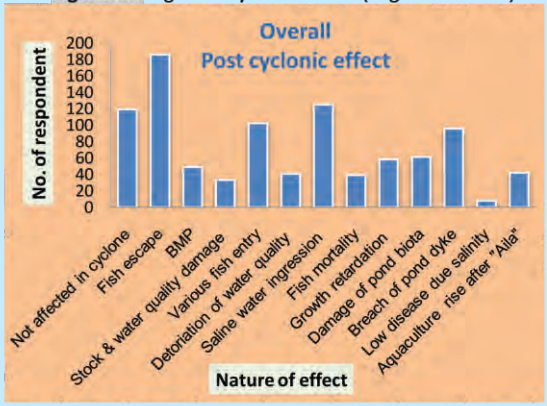


Fig 7.9.2d: Post cyclonic effect (Overall)

Table 7.9.3 MAJOR PROBLEM IN CULTURE DURING CYCLONE (n = 451)

No. of respondent farmers →	Sagar	Basanti	Overall
Ingression of saline water into pond	200	106	306
Breach of pond dyke	205	116	321
Escape of fish stock from the pond	138	97	235
Entry of other (unwanted) fish species	52	31	83

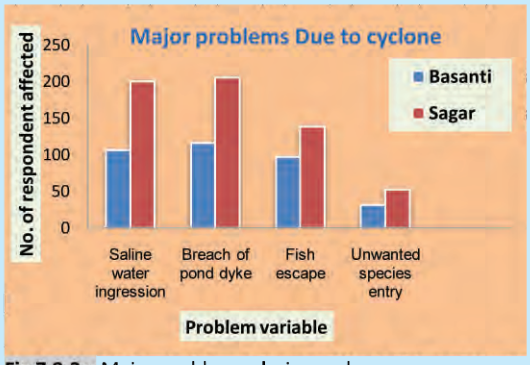


Fig 7.9.3c: Major problems during cyclone

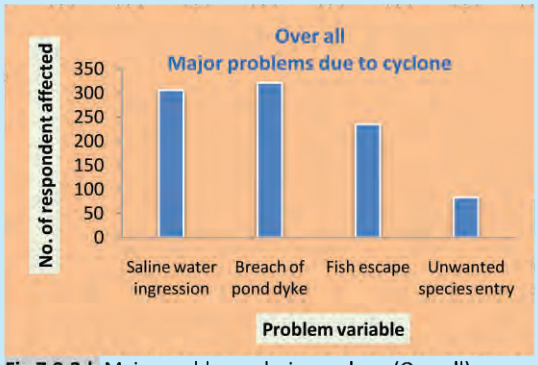


Fig 7.9.3d: Major problems during cyclone (Overall)

Table 7.9.4 COPING MEASURES AGAINST CYCLONE EVENTS (n = 451)

No. of respondent farmers →	Sagar	Basanti	Overall
Application of lime	46	4	50
Addition of fresh/rain water	32	12	44
Application of chemicals/fertilizers	21	8	29
Dewatering	33	42	75
Repair of pond dyke with earth/polythene	88	77	165
Addition of tree branches in the pond for fish aggregation	4	2	6
Plantation in pond dyke	65	10	75
Increase of pond dyke height to prevent entry of saline water	115	26	141
Application of cow dung for saline water treatment	3	1	4
No measures taken	43	40	83

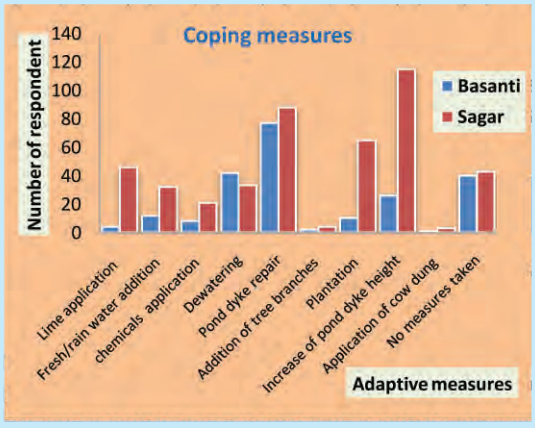


Fig 7.9.4c: Coping measures adapted by farmers (sagar & Basanti)

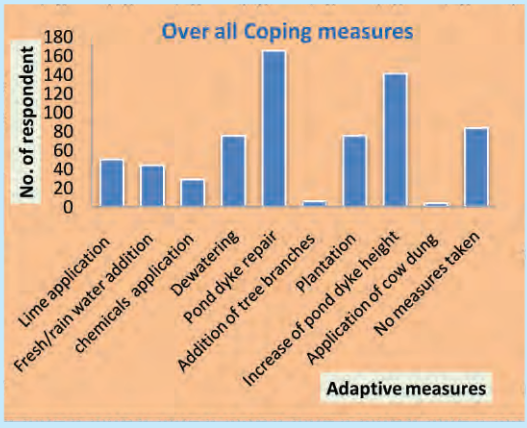


Fig 7.9.4d: Coping measures adapted by farmers (Overall)

Table 7.9.5 BIOGENIC CHANGES OBSERVED IN FISH WITH CLIMATE CHANGE (n = 451)

No. of respondent farmers →	Sagar	Basanti	Overall
Freshwater fish survive in low saline water	71	149	220
Brackishwater fish & shell fish survive in fresh water	68	147	215
Fish growth reduces	59	11	70
Disease occurrence rises	39	5	44
Disease occurrence decreases	16	2	18
Egg laying & spawning time change	36	2	38
Not observed	42	32	74

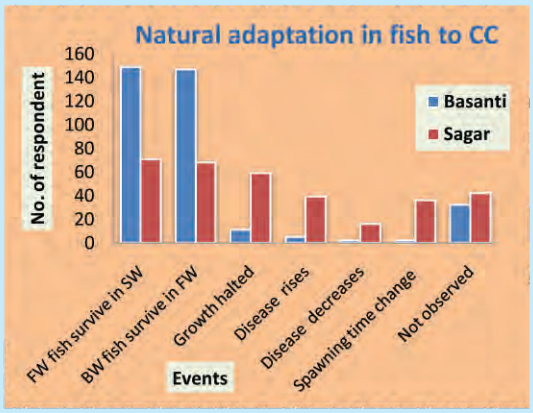


Fig 7.9.5c: Farmers view on natural adaptation of fish in CC (Sagar & Basanti)

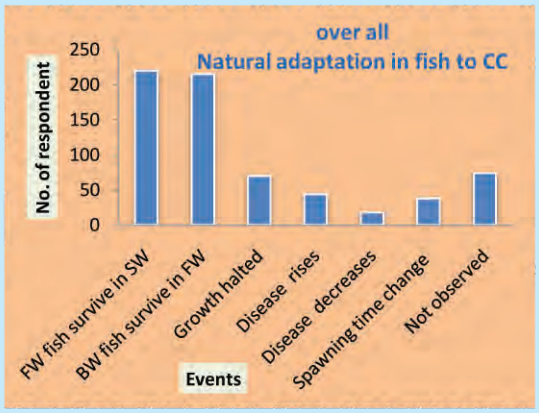


Fig 7.9.5d: Farmers view on natural adaptation of fish in CC (Overall)

Table 7.9.6 FARMERS VIEW ON FREQUENCY OF CYCLONE (n = 451)

No. of respondent farmers →	Sagar	Basanti	Overall
Increased in last 20 years	195	199	394
Decreased in last 20 years	42	7	49
Remained same	7	1	8
Total	244	207	451

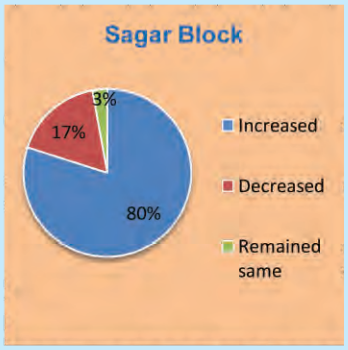


Fig 7.9.6a: Farmers view on frequency of cyclone (Sagar Block)

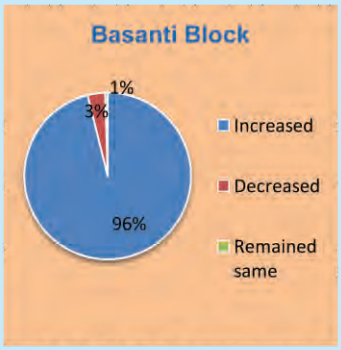


Fig 7.9.6b: Farmers view on frequency of cyclone (Basanti Block)

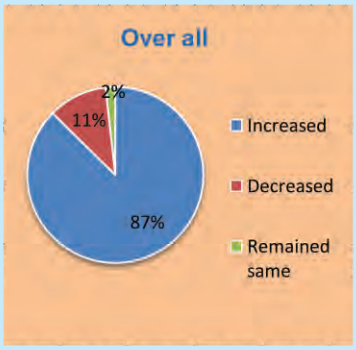


Fig 7.9.6c: Farmers view on frequency of cyclone (Sagar Block)

7.10 Environmental threats in sundarban Biome

Table 7.10.1 IMPACT OF CLIMATE CHANGES IN SUNDARBAN (n = 451)

No. of respondent farmers →	Sagar	Basanti	Overall
Irregularities in season change	125	55	180
Rises in temperature, very hot during summer	136	142	278
Erratic monsoon / low rainfall	65	46	111
More cyclone & heavy downpour during cyclone	30	42	72
Shortening of monsoon & winter period	24	9	33
Increase in river salinity	4	3	7
Loss in agriculture, aquaculture and animal husbandry	19	3	22
Flood	10	12	22
Drought	4	10	14
pH fluctuation in pond	4	1	5
Loss of land due to erosion	18	3	21
Loss of mangrove & wild life	52	2	54
Migration of people from island for work	4	2	6
Increase in human diseases	3	5	8
Does not know	49	32	81

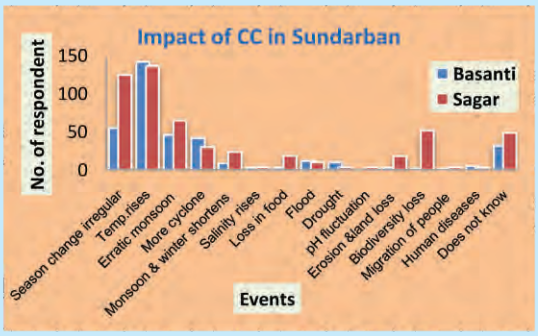


Fig 7.10.1c: Farmers view on impact of CC in Sundarban

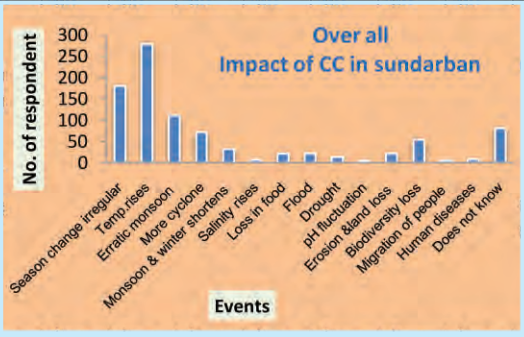


Fig 7.10.1d: Farmers view on impact of CC in Sundarban

Table 7.10.2 IMPACT ON WILD SHRIMP SEED CATCH (n = 451)

No. of respondent farmers →	Sagar	Basanti	Overall
Loss of riverine ecosystem & biodiversity	106	53	159
Killing of seed of miscellaneous shell fish and fin fish	168	157	325
Strong Govt. rule to stop shrimp seed catch	30	13	43
Air pollution due to bad odour by dead seeds thrown on the dyke	8	5	13
Damage of river bund due to constant shrimp seed catching activities	5	63	68
Destruction of mangrove seedlings	7	44	51
Does not know	43	25	68

Fig 7.10.2c: Farmers view on impact of wild seed catch (Sagar & Basanti)

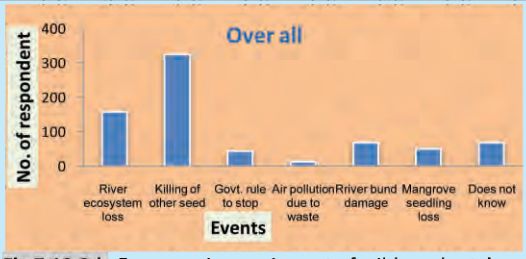


Fig 7.10.2d: Farmers view on impact of wild seed catch (Overall)

Table 7.10.3 FISHES UNDER THREAT (n = 451)

No. of respondent farmers →	Sagar	Basanti	Overall	No. of respondent farmers →	Sagar	Basanti	Overall
Pabda (*Ompok pabda*)	93	16	109	Kholse(*Colisa fasciata*)	7	15	22
Boal (*Wallago attu*)	168	99	267	Chitol (*Chitala chitala*)	1	3	4
Chang (*Channa gachua*)	173	54	227	Pholui (*N.notopterus*)	6	4	10
Saral Punti (*Puntius sarana*)	107	22	129	Akash Tengra (*Mystus guilo*)	3	1	4
Sutafuli Tangra (*M.vittatus*)	18	2	20	Murrel (*C.marulius, C.striata, C. punctata*)	85	71	156
Catfishes (*Clarias batrachus, Heteropneustes fossilis*)	114	34	148	Pakal (*Mastacembelus armatus/ Macrognathus pancalus*)	8	29	37
Bele (*Glossogobius sp.*)	3	4	7	Koi (*Anabas testudineus*)	29	61	90
Nuna Bele (*G.giuris*)	8	1	9	Tint Punti (*Ticto ticto*)	3	25	28
Ban (*Anguilla bengalensis*)	47	45	92	Chanda (*Chanda nama*)	8	38	46
Mourala (*A.mola*)	20	10	30	Nadosh (*Nandus nandus*)	56	130	186

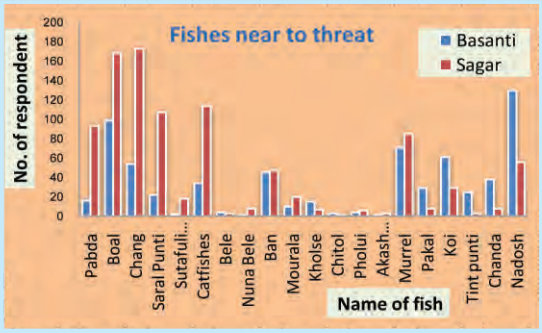


Fig 7.10.3a: Farmers view on presumed threatened fish (Sagar & Basanti)

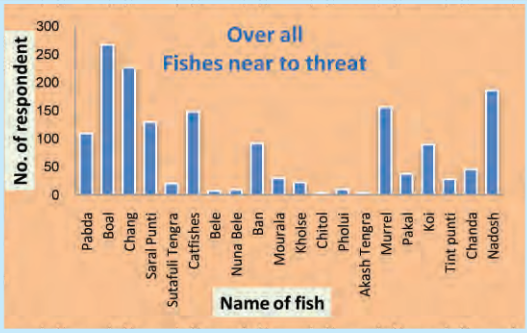


Fig 7.10.3b: Farmers view on presumed threatened fish (Overall)

Table 7.10.4 EXOTIC FISH WIDELY CULTURED (n = 451)

No. of respondent farmers	Sagar	Basanti	Overall	No. of respondent farmers	Sagar	Basanti	Overall
Rupchanda	242	204	446	Pangus	22	73	95
Hybrid Magur	189	96	285	Grass Carp	3	8	11
Silver Carp	9	17	26	Nilotica	3	5	8
Bighead Carp	4	3	7	Golden Carp	4	11	15

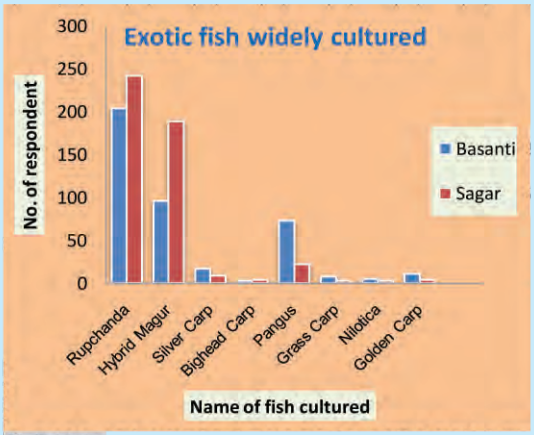


Fig 7.10.4c: Other invasive species cultured in locality (Sagar & Basanti)

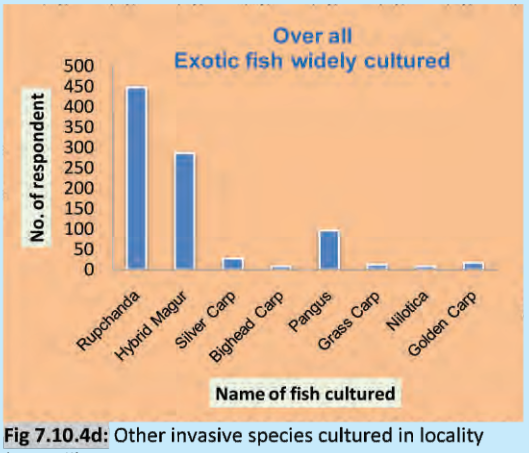


Fig 7.10.4d: Other invasive species cultured in locality (Overall)

Table 7.10.5 NATURAL BREEDING STATUS OF FISHES [*Cat fishes, Murrels, Small Indigenous Species] (n = 451)

No. of respondent farmers →	Sagar	Basanti	Overall
Natural breeding reduces due to huge application of chemicals/pesticides in paddy fields	34	55	89
Breeding habitat destruction	40	78	118
Natural breeding reduces due to inadequate water availability in low lying area/paddy field & due to crop rotation	24	24	48
Natural breeding decreases due to climate change	13	16	29
Natural breeding status very poor at present	132	47	179
Natural breeding reduces due to various diseases	7	4	11
Natural breeding reduces due to anthropogenic activities	7	2	9
Natural breeding status normal at present	12	1	13
Does not know	12	26	38

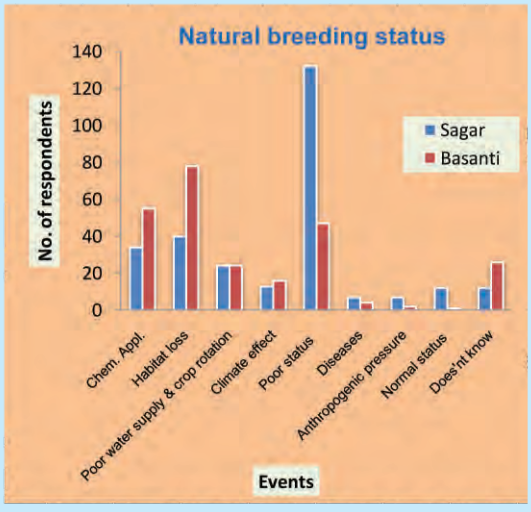


Fig: Farmers view on natural breeding status of some fishes (Sagar & Basanti Block)

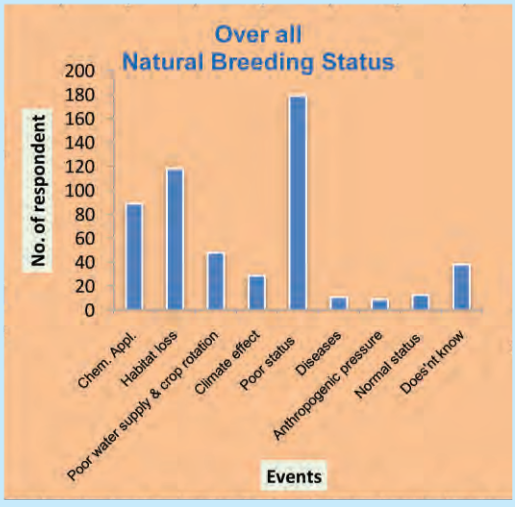


Fig: Farmers view on natural breeding status of some fishes (Overall)

*Catfishes include *Clarias batrachus, Heteropneustes fossilis, Anabas testudineus*
*Murrels include *Channa marulius, Channa striatus, Channa punctatus*
*SIS include *Ticto ticto, Puntius puntius, Amblypharyngodon mola*

7.11. Risk Assessment of Climate Change variables

Risk can be defined as the probability of harmful consequences, or expected losses (deaths, injuries, property, livelihoods, economic activity disrupted or environment damaged) resulting from interactions between natural or human-induced hazards and vulnerable conditions.

For the purpose of this study, risk is defined as the likelihood of aquaculture and livelihood assets being affected as a result of high intensity climate change events, and the varying degrees of consequence.

The assessment of risk is based on determining the likelihood and consequence of something happening. It involves following steps-

1. Determination of qualitative assets (Livelihood, fishery, and biodiversity) which is being affected.
2. Determination of consequences of climate change event on assets.
3. Determination of likelihood of each asset will be affected.
4. Determination of risk rating.

Table 7.11a : Qualitative Measures of Consequence

Level	Descriptor	Livelihood	Fishery	Biodiversity
1	**Little Negative**	No or little negative effect on livelihood & economy	No or little negative effect on culture fishery	No or little negative effect on local biodiversity
2	**Minor Negative**	Localized & short-term disruption of livelihood & economy	Temporary negative effect on culture fishery	Minor environmental damage that could be reversed
3	**Moderately Negative**	Moderate negative effect on livelihood & economy, damage recoverable by maintenance and minor repair	Short term negative effect on culture fishery	Significant environmental damage that might be reversed with intense efforts
4	**Extremely Negative**	Extensive negative effect on livelihood & economy, a key element of economy is disrupted for an extended period of time, required extensive maintenance and repair	Significant long term negative effect on culture fishery	Extensive loss of environmental amenities and significant long term negative effect on biodiversity
5	**Disastrous**	Permanent negative effect on livelihood & economy, more than one key element of economy is disrupted for an extended period of time	Major widespread damage and permanent loss of culture fishery	Major widespread loss of environmental amenity and progressive irrecoverable environmental damage

Table 7.11b : Qualitative Measures of LIkelihood

Level	Descriptor	Recurrent risk	Event occurrence
5	**Almost Certain**	Could occur more than once in a year	More likely than not (Probability > 50%)
4	**Likely**	May occur about once in a year	As likely as not (50/50 chance)
3	**Possible**	May occur once in 10 years	Less likely than not, but still appreciable (probability <50%, but still quite high)
2	**Unlikely**	May occur once in 10-25 years	Unlikely, but not negligible (probability low, but noticeably >0)
1	**Rare**	Unlikely during next 25 years	Negligible (Probability very small, close to 0)

Table 7.11c : Risk Rating Matrix

Likelihood	Consequences				
	Little Negative (1)	**Minor Negative** (2)	**Moderately Negative** (3)	**Extremely Negative** (4)	**Disastrous** (5)
Almost Certain (5)	Medium (5)	Medium (10)	High (15)	Extreme (20)	Extreme (25)
Likely (4)	Low (4)	Medium (8)	High (12)	High (16)	Extreme (20)
Possible (3)	Low (3)	Medium (6)	Medium (9)	High (12)	High (15)
Unlikely (2)	Low (2)	Low (4)	Medium (6)	Medium (8)	Medium (10)
Rare (1)	Low (1)	Low (2)	Low (3)	Low (4)	Medium (5)

Extreme Risk ≥ 20	:	Priority attention is required to develop management and adaptation plans
High Risk ≥ 20	:	Action is required to develop management and adaptation plans
Medium Risk ≥ 5	:	Action to manage risks by monitoring or planning response procedure is required
Low Risk <5	:	Routine monitoring is required but specific application of resources is unlikely

Table 7.11d: Risk Assessment of Climate Change variables in Sagar Block of Sundarban

Likelihood	Consequences				
	Little Negative (1)	Minor Negative (2)	Moderately Negative (3)	Extremely Negative (4)	Disastrous (5)
Almost Certain (5)		Temp. Rise Score: 10			Cyclone Score: 25
Likely (4)		Hot and Extended summer Score: 8	Erratic monsoon Score: 12		Coastal Flooding Score: 20
Possible (3)		Sea Level Rise Score: 6	Precipitation Score: 9	Storm Surge Score: 12	Land Erosion Score: 15
Unlikely (2)					
Rare (1)					

Table 7.11e : Risk Assessment of Climate Change variables in Basanti Block of Sundarban

Likelihood	Consequences				
	Little Negative (1)	Minor Negative (2)	Moderately Negative (3)	Extremely Negative (4)	Disastrous (5)
Almost Certain (5)		Temp. Rise Score: 10			Cyclone Score: 25
Likely (4)	Coastal Flooding Score: 4	Hot and Extended summer Score: 8	Erratic monsoon Score: 12		
Possible (3)	Sea Level Rise Score: 3	Land Erosion Score: 6	Precipitation Score: 9	Storm Surge Score: 12	
Unlikely (2)					
Rare (1)					

Table 7.11f : Relationship between climate change and risks associated with aquaculture

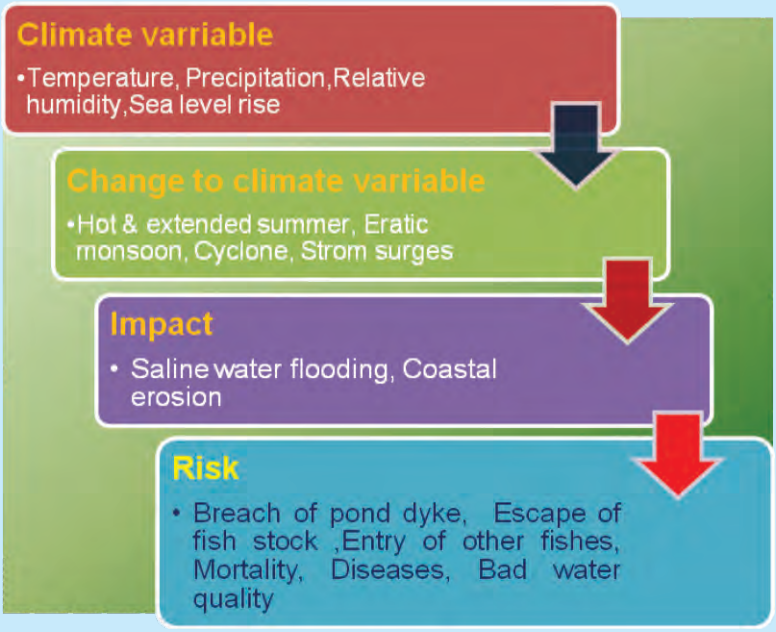


Table 7.11g: Climate calendar of last ten years in two blocks

Climatic event	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Summer												
High Temp.												
Monsoon												
Heavy Rain												
Winter												
Low temp.												

Table 7.11h: Aquaculture crop calendar in two blocks

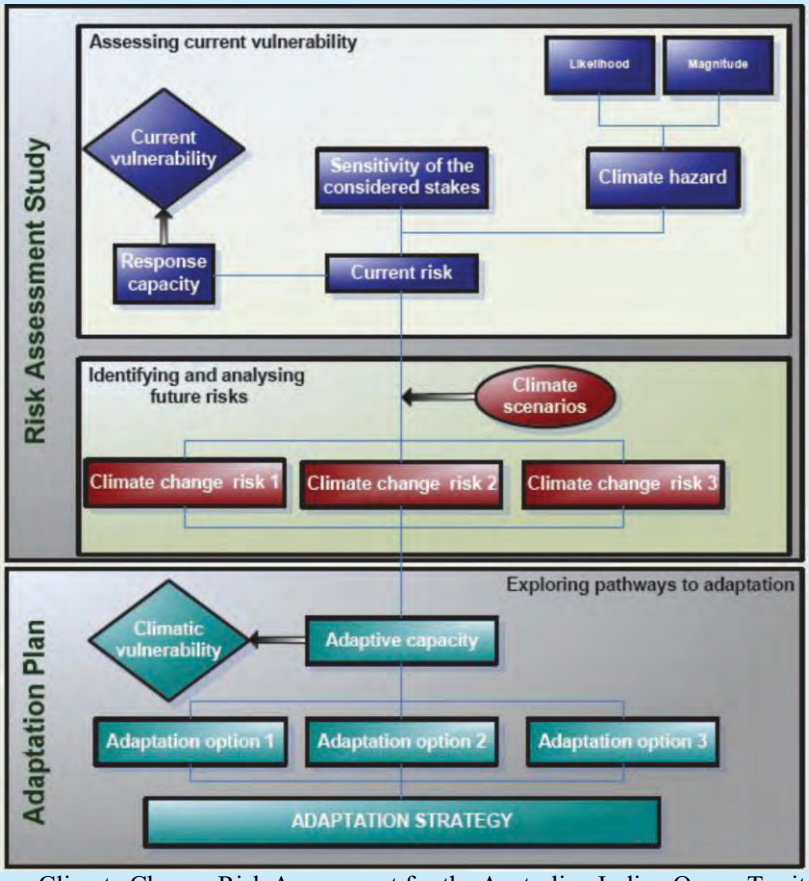
Climatic event	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Freshwater polyculture												
Shrimp monoculture												
Brackish water polyculture												
Bhery culture												
Paddy cum fish culture												
Sagar Block	Basanti Block											

Table 7.11i: Classification of major Risks involved in aquaculture due to saline water inundation

Sagar Block		Basanti Block	
Risk attributes	**Rating**	**Risk attributes**	**rating**
Breach of pond dyke		Breach of pond dyke	
Escape of fish stock		Escape of fish stock	
Entry of unwanted species		Entry of unwanted species	
Mortality of fish		Mortality of fish	
Retardation of growth		Retardation of growth	
Detoriation of water quality		Detoriation of water quality	
Damage of pond environment		Damage of pond environment	
Diseases		Diseases	

Risk Rating	Extreme Risk	High Risk	Medium Risk	Low Risk
Colour Code				

Fig 7.11j: The risk assessment process



Source: Climate Change Risk Assessment for the Australian Indian Ocean Territories. www.regional.gov.au/territories/.../Final+Report+CKI+and+CC.pdf

Table 7.11k : Key Terms of Climate Change Risk Assessment

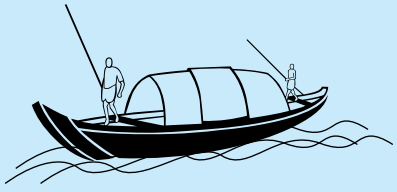
Key Terms	
Climate change	Climate change refers to a change of climate that is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and that is in addition to natural climate variability observed over comparable time periods (United Nations Framework Convention on Climate Change)
Climate scenario	A coherent, plausible but often simplified description of a possible future state of the climate. A climate scenario should not be viewed as a prediction of the future climate. Rather, it provides a means of understanding the potential impacts of climate change, and identifying the potential risks and opportunities to an organisation created by an uncertain future climate.
Risk	Risk is defined in general terms as the product of the frequency (or likelihood) of a particular event and the consequence of that event, be it in terms of lives lost, financial cost and/or environmental impact.
Hazard	A physically defined source of potential harm, or a situation with a potential for causing harm, in terms of human injury; damage to health, property, the environment, and other things of value; or some combination of these.
Sensitivity	Refers to the degree to which a system is affected, either adversely or beneficially, by climate related variables including means, extremes and variability.
Adaptation	Actions in response to actual or projected climate change and impacts that lead to a reduction in risks or a realisation of benefits. A distinction can be made between a planned or anticipatory approach to adaptation (i.e. risk treatments) and an approach that relies on unplanned or reactive adjustments.
Adaptive capacity	The capacity of an organisation or system to moderate the risks of climate change, or to realise benefits, through changes in its characteristics or behaviour. Adaptive capacity can be an inherent property or it could have been developed as a result of previous policy, planning or design decisions of the organisation.
Mitigation	A human intervention to actively reduce the production of greenhouse gas emissions (reducing energy consumption in transport, construction, at home, at work etc.), or to remove the gases from the atmosphere (sequestration).
Vulnerability	Vulnerability is a function of risk and response capacity. It is a combination of the physical parameter of the hazards and its consequences such as personal injuries, degradation of buildings and infrastructure and functional perturbations. It is also varying depending on non physical factors such as emergency preparation, education, recovering capacity.
Climatic vulnerability	Climatic vulnerability is defined by the IPCC as “the degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate change and variation to which a system is exposed, its sensitivity, and its adaptive capacity”

Source: Climate Change Risk Assessment for the Australian Indian Ocean Territories. www.regional.gov.au/territories/.../Final+Report+CKI+and+CC.pdf

7.12 Climate Change associated risk in aquaculture and their assessment

Geographic location and distance from the sea is different in two study sites. Sagar island is located in the western sector of Indian Sundarban at the confluence of Bay of Bengal and Hoogly river. Whereas Basanti block is located in eastern sector of Indian Sundarban and far from sea. Survey results reveal that the inhabitants of Sundarban are experiencing extended & extreme summer, erratic monsoon and short winter. The frequency and intensity of extreme weather events like cyclone and storm surge have increased over the period of time. These have significant bearing on erosion of land mass and saline water ingression in the inhabited areas resulting loss of lives, agriculture and fish crops. Farmers consider aquaculture as a victim of climate change. Sagar being a sea facing island is more sensitive to climate change. It has suffered the bulk of erosion and only marginal accretion. Fishponds in low-lying areas of Gangasagar, Dhablat, Ramkarchar, Daspara Sumati Nagar and Ghoramara Gram Panchayats of Sagar block are prone to coastal flooding during rainy seasons. Ponds located at Jharkhali and Nafargunj Gram Panchayats of Basanti block are sensitive to saline water inundation during monsoonal storm.

Respondents of Sagar block considered events like cyclone and coastal flooding as extreme risk; erratic monsoon, storm surge and land erosion as high risk; temperature rise, sea level rise, hot & extended summer and precipitation as medium risk. Likewise, in Basanti block the respondents rated cyclone as extreme risk; erratic monsoon, storm surge as high risk; temperature rise, hot & extended summer, land erosion, and precipitation as medium risk; coastal flooding and sea level rise as low risk. Fish farmers of Sagar block classified the consequences of saline water flooding like breach of pond embankment and mass mortality of fishes as extreme risk; escape of existing fish stock and diseases as high risk; entry of unwanted species, retardation of growth and deterioration of water quality as medium risk; and damage of pond environment as low risk. Similarly, in Basanti block farmers categorised breach of pond dyke, mass mortality of fishes and entry of unwanted species as extreme risk; escape of fish and diseases as high risk; retardation of growth as medium risk; deterioration of water quality and damage of pond environment as low risk.



7.13 Brief Testimonials on Climate Change in Sundarban

Dulal Dinga, Age: 52
Village: Natendrapur,
Sagar Block, Sundarban

Incidence of tidal water over toping embankments during cyclone has increased over the period of time. This has resulted in flooding of agricultural fields as well as ponds. The island is very prone to erosion. In last 30-40 years, the hungry river has eaten away three island / *mouza* of sagar block (Lohachara, Bisalakshipur and Khasimara). At present, the fast eroding mouza (revenue village) are Botkahli, Beguakhali, Sapkhali, Muriganga, Sumatinagar & Ghoramara. Unpredictable weather and changing climate are making our lives horrible. Few prominent changes are: hotter summer, late arrival of winter, erratic rainfall. Monsoon rain is scanty. However, sometime very heavy rain due to formation of depression in bay of Bengal causing loss to the life, property and crop.

My family totally depends on income from agriculture and fishery (from 13 *bighas* of agricultural land and 4 *bighas* of pond). Entire patch of land is prone to saline water inundation as it is located beside a tidal-fed creek named Kirtankhali. When I compare the climate during my childhood and now, there is a remarkable change. Due to changing climate, pest attack and disease incidence in agriculture have increased leading to excess application of pesticide and chemicals. Now I am doing integrated farming; paddy, vegetable, banana, fishery together and earning comparatively better. Tidal surges now have become much powerful and hitting the embankments hard, often breaking them. It floods the pond and agricultural land. I try to prevent the escape of fish from the pond during flood. I protect my pond by erecting net fencing around the dyke.

Satyabrata Jana,
Age: 55,
Village: Bishnupur,
Sagar Block,
Sundarban

Sasanka Koyal,
Age: 75
Village: Bishnupur,
Sagar Island

Climate of Sundarban is definitely changing. We live in an island and we are in the mercy of river Ganga. The couse of river is changing and it may be a threat to the island. Our livelihood is in danger. Young boys are leaving the island in search of job. Agriculture and fishery are very much affected by natural calamities like flood, storm and erosion. People are cultivating betel leaf (paan) as cash crop and it is profitable also. But barouj (betel vine) are very much vulnerable to storm and flood. Due to changing climate, betel is also very much affected by disease and pest. Due to lack of technical knowledge, the betel farmers face lots of problems. In aquaculture, freshwater fish culture is very common. 15-20 years back, shrimp farming started in the island by local farmers and few outsiders also. But it stopped after some years due to virus attack. But recently again the farmers are taking up shrimp farming. Fishery also vulnerable to extreme climate events.

7.13 Brief Testimonials on Climate Change in Sundarban

Nurul Islam sardar, Age: 52,
Village: Uttar Goran Bose No:7, Bharatgarh,
Basanti Block

I have 33 bigha of agricultural land and 10 bigha of fishery. Our area was badly affected by Aila in 2009 mainly due to saline water flooding. After Aila, two years we did not have proper agriculture due to salinity of soil. Even now we cannot grow crops like potato, chilli, Ladies' finger, green gram etc. which we used to grow before Aila. Now we get few brackishwater fish like Bhetki, Tilapia, Lona tengra etc. in our freshwater pond. Though saline creek is nearer to my ponds, I cannot cultivate brackishwater fishes in full fledge due to non-availability of saline water in the creek even in spring tide. Govt. should dredge the creeks so that we culture brackishwater fish in our ponds. As my agricultural lands are getting saline due to frequent flooding, I feel it is worthwhile to convert land to fishpond.

I have brackishwater ponds in which I am doing crab fattening for past 3-4 years. It is profitable as it fetches good sale price due to export potential. In Sundarban, especially during rainy season we experience frequent cyclone due to which tidal surges are common. It often floods our agricultural land with salt water. Hence, some people now preferring brackishwater pisciculture, especially crab fattening over agriculture. Crab aquaculture can develop more in this region if Govt sets up a crab hatchery in Sundarban. This year we are getting more diseases in crab which may be due to climate change. Government should arrange training for crab farmers of this region.

Madhusudan Roy, Age: 60,
Village: Jharkhali 2 No. Scheme,
Basanti Block

Manindranath Giri,
Age: 66,
Village: Bishnupur,
Sagar Island, Sundarban

Sagar island is eroding fast. People living nearer to river are more vulnerable to erosion and flooding. In my area agricultural lands are turning saline due to repeated flooding. Fish crops are also getting affected due to breach of dyke, escape of fish, mortality etc. In some localities, freshwater fish farming is replaced by brackishwater fish farming. Very recently shrimp farming is gaining popularity in the areas nearer to salt water creek. But shrimp farming is very risky as it involves big investment and prone to disease attack. I am not sure for how many more year people will be able to live in this island. We are worry for the wellbeing of our next generation.

8. CONCLUSION

Evidences of climate change are numerous in Sundarban. These are duly supported by the feedbacks from local people, the scientific studies and the survey reports. Broadly the changes are: increase in air and water temperature, rise in sea level, enhanced erosion of land, amplification in frequency and intensity of extreme weather events like cyclone and storm *etc.* During cyclone and storm surge, saline water of the river rushes into the islands by breaking the embankments and incurs irreparable loss / damage of assets, lives and farmlands. These are putting enormous stresses, both biotic and abiotic on live and livelihood of the people of Sundraban. Sea levels are rising faster than the global average and high intensity events such as severe cyclones and tidal surges are becoming more frequent. As land-based livelihood activities get impacted due to these factors, more and more people are exploiting the living resources of the ecosystem in a manner that will be difficult to sustain over the long term. The situation has the potential to erode ecosystem integrity due to over exploitation of natural resources. Moreover, the loss of land is now a reality, causing human dislocation.

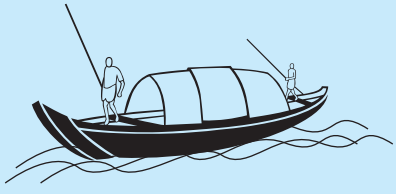
People in the Sundarban live a precarious existence at the best of times, but now global climate change is making matters worse for the Sundarban and its inhabitants. The situation can be tackled by enhancing risk preparedness and adaptive capacity of vulnerable communities. Developing policies and programs to improve the resilience of natural resources, implementation of climate adaptive livelihood activities, thorough assessments of risk and vulnerability, by increasing awareness of climate change impacts and strengthening key institutions, may help the communities adapt to climate change. In this context, adoption of climate-resilient agriculture including animal husbandry and fishery as an adaptation strategy will help in meeting the food security of Sundraban in changing climate.

Aquaculture operations in the region have to cope with changed climatic conditions prevailing in the region. Farmers are currently tackling the problems through short-term coping measures which need scientific improvements to give long-term relieve to the farmers. This is possible through formulation of climate-resilient adaptation strategies that will reduce the adverse consequences, and increases the positive consequences. Suggested adaptation strategies are outlined below.

- Prospect of alternative species is to be examined where the existing species is misfit. Introduction of salt tolerant freshwater species with better growth rate in the freshwater aquaculture areas prone to saline water inundation.

- Changes in the culture pattern and species combination for the affected regions. Over dependence on specific species should be avoided and emphasis should be given on species diversification. Addition of high value species should also be examined.

- Providing prompt information on extreme weather events like cyclone, depression, storm surges, tsunami *etc.* to the farmer directly through mass media / local media and guide them for taking suitable decisions.
- More integration among the farmers, aquaculture experts, climate scientists and extension workers is necessary.
- Repairing of age-old embankments and construction of new embankments wherever necessary to protect the island from the aggression of saline water during the period of high-tides accompanied by cyclonic storms.
- Better utilization of rainwater harvest ponds through scientific fish farming and integrating with livestock and crop production.
- Land shaping, reclamation and re-excavation of sweet water sources including step-cutting or terracing on inward-slopes of the ponds. These steps or terraces can be used for vegetable cultivation during dry periods.
- Integrated fish farming with livestock and agriculture can be popularized for more employment generation, better economic returns and less risk.
- Linkage between the fisheries output and effective marketing / processing has been weak in Sundarban region which needs to strengthened for better remuneration to the farmers.
- Development of alternative climate adaptive livelihood options for the fish farmers which will match to their skill and capacity.
- For each incidence of probable abnormal behaviour of weather, *viz.,* drought, flood and cyclone, area-specific, crop-specific and time-specific contingency plan should be prepared beforehand so that the action can be initiated at the very onset.
- Awareness to be created among the farming community and the common man about the various climate change issues with possible causes and impact.
- Crop-weather insurance should be introduced and implemented thoroughly.



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10. ACRONYMS AND SYMBOLS

^{0}C	Degree Celsius
CRIDA	Central Research Institute for Dryland Agriculture
CS	Cyclonic storm
EUS	Epizootic Ulcerative Syndrome
GP	Gram Panchayet
Ha	Hectare
Hr	Hour
IMC	Indian Major Carp
JGVK	Joygopalpur Gram Vikash Kendra
Kg	Kilogram
Km	Kilometre
Mm	Millimetre
MoEF	Ministry of Environment and Forests (India)
MPEDA	The Marine Products Export Development Authority
MT	Metric Ton
N	Sample Number
NGO	Non-Governmental Organization
NLTA	Non Lending Technical Assistance
NRM	Natural Resource Management
OBC	Other Backward Class
PL	Post Larvae
PPT	Parts Per Thousand
PSU	Practical Salinity Unit
PUPA	Paribesh Unnayan Parishad
PVC	Polyvinyl Chloride
RMSL	Relative Mean Sea Level
RSL	Rising Sea Level
Rs	Rupees
SC	Schedule Caste
SIS	Small Indigenous Species
SRC	Sub Regional Centre
SST	Sea Surface Temperature
ST	Schedule Tribe
UNESCO	The United Nations Educational, Scientific and Cultural Organization
WSSV	White Spot Syndrome Virus
WWF	World Wide Fund for Nature

Annexure - I

DEVELOPMENT OF CLIMATE RESILIENT AQUACULTURE STRATEGIES FOR SAGAR AND BASANTI BLOCKS OF INDIAN SUNDARBAN OF WEST BENGAL

Sponsored Research Component of National Initiative on Climate Resilient Agriculture (NICRA), ICAR

WEST BENGAL UNIVERSITY OF ANIMAL AND FISHERY SCIENCE
68, KSHUDIRAM BOSE SARANI, BELGACHIA, KOLKATA-700037

SURVEY QUESTIONNAIRE

A. GENERAL INFORMATION		
1. NAME OF FARMER :		
2. VILLAGE:	**GRAM PANCHAYAT:**	**BLOCK:**
3. AGE: Yrs.	**SEX:** Male / Female	**CASTE:** General / SC / ST / OBC / Muslim
4. EDUCATIONAL QUALIFICATION: Illiterate / Literate (Class:)		
5. FAMILY MEMBERS: Total: ; (Male: , Female:)		
6. INCOME SOURCE: (Tick options) Agriculture / Animal Husbandry / Fishing / Aquaculture / Service / Business / Others (Specify)		
7. FAMILY INCOME: Rs. / year		
B. INFORMATION ON AQUACULTURE		
8. TYPE OF AQUACULTURE: (i) Fin Fish *(Machh)* / Shell Fish *(chingri)* / Both (ii) Freshwater / Brackishwater / Both (iii) Traditional / Modified Extensive / Semi-intensive (iv) Monoculture / Polyculture / Integrated		
9. TYPE OF PONDS: (i) Seasonal / Perennial (ii) Inlet & Outlet – Present / Absent (iii) Total number of pond: (Grow-out: ; Nursery:) (iv) Total ponds area: Bigha (Ha.) (v) Water Depth in Summer: m; Moonsoon: m, Winter: m (v) Water Source: Rain water / Ground water / Creek water (vi) Other use of pond water: Household / irrigation / bathing		

(I)

C. POND MANAGEMENT

10. POND PREPERATION: (Put Tick Mark)

Dewatering / Bottom Sediment removal / De-weeding / Eradication of predator / Liming / Manuring

11. STOCKING: (i) Seed Source: Hatchery / Natural

(ii) Stocking type: Single / Multiple stocking

(iii) Fish Seed size: Spawn / fry / Fingerling

(iv) Prawn Seed size: PL / Juvenile

(v) Seed acclimatization done: Yes / No

(vi) Disinfection of seed done: Yes / No

(vii) Fish Species stocked:

(viii) Fish stocking rate : / bigha (/ ha)

(ix) Prawn Species stocked :

(viii) Prawn stocking rate: / bigha (/ ha)

12. SUPPLEMENTARY FEEDING: (i) Supplementary Feeding done : Yes / No

(ii) Type of feed: Rice bran & oil cake / Farm made / Branded Feed

(iii) If branded; Brand name: ; Pellet / Mash / wet ball

(iv) Frequency of feeding: Daily / ____ times per week

(v) Nature of Feeding: Broadcasting / tray feeding / bag feeding

13. HEALTH MANAGEMENT: (Put Tick Mark)

(i) Common diseases **in Fish**: Body Ulcer-EUS, Fin & tail rot, Fish lice- Argulus, Mal-nutrition (poor growth with large head & slender body), Others

(ii) Occurrence of disease (Season): Summer / Monsoon / Winter

(iii) Occurrence of disease (in growth phase): After stocking / Mid-crop / End-crop

(iv) Common diseases **in Prawn**: White spot virus, blackening of gill, Black lesion on shell & tail, Fungus outgrowth on shell, Others

(v) Occurrence of disease (Season): Summer / Monsoon / Winter

(vi) Occurrence of disease (in growth phase): After stocking / Mid-crop / End-crop

(vii) Treatment against disease: Liming / water exchange / use of chemicals / antibiotics

14. HARVESTING: (i) Mode of harvest: Single / Multiple

(ii) Fish species showing best growth (in order):

(iii) Prawn species showing best growth (in order):

(iv) Total Fish production: kg / Bigha / _____(duration)

(v) Total Prawn production: kg / Bigha / _____(duration)

(ii)

15. MARKETING: (i) Mode of marketing: At pond site / Local market / through middle man

(ii) Av. Sale price of fish : Rs. _____ / kg for fish size of _____

(iii) Av. Sale price of prawn : Rs. _____ / kg for prawn size of _____

16. WATER QUALITY: (i) Water pH (if measured): (ii) Water Salinity (if measured): ppt

(iii) Av. Water colour: Green / Dark Green / Light Green / Brown / Muddy / Others

(iv) Depletion of dissolved oxygen: Occur / Not occur / Not observed

17. KNOWLEDGE IN AQUACULTURE: (Tick options)

Govt. training / NGO training / from other farmers / self taught / from mass media

D. CLIMATE CHANGE / ENVIRONMENTAL ISSUES

18. PRE & POST Cyclone (*Aila*) SCENARIO IN AQUACULTURE: (in species composition, stocking density, management etc.)

Pre-Cyclone	Post-Cyclone
(i)	
(ii)	
(iii)	
(iv)	

19. FREQUENCY OF CYCLONE IN LAST 20 YEARS:

Increased / Decreased / Remained same / Does not know

20. PROBLEMS ENCOUNTERED IN AQUACULTURE DUE TO CYCLONE:

(i) Ingression of saline water into the pond

(ii) Breach of pond dyke

(iii) Escape of fish stock from the pond

(iv) Entry of other (unwanted) fish species

(v) Any other (explain, if any)

21. MEASURES TAKEN IN CASE OF INFLUX OF SALINE WATER IN FRESHWATER POND:

(i)

(ii)

(iii)

22. KNOWLEDGE ABOUT POSSIBLE IMPACTS OF CLIMATE CHANGE ON SUNDARBANS:

(i)

(ii)

(iii)

23. PRESENCE OF INVASIVE ALIEN SPECIES (IF ANY) IN THE LOCALITY: Paku (Rup Chanda), Hybrid Magur, Others (specify, if any)
24. NAME OF FEW THREATENED FISH SPECIES IN THE LOCALITY:
25. AWARENESS ON POSSIBLE ENVIRONMENTAL IMPACT OF SHRIMP SEED CATCH FROM THE RIVER:
26. HAVE YOU OBSERVED ANY NATURAL ADAPTATION OF FISH TO CLIMATE CHANGE?:
27. ANY INFORMATION OTHER THAN THE ONES DISCUSSED WHICH YOU WOULD WANT TO TELL:
28. PRESENT STATUS OF SELF-BREEDING FISHES (Magur, Koi, Singi, Chang, Lata, Punti, etc.}:

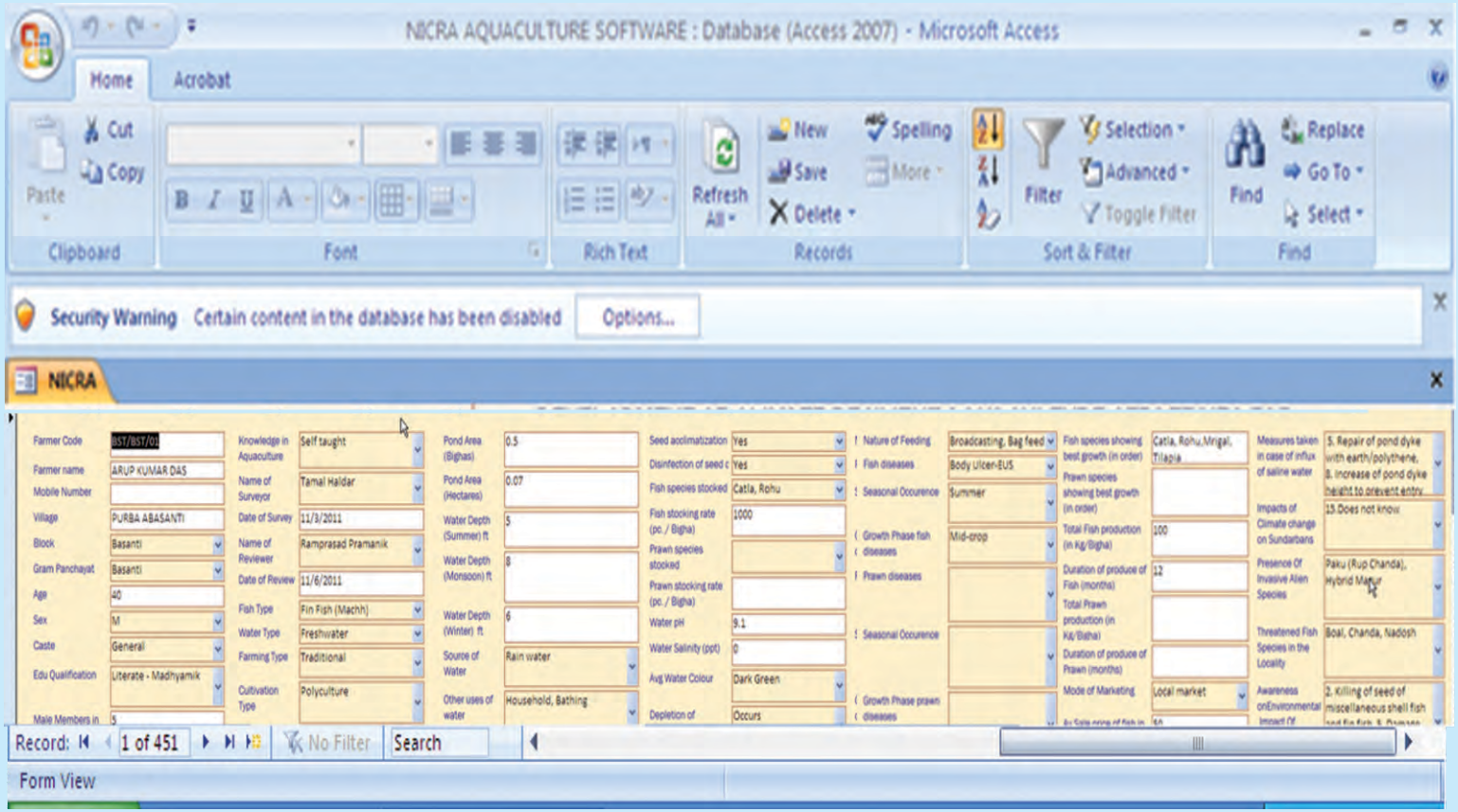
THANK YOU

Signature of the Farmer
Date:

Signature of Surveyor

Signature of Reviewer
Date:

Snap Shot of Survey Data Entry Software



List of Farmers Surveyed and Information on their Aquaculture Practices

BASANTI B L O C K

Block	Gram Panchayat	Farmer Code	Farmer Name	Village	Caste	Annual Income (Rs.)	Water Type	Fish Type	Farning Type	Cultivation Type	Pond Area (Bigha)	Sup. Feed	Fish Prod.(Kg)/ Bigha	Prawn Prod. (Kg)/ Bigha
Basanti														
	Basanti													
		BST/BST/01	ARUP KUMAR DAS	PURBA ABASANTI	General	36000	Freshwater	Fin Fish	Traditional	Polyculture	0.5	Yes		100
		BST/BST/02	NAKUL SRAKAR	RADHABALLAVPUR	General	150000	Freshwater	Fin Fish	Traditional	Polyculture	0.2	Yes		160
		BST/BST/03	RATHIKANTA HALDER	RADHABALLAVPUR	SC	60000	Both	Fin Fish	Modified Exte	Integrated	1	Yes		100
		BST/BST/04	AMBALIKA HALDER	KALIDANGA	SC	36000	Freshwater	Fin Fish	Traditional	Polyculture	1	Yes		170
		BST/BST/05	MANA NASKAR	KALIDANGA	General	60000	Freshwater	Fin Fish	Traditional	Integrated	0.6	No		80
		BST/BST/06	USHARANI DAS	SRIRAMPUR	General	72000	Freshwater	Fin Fish	Traditional	Integrated	0.5	Yes		180
		BST/BST/07	INDRAJIT DEBNATH	KALIDANGA	OBC	24000	Freshwater	Fin Fish	Traditional	Polyculture	2	Yes		100
		BST/BST/08	DHIMAN CHANDRA DAS	PASCHIM BASANTI	General	120000	Freshwater	Fin Fish	Traditional	Integrated	10	Yes		150
		BST/BST/09	TAPAN MONDAL	SRIRAMPUR	General	48000	Freshwater	Fin Fish	Traditional	Polyculture	1	Yes		170
		BST/BST/10	DIBYENDU MONDAL	RADHABALLAVPUR	General	36000	Freshwater	Fin Fish	Traditional	Polyculture	0.4	Yes		120
		BST/BST/11	KHOKA HALDER	PURBA BASANTI	General	36000	Freshwater	Fin Fish	Traditional	Polyculture	0.25	Yes		170
		BST/BST/12	DULAL BAR	KALIDANGA	OBC	36000	Freshwater	Fin Fish	Traditional	Polyculture	0.5	Yes		120
		BST/BST/13	MALI SHIKDAR	KALIDANGA	SC	60000	Freshwater	Fin Fish	Traditional	Polyculture	2	Yes		120
		BST/BST/14	APILUDDIN KHAN	KALIDANGA	Muslim	120000	Freshwater	Fin Fish	Traditional	Integrated	1	Yes		120
		BST/BST/15	AKHIL NASKAR	KALIDANGA	OBC	6000	Freshwater	Fin Fish	Traditional	Integrated	1	Yes		130
		BST/BST/16	PROBHAT HALDER	KALIDANGA	General	36000	Freshwater	Fin Fish	Traditional	Polyculture	0.3	Yes		70
		BST/BST/17	GOPAL NASKAR	KALIDANGA	General	36000	Freshwater	Fin Fish	Traditional	Integrated	0.75	Yes		100
		BST/BST/18	PREMANANDA NASKAR	SRIRAMPUR	General	96000	Freshwater	Fin Fish	Traditional	Polyculture	0.75	Yes		150

Block	Gram Panchayat	Farmer Code	Farmer Name	Village	Caste	Annual Income (Rs.)	Water Type	Fish Type	Farming Type	Cultivation Type	Pond Area (Bigha)	Sup. Feed	Fish Prod.(Kg)/ Bigha	Prawn Prod. (Kg)/ Bigha
		BST/BST/19	PRADIP DEBNATH	RADHABALLAVPUR	SC	120000	Freshwater	Fin Fish	Traditional	Polyculture	1	Yes	120	
		BST/BST/20	TAPAN DAS	PRIYANATH PALLY	SC	120000	Freshwater	Both	Traditional	Monoculture	1	Yes	140	8
No. of families covered in GP		20												
	Bharat Garh													
		BST/BTR/01	ARJUN CHANDRA SARDA	GARANBOSE 2NO	OBC	36000	Freshwater	Both	Traditional	Polyculture	2	No	150	20
		BST/BTR/02	MRITUNJAY SARDAR	BHARATGARH NO 7	ST	25000	Freshwater	Fin Fish	Traditional	Polyculture	1	Yes	120	
		BST/BTR/03	RANJAN MONDAL	MAHESHPUR	SC	18000	Freshwater	Fin Fish	Traditional	Polyculture	1	No	100	
		BST/BTR/04	SHAMIR HAIT	BHARATGARH NO 7	SC	20000	Both	Both	Modified Exte	Integrated	1	Yes	120	35
		BST/BTR/05	NAKUL CHANDRA MOND	BHARATGARH N0 6	SC	25000	Freshwater	Both	Traditional	Integrated	1.5	No	100	15
		BST/BTR/06	HARAN CHANDRA MOND	BHARATGARH NO 1	General	30000	Freshwater	Both	Modified Exte	Integrated	2	Yes	100	25
		BST/BTR/07	GOLOKBARI SARKAR	GARANBOSE NO 2	SC	24000	Both	Both	Traditional	Polyculture	1	Yes	150	35
		BST/BTR/08	BABLU MOLLA	GARANBOSE NO 2	Muslim	20000	Freshwater	Both	Traditional	Integrated	0.5	Yes	70	30
		BST/BTR/09	LAXMAN MONDAL	BHARATGARH NO 7	SC	20000	Both	Both	Modified Exte	Integrated	1	Yes	150	50
		BST/BTR/10	BHANU KANTA MAHAKU	GARANBOSE NO 4	General	18000	Freshwater	Both	Traditional	Integrated	1.5	Yes	150	30
		BST/BTR/11	BHARAT MAHAKUR	GARANBOSE NO 4	General	28000	Freshwater	Both	Traditional	Polyculture	1	Yes	70	20
		BST/BTR/12	AMULLYA MAHAKUR	GORANBOSE NO 4	General	40000	Freshwater	Both	Traditional	Polyculture	1	No	80	15
		BST/BTR/13	JATIN MAHATO	BHARATGARH NO 5	ST	28000	Freshwater	Both	Traditional	Integrated	4	No	60	10
		BST/BTR/14	NIRANJAN MAHAKUR	GARANBOSE	General	24000	Both	Both	Modified Exte	Integrated	1.5	No	133	14
		BST/BTR/15	SAHEB ALI LASKAR	GARNBOSE NO 3	Muslim	18000	Freshwater	Both	Modified Exte	Polyculture	3	Yes	110	18
		BST/BTR/16	SWAPAN MONDAL	BHAGAR GHERI NO 6	SC	16000	Freshwater	Both	Traditional	Integrated	2.5	Yes	125	10
		BST/BTR/17	DIBAKAR SARKAR	BHARATGARH NO 5	SC	60000	Freshwater	Both	Modified Exte	Integrated	2	Yes	120	15
		BST/BTR/18	ABHIMUNYA MAHATO	BHARATGARH	ST	24000	Freshwater	Both	Traditional	Polyculture	1	Yes	100	20
		BST/BTR/19	PROSAD NASKAR	BHARATGARH N0 7	OBC	25000	Freshwater	Both	Traditional	Integrated	2	Yes	150	25
		BST/BTR/20	JADAB HALDER	BHARATGARH	SC	20000	Freshwater	Fin Fish	Traditional	Polyculture	1	No	80	
		BST/BTR/21	RATAN BAR	BHARATGARH NO 7	SC	50000	Freshwater	Both	Traditional	Polyculture	7.5	No	120	25

Block	Gram Panchayat	Farmer Code	Farmer Name	Village	Caste	Annual Income (Rs.)	Water Type	Fish Type	Farming Type	Cultivation Type	Pond Area (Bigha)	Sup. Feed	Fish Prod.(Kg)/ Bigha	Prawn Prod. (Kg)/ Bigha
No. of families covered in GP	21													
	Chara Bidya													
		BST/CBY/01	MIR MAFIJUL ISLAM	CHARABIDYA	Muslim	80000	Freshwater	Both	Traditional	Polyculture	1.5	Yes	150	10
		BST/CBY/02	MAZIBAR LASKAR	3 NO CHARABIDYA	Muslim	70000	Both	Both	Traditional	Polyculture	2	Yes	300	35
		BST/CBY/03	RUHUL AMIN GAZI	4 NO PATUAKHALI	Muslim	36000	Freshwater	Both	Traditional	Polyculture	2	Yes	250	20
		BST/CBY/04	SURAJ SARKAR	6 NO CHARABIDYA	SC	30000	Freshwater	Both	Traditional	Polyculture	1.5	Yes	150	25
		BST/CBY/05	ISMAIL MAJHI	CHARABIDYA	Muslim	60000	Freshwater	Both	Traditional	Polyculture	1	Yes	200	14
		BST/CBY/06	SAFIRULA GAZI	PETUAKHALI	Muslim	50000	Both	Both	Traditional	Polyculture	2	Yes	250	20
		BST/CBY/07	HAJARI LAL MONDAL	6 NO CHARABIDYA	SC	50000	Both	Both	Traditional	Polyculture	3	Yes	300	30
		BST/CBY/08	UJIR SARDAR	CHARABIDYA	Muslim	30000	Freshwater	Fin Fish	Traditional	Polyculture	2.5	Yes	250	
		BST/CBY/09	MRINAL KANTI NASKAR	6 N0 CHARABIDYA	SC	30000	Both	Both	Traditional	Polyculture	2	Yes	250	20
		BST/CBY/10	MOHAMOOD MOLLA	4 N0 PETUAKHALI	Muslim	25000	Freshwater	Fin Fish	Traditional	Polyculture	2	Yes	250	
		BST/CBY/11	SANNYASI SRADAR	2 N0 CHARABIDYA	SC	30000	Freshwater	Fin Fish	Traditional	Integrated	1.5	Yes	350	
		BST/CBY/12	GOUR CHANDRA SANFUI	1 NO CHARABIDYA	SC	45000	Freshwater	Fin Fish	Traditional	Polyculture	1	Yes	150	
		BST/CBY/13	SANKARINDU NASKAR	CHARABIDYA	SC	40000	Freshwater	Fin Fish	Traditional	Integrated	3	Yes	130	
		BST/CBY/14	MAHABUB HASAN MOLL	4 NO PETUAKHALI	Muslim	30000	Freshwater	Fin Fish	Traditional	Polyculture	2.5	Yes	200	
		BST/CBY/15	SUROJ HALDER	CHARABIDYA	SC	35000	Freshwater	Fin Fish	Modified Exte	Polyculture	1.5	Yes	200	
		BST/CBY/16	NILMONI SARKAR	2 N0 CHARABIDYA	General	25000	Freshwater	Fin Fish	Traditional	Polyculture	2	Yes	200	
		BST/CBY/17	ABU JAFAR MOLLA	CHARABIDYA	Muslim	100000	Freshwater	Both	Traditional	Polyculture	1	Yes	250	30
		BST/CBY/18	TUSHAR KANTI HALDER	CHARABIDYA	SC	40000	Freshwater	Both	Traditional	Polyculture	2	Yes	250	20
		BST/CBY/19	GOBINDA SARKAR	CHARABIDYA	SC	25000	Freshwater	Fin Fish	Traditional	Polyculture	0.5	Yes	125	
		BST/CBY/20	TIMIR SARDAR	CHARABIDYA	ST	40000	Freshwater	Fin Fish	Traditional	Polyculture	1	Yes	125	
No. of families covered in GP	20													

Block	Gram Panchayat	Farmer Code	Farmer Name	Village	Caste	Annual Income (Rs.)	Water Type	Fish Type	Farning Type	Cultivation Type	Pond Area (Bigha)	Sup. Feed	Fish Prod.(Kg)/ Bigha	Prawn Prod. (Kg)/ Bigha
	Chunakhali													
		BST/CKL/01	CHATTAR LASKAR	UTTAR CHUNAKHALI	Muslim	30000	Freshwater	Both	Modified Exte	Integrated	2	Yes	150	30
		BST/CKL/02	MD. ABUL HASHIM MOLL	UTTAR CHUNAKHALI	Muslim	100000	Freshwater	Both	Traditional	Polyculture	4.5	Yes	150	50
		BST/CKL/03	MIR JIAUR RAHAMAN	UTTAR CHUNAKHALI	Muslim	80000	Freshwater	Fin Fish	Traditional	Monoculture	10	Yes	500	30
		BST/CKL/04	RAMESH SARDAR	UTTAR CHUNAKHALI	ST	25000	Freshwater	Fin Fish	Modified Exte	Integrated	1.5	Yes	250	
		BST/CKL/05	MEHIRUL MOLLA	UTTAR CHUNAKHALI	Muslim	36000	Both	Both	Traditional	Polyculture	4	Yes	300	25
		BST/CKL/06	MIR SAH ALAM	UTTAR CHUNAKHALI	Muslim	70000	Freshwater	Both	Traditional	Polyculture	3	Yes	300	30
		BST/CKL/07	MIR ABDUL KARIM	UTTAR CHUNAKHALI	Muslim	50000	Both	Both	Modified Exte	Polyculture	6	Yes	120	40
		BST/CKL/08	MIR NURUJJAMAN	UTTAR CHUNAKHALI	Muslim	48000	Both	Both	Modified Exte	Polyculture	2	Yes	150	15
		BST/CKL/09	ALAUDDIN MOLLA	UTTAR CHUNAKHALI	Muslim	30000	Freshwater	Both	Modified Exte	Polyculture	2.5	Yes	100	20
		BST/CKL/10	KUTUBUDDIN MOLLA	UTTAR CHUNAKHALI	Muslim	40000	Freshwater	Both	Traditional	Polyculture	1.5	Yes	120	20
		BST/CKL/11	PRAKASH SARDAR	UTTAR CHUNAKHALI	ST	36000	Freshwater	Both	Modified Exte	Integrated	2	Yes	120	15
		BST/CKL/12	BIMAL MISRTY	UTTAR CHUNAKHALI	SC	36000	Freshwater	Both	Modified Exte	Polyculture	2	Yes	125	15
		BST/CKL/13	UTTAM SARDAR	UTTAR CHUNAKHALI	ST	48000	Freshwater	Both	Modified Exte	Polyculture	2	Yes	150	50
		BST/CKL/14	PABITRA SARDAR	UTTAR CHUNAKHLAI	ST	50000	Freshwater	Both	Modified Exte	Integrated	1.5	Yes	170	30
		BST/CKL/15	GOUTAM SARDAR	BORIA	ST	20000	Freshwater	Fin Fish	Traditional	Polyculture	3	Yes	75	
		BST/CKL/16	MAHABUB MOLLA	UTTAR CHUNAKHALI	Muslim	40000	Freshwater	Both	Modified Exte	Integrated	2	Yes	110	45
		BST/CKL/17	LOTEMAN MOLLA	UTTAR CHUNAKHALI	Muslim	45000	Freshwater	Both	Modified Exte	Polyculture	1	Yes	120	35
		BST/CKL/18	BIMAL SARDAR	UTTAR CHUNAKHALI	ST	36000	Freshwater	Both	Traditional	Integrated	1.5	Yes	135	15
	No. of families covered in GP	18												
	Jharkhali													
		BST/JKL/01	DEBDAS MONDAL	2ND SCHEME	SC	30000	Freshwater	Both	Traditional	Monoculture	0.5	No	300	40
		BST/JKL/02	AMAL MONDAL	TRIDIBNAGAR BLOCK-1	SC	13000	Freshwater	Both	Traditional	Polyculture	2.5	Yes	250	30
		BST/JKL/03	NIRMAL SARKAR	TRIDIBNAGAR C	SC	25000	Freshwater	Both	Traditional	Polyculture	2	No	100	50
		BST/JKL/04	GOURANGA DAS	JHARKHALI NO - 4	SC	30000	Freshwater	Fin Fish	Traditional	Polyculture	1	Yes	100	30

Block	Gram Panchayat	Farmer Code	Farmer Name	Village	Caste	Annual Income (Rs.)	Water Type	Fish Type	Farming Type	Cultivation Type	Pond Area (Bigha)	Sup. Feed	Fish Prod.(Kg)/ Bigha	Prawn Prod. (Kg)/ Bigha
		BST/JKL/05	BABLU MAJHI	JHARKAHLI 2ND SCHE	SC	30000	Both	Both	Traditional	Polyculture	2	No	150	15
		BST/JKL/06	BIMAL HALDER	JHARKHALI NO - 3	SC	24000	Freshwater	Fin Fish	Traditional	Polyculture	1	No	100	
		BST/JKL/07	KHOKAN GAYEN	LASKARPUR - 1	SC	14000	Freshwater	Both	Traditional	Polyculture	1	No	130	30
		BST/JKL/08	NIRUPAM MONDAL	JHARKHALI NO - 3	SC	24000	Freshwater	Both	Traditional	Polyculture	1.5	No	150	40
		BST/JKL/09	SAMAR DHALI	TRIDIBNAGAR B	SC	25000	Freshwater	Both	Traditional	Polyculture	1	No	150	25
		BST/JKL/10	BIJOY MISTRY	TRIDIBNAGAR BLOCK -	SC	15000	Both	Both	Modified Exte	Polyculture	2.5	No	150	30
		BST/JKL/11	KARTIK HALDER	TRIDIBNAGAR - A	SC	60000	Both	Both	Modified Exte	Polyculture	6	Yes	200	50
		BST/JKL/12	BICHITRA BISWAS	jharkhali	SC	20000	Freshwater	Both	Traditional	Polyculture	1	Yes	100	30
		BST/JKL/13	ASIT RANA	2ND SCHEME	SC	20000	Freshwater	Both	Traditional	Polyculture	0.5	Yes	100	20
		BST/JKL/14	BIKASH MONDAL	2ND SCHEME	SC	36000	Both	Fin Fish	Traditional	Polyculture	2	No	200	50
		BST/JKL/15	AMAL MALLICK	4 NO JHARKAHLI	SC	12000	Freshwater	Fin Fish	Traditional	Polyculture	0.5	No	70	
		BST/JKL/16	RAJESWAR MONDAL	PROJA GHERI	SC	20000	Both	Both	Traditional	Polyculture	5	No	150	40
		BST/JKL/17	BIMAL HLADER	JHARKHALI NO - 3	SC	60000	Freshwater	Both	Traditional	Polyculture	1	Yes	80	15
		BST/JKL/18	BHAJAHARI MONDAL	JHARKHALI NO- 3	SC	60000	Freshwater	Both	Traditional	Polyculture	2	Yes	200	25
		BST/JKL/19	DHIRENDRANATH SARDA	JHARKHALI NO - 3	SC	18000	Both	Both	Traditional	Polyculture	1	No	200	10
		BST/JKL/20	ARABINDA SARDAR	TRIDBNAGAR - A	SC	20000	Freshwater	Both	Traditional	Polyculture	1	No	60	10
No. of families covered in GP		20												
	Jyotishpur													
		BST/JTR/01	DHANANJOY MONDAL	JYOTISHPUR	SC	100000	Freshwater	Both	Traditional	Polyculture	1	Yes	150	25
		BST/JTR/02	HALADHAR BAR	JOYGOPALPUR	SC	35000	Freshwater	Both	Traditional	Polyculture	1	No	100	15
		BST/JTR/03	UDAY CHANDRA MONDA	JOYGOPALPUR	SC	20000	Freshwater	Both	Traditional	Integrated	1	No	60	15
		BST/JTR/04	NARAYAN BISWAS	3 NO RANIGARH	OBC	30000	Freshwater	Both	Traditional	Polyculture	0.5	Yes	60	10
		BST/JTR/05	JAGADISH MONDAL	JYOTISHPUR	SC	25000	Freshwater	Both	Traditional	Polyculture	1.5	Yes	150	10
		BST/JTR/06	DILIP ADHIKARI	JYOTISHPUR	OBC	50000	Freshwater	Both	Traditional	Polyculture	3	Yes	100	10
		BST/JTR/07	TAPAN KUMAR SARDAR	RADHARANIPUR	ST	24000	Freshwater	Both	Traditional	Polyculture	1	Yes	150	25

Block	Gram Panchayat	Farmer Code	Farmer Name	Village	Caste	Annual Income (Rs.)	Water Type	Fish Type	Farning Type	Cultivation Type	Pond Area (Bigha)	Sup. Feed	Fish Prod.(Kg)/ Bigha	Prawn Prod. (Kg)/ Bigha
		BST/JTR/08	UTTAM SARDAR	JOYGOPALPUR	OBC	25000	Freshwater	Both	Traditional	Polyculture	2	Yes	125	10
		BST/JTR/09	PROVAS HALDER	JYOTISHPUR	SC	40000	Freshwater	Both	Traditional	Polyculture	2	Yes	120	10
		BST/JTR/10	AMAL DAS	RADHARANIPUR	SC	25000	Freshwater	Both	Traditional	Polyculture	1	No	100	10
		BST/JTR/11	BIRENDRANATH GOAL	RADHARANIPUR	General	35000	Freshwater	Both	Traditional	Polyculture	0.5	Yes	150	60
		BST/JTR/12	SANTOSH MONDAL	JYOTISHPUR	SC	30000	Freshwater	Both	Traditional	Polyculture	1.5	Yes	90	20
		BST/JTR/13	SUJATA MONDAL	JYOTISHPUR	SC	30000	Freshwater	Both	Traditional	Polyculture	2.5	Yes	80	10
		BST/JTR/14	ANANTA SAMANTA	RADHARANIPUR	General	30000	Freshwater	Both	Modified Exte	Polyculture	2	No	150	15
		BST/JTR/15	KABIRANJAN NASKAR	JOYGOPALPUR	SC	25000	Freshwater	Both	Traditional	Polyculture	1	Yes	100	15
		BST/JTR/16	BINOD BIHARI DAS	HAREKRISHNAPUR	SC	35000	Freshwater	Both	Modified Exte	Polyculture	2	Yes	150	20
		BST/JTR/17	BIJOYKRISHNA CHOUDH	HAREKRISHNAPUR	SC	25000	Freshwater	Both	Traditional	Polyculture	3	Yes	100	20
		BST/JTR/18	HARASIT ROY	JOYGOPALPUR	SC	40000	Freshwater	Both	Traditional	Polyculture	2	Yes	70	10
		BST/JTR/19	DULAL GHARAMI	JYOTISHPUR	SC	35000	Freshwater	Both	Traditional	Polyculture	1.5	No	80	5
		BST/JTR/20	NAKUL HALDER	JYOTISHPUR	SC	35000	Freshwater	Both	Modified Exte	Integrated	1	Yes	100	10
		BST/JTR/21	SONATAN NASKAR	RANIGARH NO 2	SC	35000	Freshwater	Both	Traditional	Polyculture	2	Yes	80	12
		BST/JTR/22	JOYDEB MONDAL	JYOTISHPUR	SC	25000	Freshwater	Both	Traditional	Polyculture	2	Yes	150	10
		BST/JTR/23	SUKDEB AGUAN	RADHARANIPUR	SC	30000	Freshwater	Fin Fish	Traditional	Polyculture	1	No	100	
		BST/JTR/24	MRITTYUNJAY PATTANAY	RADHARANIPUR	General	36000	Freshwater	Both	Traditional	Polyculture	2	No	120	15
		BST/JTR/25	BHOLANATH HALDER	4 NO HAREKRISHNAPU	SC	30000	Freshwater	Fin Fish	Traditional	Polyculture	1	Yes	200	
No. of families covered in GP		25												
	Masjidbati													
		BST/MSB/01	AJIT HAZRA	MOKAMBERIA	SC	20000	Freshwater	Fin Fish	Traditional	Polyculture	1	Yes	140	
		BST/MSB/02	NITAI SARDAR	Uttar Mokamberia	SC	20000	Freshwater	Fin Fish	Traditional	Polyculture	2	No	160	
		BST/MSB/03	KAJAL MAITY	MASJIDBATI	General	20000	Both	Both	Modified Exte	Polyculture	3	Yes	130	40
		BST/MSB/04	CHAMPA DEBNATH	DAKSHIN BAT TALA	SC	30000	Freshwater	Fin Fish	Traditional	Polyculture	1	Yes	90	
		BST/MSB/05	GOPAL MONDAL	GODKHALI	ST	20000	Freshwater	Both	Traditional	Polyculture	1	Yes	100	15

Block	Gram Panchayat	Farmer Code	Farmer Name	Village	Caste	Annual Income (Rs.)	Water Type	Fish Type	Farning Type	Cultivation Type	Pond Area (Bigha)	Sup. Feed	Fish Prod.(Kg)/ Bigha	Prawn Prod. (Kg)/ Bigha
		BST/MSB/06	PARAN MONDAL	GODKHALI	SC	45000	Freshwater	Both	Traditional	Polyculture	4	Yes	150	35
		BST/MSB/07	DIPAK MONDAL	GODKHALI	ST	20000	Freshwater	Fin Fish	Traditional	Polyculture	1	Yes	170	
		BST/MSB/08	TAPAS MONDAL	MASJIDBATI	SC	20000	Freshwater	Both	Modified Exte	Polyculture	1	Yes	125	40
		BST/MSB/09	SHIPRA MONDAL	RAMKRISHNAPUR	SC	20000	Freshwater	Both	Traditional	Polyculture	1	Yes	130	25
		BST/MSB/10	GANESH SANA	GODKHALI	General	20000	Freshwater	Fin Fish	Traditional	Polyculture	0.5	No	125	
		BST/MSB/11	KAJAL MONDAL	RAMKRISHNAPUR	SC	20000	Both	Both	Modified Exte	Polyculture	1	Yes	170	115
		BST/MSB/12	CHAMPA PAIK	DAKSHIN BAT TALA	SC	20000	Freshwater	Fin Fish	Traditional	Polyculture	1	Yes	70	
		BST/MSB/13	PRITYLATA GAIN	DAKSHIN BAT TALA	SC	20000	Freshwater	Both	Modified Exte	Polyculture	1.5	Yes	125	25
		BST/MSB/14	TAPAS MISHRA	GODKHALI	General	25000	Freshwater	Fin Fish	Traditional	Polyculture	1	Yes	120	
		BST/MSB/15	ASHIM MONDAL	GODKHALI	General	20000	Freshwater	Fin Fish	Traditional	Polyculture	1	No	125	15
		BST/MSB/16	KAMAL MONDAL	GODKHALI	SC	20000	Freshwater	Fin Fish	Traditional	Polyculture	1	Yes	110	35
		BST/MSB/17	AMITABHA MAITY	MASJIDBATI	General	25000	Freshwater	Fin Fish	Traditional	Polyculture	2	Yes	200	
		BST/MSB/18	MAMATA SARKAR	DAKSHIN BAT TALA	SC	20000	Freshwater	Fin Fish	Traditional	Polyculture	0.5	Yes	120	
		BST/MSB/19	ANUP MAITY	MASIJDBATI	General	20000	Both	Both	Traditional	Polyculture	3	Yes	125	15
		BST/MSB/20	ARATI PAL	MASJIDBATI	OBC	20000	Freshwater	Fin Fish	Traditional	Polyculture	0.75	Yes	160	
No. of families covered in GP		20												
	Nafargunj													
		BST/NFR/01	RADHA GOBINDA BARIK	BIRINCHI BARI	SC	19000	Both	Both	Traditional	Polyculture	3	No	95	5
		BST/NFR/02	PHATIK MONDAL	HIRONMOYPUR	SC	19000	Freshwater	Both	Traditional	Polyculture	2	Yes	100	15
		BST/NFR/03	TARAN SARDAR	BIRINCHI BARI	ST	24000	Both	Both	Traditional	Polyculture	4.5	No	90	5
		BST/NFR/04	UTTAM DAS	BIRINCHI BARI	General	24000	Both	Both	Traditional	Polyculture	4	Yes	150	25
		BST/NFR/05	NANDARAM JANA	BIRINCHI BARI	General	19000	Both	Both	Traditional	Polyculture	4	Yes	125	20
		BST/NFR/06	MURARI DEBSHARMA	BIRINCHI BARI	General	20000	Both	Both	Modified Exte	Polyculture	2	No	90	20
		BST/NFR/07	LABA KUMAR MONDAL	BIRINCHI BARI	SC	19000	Freshwater	Both	Traditional	Polyculture	3.5	Yes	80	34
		BST/NFR/08	ANUPAM JANA	NAFARGAUNJ	General	19000	Freshwater	Fin Fish	Traditional	Polyculture	0.5	No	70	

Block	Gram Panchayat	Farmer Code	Farmer Name	Village	Caste	Annual Income (Rs.)	Water Type	Fish Type	Farming Type	Cultivation Type	Pond Area (Bigha)	Sup. Feed	Fish Prod.(Kg)/ Bigha	Prawn Prod. (Kg)/ Bigha
		BST/NFR/09	SUPRABHAT DAS	NAFARGANJ	General	35000	Freshwater	Both	Traditional	Polyculture	1	Yes	80	10
		BST/NFR/10	RAMKRISHNA MAITY	NAFARGUNJ	General	19000	Both	Both	Traditional	Integrated	1.5	Yes	160	10
		BST/NFR/11	SUPRABHAT DAS	BIRINCHIBARI	General	21600	Both	Both	Traditional	Polyculture	8	Yes	70	25
		BST/NFR/12	SHUKDEB HALDER	BIRINCHIBARI	General	19000	Freshwater	Fin Fish	Traditional	Polyculture	7.5	No	200	
		BST/NFR/13	SUNIL BAIDYA	NAFARGAUNJ	SC	24000	Freshwater	Both	Traditional	Polyculture	2	No	80	
		BST/NFR/14	BISWAJIT BERA	BIRINCHI BARI	General	20000	Both	Both	Traditional	Integrated	3	Yes	70	15
		BST/NFR/15	BIJON BIHARI MONDAL	BIRINCHIBARI	General	24000	Freshwater	Both	Traditional	Polyculture	4	Yes	95	25
		BST/NFR/16	KHUDIRAM KARAN	NAFARGAUNJ	General	19000	Freshwater	Both	Traditional	Polyculture	2	Yes	200	45
		BST/NFR/17	SANTANU SARDAR	NAFARGAUNJ	ST	20000	Freshwater	Both	Traditional	Polyculture	12	Yes	90	25
		BST/NFR/18	SUBHAS MISTRI	HIRANMAYPUR	SC	27000	Freshwater	Both	Traditional	Integrated	1	No	150	5
		BST/NFR/19	GAZI SARDAR	BIRINCHIBARI	Muslim	19000	Freshwater	Both	Traditional	Polyculture	4.5	Yes	125	10
		BST/NFR/20	SUDHIR CHNADRA MON	BIRINCHIBARI	SC	20000	Freshwater	Both	Traditional	Polyculture	2	Yes	90	10
No. of families covered in GP		20												
	Phul Malancha													
		BST/PML/01	ROHIDUL LASKAR	NIRDESHKHALI	Muslim	45000	Freshwater	Fin Fish	Traditional	Polyculture	1	Yes	100	
		BST/PML/02	SIRAJUL MONDAL	PANIKHALI	Muslim	45000	Freshwater	Fin Fish	Traditional	Polyculture	1.5	Yes	125	
		BST/PML/03	KARIMULLA MOLLA	CHATRAKHALI	Muslim	40000	Freshwater	Fin Fish	Traditional	Polyculture	3.5	Yes	130	
		BST/PML/04	UCHHUP MOLLA	CHATRAKHALI	Muslim	50000	Freshwater	Fin Fish	Traditional	Polyculture	2.5	Yes	140	
		BST/PML/05	RAFIKUL LASKAR	NIRDESHKHALI	Muslim	40000	Freshwater	Both	Modified Exte	Polyculture	2	Yes	150	35
		BST/PML/06	ABDULLA SEIKH	NIRDESHKHALI	Muslim	36000	Freshwater	Fin Fish	Modified Exte	Polyculture	2	Yes	125	
		BST/PML/07	EYAR ALI SEIKH	NIRDESHKHALI	Muslim	40000	Freshwater	Both	Modified Exte	Polyculture	1	Yes	120	15
		BST/PML/08	HADAY TULLA LASKAR	NIRDESHKHALI	Muslim	50000	Freshwater	Fin Fish	Traditional	Polyculture	10	Yes	200	
		BST/PML/09	MANIRUJJAMAN MOLLA	CHATRAKHALI	Muslim	42000	Freshwater	Fin Fish	Modified Exte	Integrated	2.5	Yes	150	
		BST/PML/10	SABIYUR HOSSEIN MOLL	CHATRAKHALI	Muslim	34000	Freshwater	Fin Fish	Modified Exte	Polyculture	2	Yes	135	

Block	Gram Panchayat	Farmer Code	Farmer Name	Village	Caste	Annual Income (Rs.)	Water Type	Fish Type	Farming Type	Cultivation Type	Pond Area (Bigha)	Sup. Feed	Fish Prod.(Kg)/ Bigha	Prawn Prod. (Kg)/ Bigha
		BST/PML/11	UTTAM SARDAR	NIRDESHKHALI	Muslim	32000	Freshwater	Fin Fish	Traditional	Polyculture	5	Yes	80	
		BST/PML/12	FARUK SARDAR	CHATRAKHALI	Muslim	34000	Freshwater	Fin Fish	Traditional	Polyculture	2.5	Yes	125	
No. of families covered in GP	12													
	Ramchandra khali													
		BST/RCK/01	KALIDAS NASKAR	RAMCHANDRAKHALI	SC	30000	Both	Both	Modified Exte	Polyculture	5	Yes	125	30
		BST/RCK/02	ABDUR RAHAMAN MOLL	KALAHATRA	Muslim	18000	Freshwater	Both	Traditional	Polyculture	1.25	No	110	15
		BST/RCK/03	SANTANU MRIDHA	SONAKHALI	SC	24000	Freshwater	Both	Traditional	Polyculture	2	No	100	20
		BST/RCK/04	BIKASH MAITY	SONAKHALI	General	24000	Freshwater	Both	Modified Exte	Polyculture	0.75	Yes	120	20
		BST/RCK/05	DIPANKAR PUNI	6 NO SONAKHALI	SC	30000	Freshwater	Both	Modified Exte	Integrated	1	Yes	125	30
		BST/RCK/06	MONOJ PRAMANIK	SONAKHALI	SC	50000	Freshwater	Both	Modified Exte	Polyculture	1.25	Yes	135	20
		BST/RCK/07	MONORANJAN NASKAR	RAMCHANDRAKHALI	SC	24000	Freshwater	Both	Traditional	Polyculture	1	No	70	20
		BST/RCK/08	JYOTIRMOY MONDAL	SONAKHALI	SC	18000	Freshwater	Both	Modified Exte	Polyculture	1	Yes	135	30
		BST/RCK/09	CHORAP MOLLA	KHIRISH KHALI	Muslim	30000	Freshwater	Both	Traditional	Polyculture	1.5	Yes	125	50
		BST/RCK/10	AVIMUNYA GAYEN	KHIRISHKHALI	SC	18000	Freshwater	Both	Modified Exte	Polyculture	1	No	45	20
		BST/RCK/11	DIPAK KUMAR BARUI	SONAKHALI NO 6	SC	18000	Freshwater	Fin Fish	Traditional	Polyculture	1	Yes	125	
		BST/RCK/12	ARATI CHATUI	KHIRISH KHALI	SC	20000	Freshwater	Both	Modified Exte	Polyculture	0.75	Yes	135	30
		BST/RCK/13	SUJAUDDIN MOLLA	SONAKHALI NO 6	OBC	24000	Freshwater	Both	Traditional	Polyculture	0.75	No	80	10
		BST/RCK/14	ABDUR SALAM SARDAR	RAMCHANDRAKHALI	Muslim	30000	Freshwater	Both	Traditional	Polyculture	5	Yes	100	30
		BST/RCK/15	ARABINDA NASKAR	HOGOLDURI	SC	100000	Brackishwat	Both	Traditional	Polyculture	130	Yes	100	50
		BST/RCK/16	SANAT NAIYA	RAMCHANDRAKHALI	SC	18000	Freshwater	Both	Traditional	Polyculture	5	No	55	10
No. of families covered in GP	16													
	Uttar Mokamberia													
		BST/UMB/01	PARIMAL HALDER	UTTAR MOKAMBERIA	SC	20000	Freshwater	Both	Traditional	Polyculture	0.75	No	200	25

Block	Gram Panchayat	Farmer Code	Farmer Name	Village	Caste	Annual Income (Rs.)	Water Type	Fish Type	Faming Type	Cultivation Type	Pond Area (Bigha)	Sup. Feed	Fish Prod.(Kg)/ Bigha	Prawn Prod. (Kg)/ Bigha
		BST/UMB/02	SWAPAN SRADAR	3 NO SONAKHALI	SC	50000	Freshwater	Both	Traditional	Polyculture	0.5	No	200	20
		BST/UMB/03	JOYDEB GHARAMI	HARBHANGI	SC	20000	Freshwater	Both	Traditional	Polyculture	2	Yes	150	10
		BST/UMB/04	HAREKRISHNA BARMAN	UTTAR MOKAMBERIA	SC	30000	Freshwater	Both	Traditional	Polyculture	0.5	No	200	20
		BST/UMB/05	DHANANJOY NASKAR	3 NO SONAKHALI	SC	20000	Freshwater	Both	Traditional	Polyculture	0.75	No	200	20
		BST/UMB/06	BIKASH MONDAL	CHARANEKHALI	SC	18000	Freshwater	Both	Traditional	Polyculture	0.25	No	150	20
		BST/UMB/07	DEBASISH MONDAL	SONAKHALI NO 2	SC	18000	Freshwater	Both	Modified Exte	Polyculture	0.75	Yes	150	20
		BST/UMB/08	BADAL NASKAR	2 NO SONAKHALI	SC	24000	Freshwater	Both	Traditional	Polyculture	1.5	No	120	30
		BST/UMB/09	TIMIR HALDER	2 NO SONAKHALI	SC	18000	Freshwater	Both	Traditional	Polyculture	1	Yes	175	40
		BST/UMB/10	PABAN SARDAR	UTTAR MOKAMBERIA	SC	18000	Freshwater	Both	Traditional	Polyculture	2	No	125	40
		BST/UMB/11	DILIP SAMANTA	5 NO SONAKHALI	General	50000	Freshwater	Both	Traditional	Polyculture	2	Yes	200	40
		BST/UMB/12	BISWAJIT SANFUI	UTTAR MOKAMBERIA	SC	24000	Freshwater	Both	Traditional	Polyculture	3	No	125	20
		BST/UMB/13	GOUR CHANDRA MONDA	UTTAR MOKAMBERIA	SC	30000	Freshwater	Both	Traditional	Polyculture	3	Yes	175	30
		BST/UMB/14	GOBINDA MONDAL	BATTALA	SC	24000	Freshwater	Fin Fish	Traditional	Polyculture	1	Yes	200	
		BST/UMB/15	BARUN GHARAMI	HARINBHANGI	SC	30000	Freshwater	Fin Fish	Traditional	Polyculture	7	Yes	500	

No. of families covered in GP 15

No. of families covered in Block 207

List of Farmers Surveyed and Information on their Aquaculture Practices

SAGAR BLOCK

Block	Gram Panchayat	Farmer Code	Farmer Name	Village	Caste	Annual Income (Rs.)	Water Type	Fish Type	Farning Type	Cultivation Type	Pond Area (Bigha)	Sup. Feed	Fish Prod.(Kg)/ Bigha	Prawn Prod. (Kg)/ Bigha
Sagar														
	Daspara Sumati Nagar - I													
		SAG/DSN-I/01	MONORANJAN DAS	DHOSPARA	SC	72000	Freshwater	Fin Fish	Modified Exte	Polyculture	3	Yes	500	
		SAG/DSN-I/02	HIMANGSHU SEKHAR DA	DHOSPARA	SC	180000	Freshwater	Fin Fish	Modified Exte	Polyculture	1.5	Yes	700	
		SAG/DSN-I/03	SUKESH SAHU	DHOSPARA	OBC	60000	Freshwater	Fin Fish	Modified Exte	Polyculture	3	Yes	100	
		SAG/DSN-I/04	SANKAR DAS	DHOSPARA	SC	36000	Freshwater	Fin Fish	Modified Exte	Polyculture	1.5	Yes	750	
		SAG/DSN-I/05	PRODDYOT DAS	DHOSPARA	General	36000	Freshwater	Fin Fish	Traditional	Monoculture	1	Yes	500	
		SAG/DSN-I/06	SAROJ KUMAR DAS	DHOSPARA	SC	36000	Freshwater	Fin Fish	Modified Exte	Polyculture	1	Yes	500	
		SAG/DSN-I/07	SUDARSHAN DAS	DHOSPARA	SC	36000	Freshwater	Fin Fish	Modified Exte	Polyculture	2	Yes	600	
		SAG/DSN-I/08	MENOKA DAS	DHOSPARA	SC	140000	Both	Fin Fish	Traditional	Polyculture	4	Yes	250	
		SAG/DSN-I/09	SHYAMAPADA CHAKRAB	DHOSPARA	General	36000	Both	Fin Fish	Modified Exte	Polyculture	5	Yes	800	
		SAG/DSN-I/10	SATYA RANJAN DINDA	MAHENDRA GAUNJ	General	60000	Freshwater	Fin Fish	Modified Exte	Polyculture	2	Yes	750	
		SAG/DSN-I/11	SATYAHARI PATRA	MAHENDRA GAUNJ	SC	50000	Freshwater	Fin Fish	Modified Exte	Polyculture	1.5	Yes	720	
		SAG/DSN-I/12	TARUN KUMAR PATRA	MAHENDRA GAUNJ	General	240000	Freshwater	Fin Fish	Modified Exte	Polyculture	2	Yes	750	
		SAG/DSN-I/13	TAPAN KUMAR PATRA	MAHENDRA GAUNJ	General	40000	Freshwater	Fin Fish	Traditional	Polyculture	2	Yes	700	
		SAG/DSN-I/14	GOURHARI ROY	DHOSPARA	General	96000	Freshwater	Fin Fish	Traditional	Polyculture	3	Yes	750	
		SAG/DSN-I/15	KHOKAN BHUINYA	GOBINDAPUR	General	36000	Freshwater	Fin Fish	Modified Exte	Polyculture	1.5	Yes	500	
		SAG/DSN-I/16	GANGADHAR MONDAL	NAGENDRA GAUNJ	SC	50000	Freshwater	Fin Fish	Traditional	Polyculture	2	Yes	400	
		SAG/DSN-I/17	GOUTAM MONDAL	GOBINDAPUR	SC	36000	Both	Fin Fish	Traditional	Polyculture	1.5	Yes	500	
		SAG/DSN-I/18	BALAI DAS	DHOSPARA	SC	40000	Both	Fin Fish	Modified Exte	Polyculture	1.5	Yes	600	
		SAG/DSN-I/19	KANAKALATI PATRA	MAHENDRA GAUNJ	General	75000	Freshwater	Fin Fish	Traditional	Polyculture	1.5	Yes	500	
		SAG/DSN-I/20	SATADAL DAS	DHOS PARA	General	60000	Freshwater	Fin Fish	Traditional	Polyculture	1.5	Yes	500	
		SAG/DSN-I/21	NIKHIL DAS	DHOSPARA	SC	60000	Both	Both	Modified Exte	Polyculture	1	Yes	750	50

No. of families covered in GP 21

Block	Gram Panchayat	Farmer Code	Farmer Name	Village	Caste	Annual Income (Rs.)	Water Type	Fish Type	Farming Type	Cultivation Type	Pond Area (Bigha)	Sup. Feed	Fish Prod.(Kg)/ Bigha	Prawn Prod. (Kg)/ Bigha
	Daspara Sumati Nagar - II													
		SAG/DSN-II/01	AMIYA PARUA	SUMATI NAGAR	General	150000	Freshwater	Fin Fish	Modified Exte	Polyculture	2	Yes	500	
		SAG/DSN-II/02	NUR MOHAMMAD KHAN	SUMATI NAGAR	Muslim	120000	Freshwater	Fin Fish	Traditional	Polyculture	0.75	Yes	500	
		SAG/DSN-II/03	SEIKH AKBAR	SUMATI NAGAR	Muslim	70000	Freshwater	Fin Fish	Traditional	Polyculture	0.6	Yes	1000	
		SAG/DSN-II/04	SUKUMAR MANNA	BANKIM NAGAR	General	100000	Both	Both	Traditional	Polyculture	2	Yes	400	50
		SAG/DSN-II/05	PREMANANDA JANA	BANKIM NAGAR	General	100000	Both	Both	Traditional	Polyculture	0.5	Yes	100	300
		SAG/DSN-II/06	TAPAN MANNA	BANKIM NAGAR	General	70000	Both	Both	Traditional	Polyculture	1	Yes	300	70
		SAG/DSN-II/07	SWAPAN MONDAL	BANKIM NAGAR	SC	90000	Freshwater	Fin Fish	Modified Exte	Polyculture	2.5	Yes	500	
		SAG/DSN-II/08	TAPAN BARIK	BANKIM NAGAR	General	70000	Both	Both	Traditional	Polyculture	2	Yes	300	70
		SAG/DSN-II/09	CHITTARANJAN DAS	BANKIM NAGAR	General	90000	Both	Both	Traditional	Polyculture	0.75	Yes	500	70
		SAG/DSN-II/10	SANKAR BHUINYA	BANKIM NAGAR	General	110000	Both	Both	Traditional	Polyculture	1.5	Yes	500	50
		SAG/DSN-II/11	LAXMAN BARIK	BANKIM NAGAR	General	100000	Brackishwat	Fin Fish	Traditional	Polyculture	1.5	Yes	700	
		SAG/DSN-II/12	UTTAM PATRA	UTTAR HARADHANPUR	OBC	80000	Both	Both	Modified Exte	Polyculture	1	Yes	280	60
		SAG/DSN-II/13	SURAPATI KUILLYA	UTTAR HARADHANPUR	SC	45000	Freshwater	Fin Fish	Traditional	Polyculture	0.5	Yes	100	
		SAG/DSN-II/14	SANJOY BERA	UTTAR HARADHANPUR	OBC	32000	Both	Both	Modified Exte	Polyculture	4	Yes	200	40
		SAG/DSN-II/15	PRADIP DAS	UTTAR HARADHANPUR	OBC	350000	Brackishwat	Shell Fis	Modified Exte	Polyculture	2	Yes		300
		SAG/DSN-II/16	SAHADEB MANNA	UTTAR HARADHANPUR	General	60000	Freshwater	Fin Fish	Modified Exte	Polyculture	1.5	Yes	300	
		SAG/DSN-II/17	ANANDA KUMAR PARIA	DAKSHIN HARADHANPI	General	50000	Freshwater	Both	Traditional	Polyculture	2	Yes	100	80
		SAG/DSN-II/18	NIRANJAN PATTA	DAKSHIN HARADHANP	General	24000	Freshwater	Fin Fish	Modified Exte	Polyculture	2	Yes	200	
		SAG/DSN-II/19	GHANASHYAM BHUINYA	SUMATI NAGAR	General	36000	Freshwater	Fin Fish	Traditional	Polyculture	1	Yes	200	
		SAG/DSN-II/20	NAREN CHANDRA MOND	SUMATI NAGAR	General	48000	Freshwater	Fin Fish	Traditional	Polyculture	1	Yes	200	
		SAG/DSN-II/21	NIBAS KUMAR SAU	BANKIM NAGAR	OBC	75000	Freshwater	Fin Fish	Modified Exte	Polyculture	2	Yes	900	
		SAG/DSN-II/22	SUKUMAR BHUINYA	BANKIM NAGAR	General	50000	Both	Both	Modified Exte	Polyculture	3	Yes	300	150
		SAG/DSN-II/23	DIBAKAR BHANDARI	BANKIM NAGAR	General	50000	Freshwater	Fin Fish	Traditional	Polyculture	2	Yes	150	

Block	Gram Panchayat	Farmer Code	Farmer Name	Village	Caste	Annual Income (Rs.)	Water Type	Fish Type	Farming Type	Cultivation Type	Pond Area (Bigha)	Sup. Feed	Fish Prod.(Kg)/ Bigha	Prawn Prod. (Kg)/ Bigha
		SAG/DSN-II/24	NIRANJAN PRAMANIK	BANKIM NAGAR 3 NO L	General	75000	Both	Both	Modified Exte	Polyculture	2	Yes	200	60
		SAG/DSN-II/25	TAPAN PATLA	MRITUNJOY NAGA	General	50000	Freshwater	Fin Fish	Traditional	Polyculture	2	Yes	200	
		SAG/DSN-II/26	APU KUMAR BERA	MRITTUNJOY NAGA	General	50000	Both	Fin Fish	Modified Exte	Polyculture	2	Yes	150	
No. of families covered in GP		26												
	Dhablat													
		SAG/DBL/01	NIRANJAN MONDAL	BASANTAPUR	General	50000	Freshwater	Fin Fish	Traditional	Polyculture	2	No	120	
		SAG/DBL/02	JHARESWAR MONDAL	DHOBLAT BASANTAPU	OBC	240000	Both	Both	Modified Exte	Integrated	3.5	Yes	120	60
		SAG/DBL/03	RAMKRISHNA MONDAL	CHEMAGURI	OBC	180000	Both	Both	Traditional	Polyculture	11	No	100	15
		SAG/DBL/04	GOBINDA MONDAL	DHABLAT KEDARPUR	General	60000	Both	Fin Fish	Traditional	Polyculture	1	Yes	200	
		SAG/DBL/05	SUKUMAR KALSA	SHIBPUR	SC	20000	Freshwater	Both	Traditional	Polyculture	2	Yes	150	30
		SAG/DBL/06	PRAVASH KUMAR BERA	SHIBPUR	General	30000	Both	Both	Modified Exte	Polyculture	1.5	Yes	110	30
		SAG/DBL/07	DILIP DAS	SHIBPUR	OBC	120000	Both	Both	Modified Exte	Polyculture	2	Yes	70	35
		SAG/DBL/08	ANANTA PATRA	SHIBPUR	SC	24000	Freshwater	Fin Fish	Traditional	Polyculture	0.4	Yes	90	
		SAG/DBL/09	SAHADEB MAITY	CHEMAGURI	General	24000	Both	Both	Traditional	Polyculture	10	No	30	20
		SAG/DBL/10	KANAI LAL KOYAL	CHEMAGURI	SC	24000	Brackishwat	Both	Traditional	Integrated	0.5	No	40	12
		SAG/DBL/11	LAL MOHAN DAS	CHEMAGURI	General	24000	Freshwater	Fin Fish	Traditional	Polyculture	1.5	No	70	
		SAG/DBL/12	BAGAMBAR MONDAL	BASANTAPUR	SC	30000	Brackishwat	Shell Fis	Traditional	Polyculture	1	Yes		700
		SAG/DBL/13	LALMOHAN JINDAL	BASANTAPUR	General	29000	Freshwater	Fin Fish	Traditional	Polyculture	2	Yes	220	
		SAG/DBL/14	DEEPNARAYAN DAS	SHIBPUR	OBC	20000	Brackishwat	Both	Modified Exte	Integrated	2.5	No	30	40
		SAG/DBL/15	MANINDRANATH KARAN	SHIBPUR	SC	48000	Freshwater	Fin Fish	Traditional	Polyculture	1.4	Yes	150	
		SAG/DBL/16	BADAL KUMAR MONDAL	CHEMAGURI	OBC	60000	Both	Both	Modified Exte	Polyculture	2	Yes	100	500
		SAG/DBL/17	LALMOHAN KARAN	SHIBPUR	SC	75000	Freshwater	Fin Fish	Traditional	Polyculture	2.5	Yes	250	
		SAG/DBL/18	PRADIP MRIDHYA	DHABLAT SHIB PUR	SC	25000	Freshwater	Fin Fish	Traditional	Polyculture	3	Yes	200	
		SAG/DBL/19	NARENDRA NATH MOND	LALPUR	General	20000	Freshwater	Fin Fish	Traditional	Polyculture	0.5	Yes	100	
		SAG/DBL/20	BHAGIRATH MAITY	PURUSHOTTOMPUR	General	24000	Freshwater	Fin Fish	Traditional	Polyculture	1	Yes	250	

Block	Gram Panchayat	Farmer Code	Farmer Name	Village	Caste	Annual Income (Rs.)	Water Type	Fish Type	Farning Type	Cultivation Type	Pond Area (Bigha)	Sup. Feed	Fish Prod.(Kg)/ Bigha	Prawn Prod. (Kg)/ Bigha
		SAG/DBL/21	SUBHAS JANA	PURUSHOTTOMPUR	General	24000	Freshwater	Fin Fish	Traditional	Polyculture	4	Yes	250	
		SAG/DBL/22	SOURAJIT DAS	PURUSHOTTOMPUR	General	100000	Brackishwat	Both	Traditional	Polyculture	4	Yes	50	300
		SAG/DBL/23	ANANDA SHIT	PURUSHOTTOMPUR	SC	18000	Freshwater	Both	Traditional	Polyculture	1	Yes	200	25
		SAG/DBL/24	AJOY NANDI	CHEMAGURI	General	45000	Freshwater	Both	Traditional	Polyculture	1	No	130	25
		SAG/DBL/25	GOBINDA PRASAD SHIT	CHEMAGURI	SC	24000	Freshwater	Fin Fish	Traditional	Polyculture	1	No	200	
		SAG/DBL/26	RATAN SHIT	CHEMAGURI	SC	40000	Freshwater	Fin Fish	Traditional	Polyculture	2	Yes	200	
		SAG/DBL/27	ASHOK MANNA	CHEMAGURI	General	24000	Freshwater	Fin Fish	Traditional	Polyculture	0.5	Yes	100	
		SAG/DBL/28	AMIT PATRA	CHEMAGURI	General	24000	Both	Fin Fish	Traditional	Polyculture	1	Yes	200	
		SAG/DBL/29	SUBOL MANNA	CHEMAGURI	General	50000	Freshwater	Fin Fish	Traditional	Polyculture	3	Yes	100	
		SAG/DBL/30	AMIYA DAS	CHEMAGURI	General	18000	Freshwater	Both	Traditional	Polyculture	0.5	Yes	300	
		SAG/DBL/31	ANUP KUMAR KARAN	CHEMAGURI	SC	80000	Brackishwat	Shell Fis	Modified Exte	Monoculture	5	Yes		70
		SAG/DBL/32	AJOY NANDI(24)	CHEMAGURI	General	30000	Freshwater	Fin Fish	Traditional	Polyculture	0.5	No	150	
No. of families covered in GP		32												
	Gangasagar													
		SAG/GNS/01	SWADESH KHAMARI	CHANDIPUR	OBC	50000	Both	Both	Traditional	Polyculture	2.8	Yes	200	30
		SAG/GNS/02	KRISHNA PRASAD JANA	MAHISHMARI	OBC	20000	Freshwater	Fin Fish	Traditional	Polyculture	2	Yes	100	
		SAG/GNS/03	ROBIN MONDAL	BISHNUPUR	OBC	24000	Freshwater	Both	Modified Exte	Polyculture	3	Yes	380	25
		SAG/GNS/04	SUKUMAR DAS	BISHNUPUR	General	20000	Freshwater	Both	Traditional	Polyculture	10	Yes	300	200
		SAG/GNS/05	KALIPADA PATRA	BISHNUPUR	SC	20000	Freshwater	Both	Traditional	Polyculture	1	Yes	200	45
		SAG/GNS/06	SUBODH KUMAR DAS	BISHNUPUR	General	50000	Freshwater	Both	Traditional	Polyculture	4	Yes	200	25
		SAG/GNS/07	SITARAM BARUI	BISHNUPUR	SC	20000	Freshwater	Fin Fish	Traditional	Polyculture	4	Yes	125	
		SAG/GNS/08	ANANTA SAHU	BISHNUPUR	General	30000	Freshwater	Fin Fish	Traditional	Polyculture	1	Yes	300	
		SAG/GNS/09	TAPAN KUAMR BHUINYA	BISHNUPUR	General	25000	Brackishwat	Shell Fis	Modified Exte	Monoculture	3	Yes		540
		SAG/GNS/10	KALIPADA JANA	BISHNUPUR	General	70000	Brackishwat	Shell Fis	Modified Exte	Monoculture	4.5	Yes		150
		SAG/GNS/11	ABANI GIRI	BISHNUPUR	General	36000	Brackishwat	Shell Fis	Semi-intensive	Monoculture	3	Yes		100

Block	Gram Panchayat	Farmer Code	Farmer Name	Village	Caste	Annual Income (Rs.)	Water Type	Fish Type	Farming Type	Cultivation Type	Pond Area (Bigha)	Sup. Feed	Fish Prod.(Kg)/ Bigha	Prawn Prod. (Kg)/ Bigha
		SAG/GNS/12	SUKHDEB KHATUA	BISHNUPUR	OBC	40000	Both	Both	Traditional	Polyculture	0.5	Yes	100	55
		SAG/GNS/13	SRIKRISHNA SINHA	BISHNUPUR	General	40000	Both	Both	Traditional	Polyculture	4	Yes	600	35
		SAG/GNS/14	ANIL KHATUA	BISHNUPUR	General	36000	Freshwater	Fin Fish	Traditional	Polyculture	1	Yes	300	
		SAG/GNS/15	MAHIRUDDIN SAHA	BISHNUPUR	Muslim	40000	Freshwater	Fin Fish	Traditional	Polyculture	3	Yes	100	
		SAG/GNS/16	DEBKUMAR MAITY	NATENDRAPUR	General	30000	Freshwater	Both	Traditional	Polyculture	10	Yes	100	70
		SAG/GNS/17	PARITOSH MONDAL	NATENDRAPUR	SC	24000	Freshwater	Both	Traditional	Polyculture	1	Yes	300	250
		SAG/GNS/18	KESHAB CHANDRA DOLUI	CHANDIPUR	SC	36000	Freshwater	Fin Fish	Traditional	Polyculture	2	Yes	200	
		SAG/GNS/19	PANKAJ JANA	BISHNUPUR	SC	45000	Brackishwat	Shell Fis	Modified Exte	Monoculture	2	Yes		150
		SAG/GNS/20	MRITYUNJOY DAS	NATENDRAPUR	OBC	45000	Freshwater	Fin Fish	Traditional	Polyculture	6	Yes	120	250
No. of families covered in GP		20												
	Ghoramara													
		SAG/GHM/01	ARUP MONDAL	ROYPARA	General	72000	Both	Both	Traditional	Polyculture	4	Yes	100	30
		SAG/GHM/02	KANAI BHUINYA	ROYPARA	General	60000	Both	Both	Traditional	Polyculture	6	Yes	200	50
		SAG/GHM/03	BIJOY SINGH	BAGPARA	General	36000	Both	Both	Traditional	Polyculture	4	Yes	300	60
		SAG/GHM/04	S.K. IDRISH	CHUNGURI	Muslim	24000	Freshwater	Fin Fish	Traditional	Polyculture	1	No	60	
		SAG/GHM/05	SEIKH MAJAHAR	CHUNPURI	Muslim	24000	Freshwater	Fin Fish	Traditional	Polyculture	1	No	120	
		SAG/GHM/06	SEIKH MONTAJ	CHUNPURI	Muslim	50000	Freshwater	Fin Fish	Traditional	Polyculture	0.5	No	100	
		SAG/GHM/07	HEMANTA KHANRA	CHUNPURI	General	36000	Both	Both	Traditional	Polyculture	2	Yes	150	100
		SAG/GHM/08	SEIKH ABDUL GONI	CHUN PURI	Muslim	24000	Freshwater	Fin Fish	Traditional	Polyculture	3	No	260	
		SAG/GHM/09	SEIKH KABIRUDDIN	CHUNPURI	Muslim	24000	Both	Both	Traditional	Polyculture	2	No	300	115
		SAG/GHM/10	BABLU KHAN	CHUNPURI	Muslim	24000	Freshwater	Fin Fish	Traditional	Polyculture	0.2	No	80	
		SAG/GHM/11	AJOY PATRA	CHUNPURI	SC	24000	Freshwater	Both	Modified Exte	Polyculture	2	Yes	200	150
		SAG/GHM/12	SEIKH ROBIUL	CHUNPURI	Muslim	36000	Freshwater	Fin Fish	Traditional	Polyculture	1	No	100	
		SAG/GHM/13	JAMSHED KHAN	CHUNPURI	Muslim	24000	Both	Both	Modified Exte	Polyculture	1	Yes	200	50
		SAG/GHM/14	AMALENDU DAS	MANDIRTALA	General	24000	Freshwater	Fin Fish	Traditional	Polyculture	1	Yes	300	

Block	Gram Panchayat	Farmer Code	Farmer Name	Village	Caste	Annual Income (Rs.)	Water Type	Fish Type	Farning Type	Cultivation Type	Pond Area (Bigha)	Sup. Feed	Fish Prod.(Kg)/ Bigha	Prawn Prod. (Kg)/ Bigha
		SAG/GHM/15	SEIKH JAMSHED ALI	MANDIRTALA	Muslim	36000	Freshwater	Fin Fish	Traditional	Polyculture	2	Yes	200	
		SAG/GHM/16	AMIT GURIA	MANDIRTALA	General	24000	Freshwater	Fin Fish	Traditional	Polyculture	1	No	200	
		SAG/GHM/17	ARUN KANTI HALDER	MANDIRTALA	General	36000	Both	Both	Traditional	Polyculture	1	No	150	50
		SAG/GHM/18	BISWANATH DAS	MANDIRTALA	SC	36000	Freshwater	Fin Fish	Traditional	Polyculture	0.5	Yes	100	
		SAG/GHM/19	SANTOSH BHUINYA	MANDIRTALA	General	50000	Freshwater	Fin Fish	Traditional	Polyculture	3	Yes	300	
		SAG/GHM/20	NARENDRA NATH KARAK	MANDIRTALA	SC	24000	Freshwater	Fin Fish	Traditional	Polyculture	1	Yes	150	
		SAG/GHM/21	RABINDRANATH JANA	MANDIRTALA	General	24000	Freshwater	Fin Fish	Traditional	Polyculture	2	Yes	200	
		SAG/GHM/22	NARAYAN KARAK	MANDIRTALA	SC	24000	Freshwater	Fin Fish	Modified Exte	Polyculture	1	Yes	110	
		SAG/GHM/23	SACHIN JANA	MANDIRTALA	General	36000	Freshwater	Fin Fish	Traditional	Polyculture	2	No	70	
		SAG/GHM/24	DAMODOR KARAK	MANDIRTALA	SC	36000	Freshwater	Fin Fish	Traditional	Polyculture	3	Yes	150	
		SAG/GHM/25	JOYDEV BHUINYA	MANDIRTALA	General	36000	Freshwater	Fin Fish	Traditional	Polyculture	3	Yes	80	
		SAG/GHM/26	AMALENDU GURIA	MANDIRTALA	General	36000	Freshwater	Fin Fish	Traditional	Polyculture	2	Yes	200	
		SAG/GHM/27	KHOKAN JANA	MANDIRATLA	General	24000	Both	Fin Fish	Modified Exte	Polyculture	2	Yes	160	
		SAG/GHM/28	SRISTIDHAR KANDAR	MANDIRTALA	General	300000	Freshwater	Fin Fish	Traditional	Polyculture	3	No	90	
		SAG/GHM/29	KRITTIBAS DOLUI	HATKHOLA	SC	36000	Freshwater	Fin Fish	Traditional	Polyculture	1	Yes	300	
		SAG/GHM/30	KALIPADA HALDER	HATKHOLA	SC	36000	Freshwater	Fin Fish	Traditional	Polyculture	6	Yes	200	
		SAG/GHM/31	UDAY HALDER	HATKHOLA	SC	36000	Freshwater	Fin Fish	Traditional	Polyculture	1	Yes	150	
		SAG/GHM/32	RAJARAM JANA	HATKHOLA	SC	36000	Freshwater	Fin Fish	Traditional	Polyculture	1	Yes	60	
No. of families covered in GP		32												
	MuriGanga - I													
		SAG/MG-1/01	Sasanka Sekhar Jana	Sapkhali	General	150000	Freshwater	Fin Fish	Traditional	Polyculture	1	Yes	150	
		SAG/MG-1/02	KANAI PRAMANIK	KHEER KUL TALA	SC	150000	Freshwater	Fin Fish	Traditional	Polyculture	0.3	Yes	200	
		SAG/MG-1/03	LAXMI KANTA DAS	FULLBARI	General	200000	Freshwater	Fin Fish	Modified Exte	Polyculture	2	Yes	300	
		SAG/MG-1/04	RAM JANA	FULLBARI	General	100000	Freshwater	Fin Fish	Traditional	Polyculture	0.5	Yes	500	

Block	Gram Panchayat	Farmer Code	Farmer Name	Village	Caste	Annual Income (Rs.)	Water Type	Fish Type	Farming Type	Cultivation Type	Pond Area (Bigha)	Sup. Feed	Fish Prod.(Kg)/ Bigha	Prawn Prod. (Kg)/ Bigha
		SAG/MG-1/05	ASHOK JANA	FULLBARI	General	50000	Freshwater	Both	Traditional	Polyculture	2.5	Yes	200	18
		SAG/MG-1/06	TAPAN KUMAR KHANRA	KACHUBERIA	General	100000	Both	Both	Traditional	Polyculture	5	Yes	700	100
		SAG/MG-1/07	NATENDRA NATH GHOSH	KACHUBERIA	OBC	50000	Both	Both	Traditional	Polyculture	0.4	No	350	100
		SAG/MG-1/08	SEIKH ABDUL JABBAR	KASH TALA	Muslim	100000	Both	Both	Traditional	Polyculture	2	Yes	40	200
		SAG/MG-1/09	SHAYAMAL PAHARI	KOSH TALA	General	200000	Freshwater	Fin Fish	Traditional	Polyculture	2.5	Yes	100	
		SAG/MG-1/10	MODHUSUDHAN GAYEN	PAKHIRALA	General	240000	Freshwater	Both	Modified Exte	Polyculture	0.35	Yes	200	50
		SAG/MG-1/11	HAREKRISHNA GIRI	SILPARA	General	200000	Both	Both	Modified Exte	Polyculture	4.5	Yes	120	200
		SAG/MG-1/12	JHANTU PONDA	SILPARA	General	120000	Both	Both	Traditional	Polyculture	0.5	Yes	100	20
		SAG/MG-1/13	SRI BRINDABAN PATI	SILPARA	General	120000	Both	Both	Traditional	Polyculture	7	Yes	150	50
		SAG/MG-1/14	ASOK GIRI	HENDEL KETKI	General	200000	Freshwater	Fin Fish	Modified Exte	Polyculture	1.5	Yes	100	
		SAG/MG-1/15	GURUPADA PATRA	COLLECTOR GAUNJ	SC	70000	Both	Both	Modified Exte	Polyculture	1	Yes	600	30
		SAG/MG-1/16	GOPAL DAS	COLLECTOR GAUNJ	General	70000	Brackishwat	Shell Fis	Semi-intensive	Monoculture	5	Yes		500
		SAG/MG-1/17	SARATHI MONDAL	COLLECTOR GAUNJ	General	50000	Both	Both	Traditional	Polyculture	1.5	Yes	200	50
		SAG/MG-1/18	ASOK KUMAR DOLUI	SHIBPUR	SC	180000	Both	Both	Traditional	Polyculture	0.75	Yes	200	50
		SAG/MG-1/19	PIJUS KUMAR PAL	PATHAR PRATIMA	General	200000	Both	Both	Semi-intensive	Polyculture	3	Yes	120	16
		SAG/MG-1/20	NARAYAN MONDAL	KACHUBERIA	SC	120000	Both	Both	Traditional	Polyculture	3	Yes	200	50
No. of families covered in GP		20												
	MuriGanga - II													
		SAG/MG-II/01	SUBHASH DAS	BAMANKHALI	General	100000	Both	Both	Modified Exte	Polyculture	5	Yes	900	150
		SAG/MG-II/02	RABIN TIWARI	BAMANKHALI	General	90000	Freshwater	Fin Fish	Traditional	Polyculture	1.5	Yes	100	
		SAG/MG-II/03	PRANAB MONDAL	BAMANKHALI	SC	100000	Freshwater	Both	Modified Exte	Polyculture	0.3	Yes	200	80
		SAG/MG-II/04	GOLAM MOHIT	BAMANKHALI	Muslim	240000	Freshwater	Both	Modified Exte	Polyculture	1	Yes	150	200
		SAG/MG-II/05	DUT KUMAR JANA	BAMANKHALI	General	50000	Freshwater	Fin Fish	Traditional	Polyculture	2	Yes	300	
		SAG/MG-II/06	DULAL BERA	BAMANKHALI	General	80000	Freshwater	Fin Fish	Modified Exte	Polyculture	1	Yes	200	

Block	Gram Panchayat	Farmer Code	Farmer Name	Village	Caste	Annual Income (Rs.)	Water Type	Fish Type	Farming Type	Cultivation Type	Pond Area (Bigha)	Sup. Feed	Fish Prod.(Kg)/ Bigha	Prawn Prod. (Kg)/ Bigha
		SAG/MG-II/07	SEIKH MANIRUL	CHAMPATALA	General	80000	Both	Both	Modified Exte	Polyculture	4	Yes	300	200
		SAG/MG-II/08	RADHESHYAM PRAMANI	BAMANKHALI	General	60000	Freshwater	Fin Fish	Modified Exte	Polyculture	2	Yes	120	
		SAG/MG-II/09	NIRMAL BERA	BAMANKHALI	General	80000	Freshwater	Fin Fish	Traditional	Monoculture	2	Yes	200	
		SAG/MG-II/10	ABDUL AKBAR	BAMANKHALI	Muslim	30000	Freshwater	Fin Fish	Modified Exte	Polyculture	1	Yes	140	
		SAG/MG-II/11	HASIKUL KHAN	BAMANKHALI	Muslim	24000	Freshwater	Fin Fish	Modified Exte	Polyculture	1	Yes	150	
		SAG/MG-II/12	ANARUL ISLAM KHAN	BAMANKHALI	Muslim	24000	Freshwater	Fin Fish	Modified Exte	Polyculture	0.3	Yes	100	
		SAG/MG-II/13	KAMAL BERA	BAMANKAHLI	General	100000	Both	Both	Modified Exte	Polyculture	6	Yes	200	100
		SAG/MG-II/14	BINOY DAS	MANDIR TALA	General	200000	Brackishwat	Fin Fish	Traditional	Polyculture	1	Yes	100	
		SAG/MG-II/15	ANUP KUMAR BAR	MANDIR TALA	SC	24000	Freshwater	Fin Fish	Traditional	Polyculture	2.5	Yes	300	
		SAG/MG-II/16	BASUDEB PRADHAN	MANDIR TOLA	General	60000	Freshwater	Fin Fish	Modified Exte	Polyculture	1.5	Yes	200	
		SAG/MG-II/17	BROJEN MRIDHA	CHAK FULL DUBI	General	400000	Brackishwat	Shell Fis	Semi-intensive	Monoculture	6	Yes		1000
		SAG/MG-II/18	DIPAK BERA	CHAK FULL DUBI	General	100000	Brackishwat	Shell Fis	Modified Exte	Monoculture	2.5	Yes		1225
		SAG/MG-II/19	GURUPADA MRIDHA	CHAK FULL DUBI	General	100000	Brackishwat	Shell Fis	Semi-intensive	Monoculture	2.5	Yes		800
		SAG/MG-II/20	NASIR ALI MOLLA	CHAK FULL DUBI	Muslim	100000	Brackishwat	Shell Fis	Semi-intensive	Monoculture	2.5	Yes		200
No. of families covered in GP		20												
	Ramkarchar													
		SAG/MKR/01	AMIT KUMAR GURIA	KRISHNANAGAR	General	100000	Freshwater	Both	Semi-intensive	Polyculture	16	Yes	50	15
		SAG/MKR/02	BHAGIRAT JANA	KHASRAMKAR	General	60000	Brackishwat	Shell Fis	Modified Exte	Monoculture	3	Yes		300
		SAG/MKR/03	SANJOY DAS	KRISHNANAGAR	SC	70000	Brackishwat	Shell Fis	Semi-intensive	Monoculture	1.5	Yes	300	
		SAG/MKR/04	ASIT BARAN PATRA	KHASRAMPUR	SC	65000	Freshwater	Fin Fish	Traditional	Polyculture	1.5	Yes	200	
		SAG/MKR/05	TAPAS KUMAR TRIPATHI	KRISHNANAGAR	General	80000	Both	Both	Modified Exte	Polyculture	4	Yes	150	100
		SAG/MKR/06	RABINDRANATH PRADHA	KRISHNANAGAR	General	55000	Brackishwat	Shell Fis	Semi-intensive	Monoculture	2	Yes		150
		SAG/MKR/07	MALA MILAN SANGHA	RAMKARCHAR	OBC	85000	Freshwater	Fin Fish	Traditional	Integrated	0.5	No	110	
		SAG/MKR/08	DIPAK MAHATA	KHASRAMKARCHAR	General	45000	Freshwater	Fin Fish	Traditional	Polyculture	0.5	Yes	120	
		SAG/MKR/09	DIPAK KUMAR PATRA	KRISHNANAGAR	General	65000	Brackishwat	Fin Fish	Semi-intensive	Monoculture	1.5	Yes		120

Block	Gram Panchayat	Farmer Code	Farmer Name	Village	Caste	Annual Income (Rs.)	Water Type	Fish Type	Farming Type	Cultivation Type	Pond Area (Bigha)	Sup. Feed	Fish Prod.(Kg)/ Bigha	Prawn Prod. (Kg)/ Bigha
		SAG/MKR/10	BADAL CHANDRA DAS	KRISHNANAGAR	OBC	36000	Freshwater	Fin Fish	Modified Exte	Polyculture	1	Yes	200	
		SAG/MKR/11	SRITANGSHU SEKHAR NA	KRISHNANAGAR	OBC	34000	Freshwater	Fin Fish	Traditional	Polyculture	0.5	No	120	
		SAG/MKR/12	BIBEKANANDA DAS	KRISHNANAGAR	SC	30000	Both	Both	Traditional	Polyculture	1	Yes	160	50
		SAG/MKR/13	SANJIB DOLUI	KRISHNANAGAR	SC	18000	Freshwater	Fin Fish	Traditional	Polyculture	0.5	Yes	160	
		SAG/MKR/14	PULAK PRADHAN	KRISHNANAGAR	SC	24000	Freshwater	Fin Fish	Traditional	Polyculture	0.5	Yes	160	
		SAG/MKR/15	MUKUL PRAMANIK	KRISHNANAGAR	ST	18000	Freshwater	Fin Fish	Traditional	Polyculture	2	No	120	
		SAG/MKR/16	AMIT GURIA	KRISHNANAGAR	General	36000	Brackishwat	Shell Fis	Modified Exte	Monoculture	16	Yes		80
		SAG/MKR/17	TAPAS JANA	KRISHNANAGAR	General	20000	Freshwater	Both	Traditional	Polyculture	1.5	Yes	100	20
		SAG/MKR/18	TAPAS KUMAR DAS	KRISHNANAGAR	General	24000	Freshwater	Fin Fish	Traditional	Polyculture	2	Yes	120	
		SAG/MKR/19	TAPAN JANA	NARHARIPUR	General	18000	Freshwater	Fin Fish	Traditional	Polyculture	0.5	Yes	120	
		SAG/MKR/20	BHASKAR CHANDRA DAS	NARHARIPUR	General	36000	Freshwater	Fin Fish	Modified Exte	Polyculture	1.5	Yes	150	
		SAG/MKR/21	`RAICHAND MONDAL	NARHARIPUR	OBC	24000	Freshwater	Fin Fish	Traditional	Polyculture	0.5	Yes	170	
		SAG/MKR/22	SUBHAS JANA	NARHARIPUR	General	24000	Freshwater	Fin Fish	Traditional	Polyculture	0.5	Yes	250	
		SAG/MKR/23	PURNENDU JANA	NARHARIPUR	General	24000	Freshwater	Fin Fish	Traditional	Monoculture	0.5	Yes	300	
		SAG/MKR/24	ASISH BHUINYA	NARHARIPUR	General	50000	Freshwater	Fin Fish	Traditional	Polyculture	2	Yes	210	
		SAG/MKR/25	GOUR SANKAR BERA	NARHARIPUR	General	40000	Freshwater	Fin Fish	Semi-intensive	Monoculture	2	Yes	300	
		SAG/MKR/26	JHANTU KUMAR JANA	NARHARIPUR	General	36000	Both	Both	Traditional	Polyculture	1	Yes	500	200
		SAG/MKR/27	BANKIM MAITY	NARHARIPUR	General	36000	Freshwater	Both	Traditional	Polyculture	3	Yes	180	150
No. of families covered in GP		27												
	Rudranagar													
		SAG/RDN/01	ARUN BEJ	JIBANTALA	General	30000	Freshwater	Fin Fish	Traditional	Polyculture	1	Yes	400	
		SAG/RDN/02	SAMARENDRA NATH JAN	JIBANTALA	General	30000	Both	Both	Traditional	Polyculture	1	Yes	600	150
		SAG/RDN/03	DIBYENDU BERA	KAMALPUR	General	38000	Freshwater	Fin Fish	Traditional	Polyculture	2	Yes	300	
		SAG/RDN/04	SUDHIR CHANDRA GURIA	RADHAKRISHNAPUR	General	50000	Both	Both	Modified Exte	Polyculture	4	Yes	100	300
		SAG/RDN/05	TAPAN GHOSH	KIRTANKHALI	OBC	100000	Both	Both	Semi-intensive	Polyculture	2.5	Yes	500	300

Block	Gram Panchayat	Farmer Code	Farmer Name	Village	Caste	Annual Income (Rs.)	Water Type	Fish Type	Farming Type	Cultivation Type	Pond Area (Bigha)	Sup. Feed	Fish Prod.(Kg)/ Bigha	Prawn Prod. (Kg)/ Bigha
		SAG/RDN/06	SWAPAN MAITY	RADHAKRISHNAPUR	General	90000	Both	Shell Fis	Traditional	Polyculture	2	Yes		700
		SAG/RDN/07	KALIPADA JANA	KIRTANKHALI	General	35000	Freshwater	Fin Fish	Traditional	Polyculture	2	Yes	800	
		SAG/RDN/08	ABHIJIT GURIA	KAMALPUR	General	70000	Freshwater	Both	Traditional	Polyculture	2	Yes	200	90
		SAG/RDN/09	ANUP HAZRA	RADHAKRISHNAPUR	General	50000	Brackishwat	Shell Fis	Semi-intensive	Polyculture	3	Yes		600
		SAG/RDN/10	SWAPAN KUMAR MAITY	KIRTANKHALI	General	50000	Both	Both	Traditional	Polyculture	1	Yes	700	530
		SAG/RDN/11	TAPAN MONDAL	JIBANTALA	General	36000	Freshwater	Fin Fish	Traditional	Polyculture	1	Yes	400	
		SAG/RDN/12	SEIKH DULU	KAMALPUR 1 NO COLO	General	30000	Freshwater	Both	Traditional	Polyculture	1.2	Yes	300	400
		SAG/RDN/13	CHINMOY JANA	JIBANTALA	General	30000	Freshwater	Fin Fish	Modified Exte	Polyculture	1	Yes	400	
		SAG/RDN/14	SRIKANTA GURIA	RADHAKRISHNAPUR	General	30000	Both	Both	Traditional	Polyculture	1	Yes	400	200
		SAG/RDN/15	AMAL GURIA	RADHAKRISHNAPUR	General	30000	Both	Shell Fis	Traditional	Polyculture	10	Yes		680
		SAG/RDN/16	ASHOK PRADHAN	RUDRANAGAR	General	150000	Both	Shell Fis	Semi-intensive	Polyculture	6	Yes		200
		SAG/RDN/17	DULAL PRADHAN	JIBAN TALA	General	40000	Freshwater	Fin Fish	Traditional	Polyculture	1	Yes	400	
		SAG/RDN/18	BIMAL DAS ADHIKARI	RUDRANAGAR	OBC	40000	Freshwater	Fin Fish	Traditional	Polyculture	0.5	Yes	110	
		SAG/RDN/19	PARITOSH ROY	KAMALPUR	General	50000	Both	Both	Traditional	Polyculture	1.5	Yes	400	80
		SAG/RDN/20	HALEMA BIBI	KAMALPUR 1 NO COLO	General	40000	Both	Both	Traditional	Polyculture	0.5	Yes	300	30
		SAG/RDN/21	NIMAI CHARAN SAHU	KAMALPUR	General	45000	Both	Both	Traditional	Polyculture	1	Yes	200	60
		SAG/RDN/22	ISWAR CHANDAR JANA	MANASA DWIP KHAS	General	30000	Freshwater	Fin Fish	Traditional	Polyculture	1	Yes	700	
		SAG/RDN/23	SEIKH JABED	JIBANTALA	Muslim	40000	Both	Both	Traditional	Polyculture	1.5	Yes	300	100
		SAG/RDN/24	RANJIT JANA	MANASADWIP	General	40000	Both	Both	Traditional	Polyculture	2	Yes	400	60
		SAG/RDN/25	AJOY MONDAL	RUDRANAGAR	OBC	40000	Both	Both	Traditional	Polyculture	2	Yes	50	200
		SAG/RDN/26	BIKASH MAITYU	MANASA DWIP	General	30000	Freshwater	Fin Fish	Traditional	Polyculture	1	Yes	200	
		SAG/RDN/27	NIMAI MAITY	MANASA DWIP	General	50000	Freshwater	Fin Fish	Traditional	Polyculture	2	Yes	200	
		SAG/RDN/28	AMAL SAHU	KAMALPUR	General	30000	Both	Both	Modified Exte	Polyculture	1.5	No	90	40
		SAG/RDN/29	BINOY MANNA	KAMALPUR	SC	30000	Both	Both	Traditional	Polyculture	0.3	No	200	200
		SAG/RDN/30	SEIKH ISAQ MOHAMMAD	KAMALAPUR	Muslim	30000	Both	Both	Traditional	Polyculture	2.5	Yes	60	100
		SAG/RDN/31	SEIKH MANIRUL	KAMALPUR	Muslim	40000	Both	Both	Traditional	Polyculture	0.5	Yes	75	80

Block	Gram Panchayat	Farmer Code	Farmer Name	Village	Caste	Annual Income (Rs.)	Water Type	Fish Type	Farming Type	Cultivation Type	Pond Area (Bigha)	Sup. Feed	Fish Prod.(Kg)/ Bigha	Prawn Prod. (Kg)/ Bigha
		SAG/RDN/32	PRABIR BALESWAR	KAMALPUR	General	36000	Freshwater	Fin Fish	Traditional	Polyculture	0.5	No	200	
		SAG/RDN/33	NISHIKANTA BALESWAR	KAMALPUR	General	35000	Freshwater	Fin Fish	Traditional	Polyculture	0.5	No	200	
		SAG/RDN/34	SUNIL BALESWAR	KAMALPUR	General	24000	Freshwater	Fin Fish	Traditional	Polyculture	1	Yes	70	
		SAG/RDN/35	PRADIP BALESWAR	KAMALPUR	General	36000	Freshwater	Fin Fish	Traditional	Polyculture	1	Yes	200	
		SAG/RDN/36	PRAJAPATI BALESWAR	KAMALPUR	General	600000	Freshwater	Fin Fish	Traditional	Polyculture	0.5	Yes	100	
		SAG/RDN/37	BIKASH DEBNATH	KAMALPUR	OBC	20000	Freshwater	Fin Fish	Traditional	Polyculture	1	Yes	150	
		SAG/RDN/38	SWADWSH DAS	KAMALPUR	General	20000	Freshwater	Fin Fish	Traditional	Polyculture	0.4	No	150	
		SAG/RDN/39	NIKHIL CHANDRA BALES	KAMALPUR	General	40000	Freshwater	Fin Fish	Traditional	Polyculture	2	No	250	
		SAG/RDN/40	NANDAGOPAL KAHTUA	KAMALPUR	General	20000	Freshwater	Fin Fish	Traditional	Polyculture	3	Yes	160	
		SAG/RDN/41	RAM CHANDRA DAS	KAMALPUR	General	70000	Freshwater	Fin Fish	Traditional	Polyculture	0.5	Yes	150	
		SAG/RDN/42	SEIKH GUL HOSSEIN	KAMALPUR	Muslim	18000	Freshwater	Fin Fish	Traditional	Polyculture	0.5	No	150	
		SAG/RDN/43	PRADIP SHEET	KAMALPUR	SC	40000	Freshwater	Fin Fish	Traditional	Polyculture	1	No	215	
		SAG/RDN/44	BIDHYADHAR SHIT	KAMALPUR	SC	18000	Freshwater	Fin Fish	Traditional	Polyculture	1	No	180	
		SAG/RDN/45	BIKASH PRADHAN	KAMALPUR	General	24000	Freshwater	Fin Fish	Traditional	Polyculture	2	Yes	200	
		SAG/RDN/46	BIKASH BAURI	RUDRANAGAR	OBC	20000	Freshwater	Fin Fish	Traditional	Polyculture	1	No	145	

No. of families covered in GP	46
No. of families covered in Block	244
No. of total families covered	451

Impacts of High Intensity Weather Event (Cyclone) on Aquaculture

BASANTI B L O C K

Block	Gram Panchayat	Farmer Code	Farmer Name	Village	Promblems Due to Cyclone	Coping Measures Taken By Farmers
Basanti						
	Basanti					
		BST/BST/01	ARUP KUMAR DAS	PURBA ABASANTI	Breach of pond dyke	5. Repair of pond dyke with earth/polythene, 8. Increase of pond dyke height to prevent entry of saline water
		BST/BST/02	NAKUL SRAKAR	RADHABALLAVPUR	Ingression of saline water into the pond, Breach of pond dyke	11.No measures taken
		BST/BST/03	RATHIKANTA HALDER	RADHABALLAVPUR	Escape of fish stock from the pond	4. Dewatering, 5. Repair of pond dyke with earth/polythene
		BST/BST/04	AMBALIKA HALDER	KALIDANGA	Breach of pond dyke	11.No measures taken, 12.Not affected in cyclone
		BST/BST/05	MANA NASKAR	KALIDANGA	Breach of pond dyke	5. Repair of pond dyke with earth/polythene
		BST/BST/06	USHARANI DAS	SRIRAMPUR	Breach of pond dyke, Escape of fish stock from the pond	5. Repair of pond dyke with earth/polythene, 8. Increase of pond dyke height to prevent entry of saline water
		BST/BST/07	INDRAJIT DEBNATH	KALIDANGA	Breach of pond dyke	5. Repair of pond dyke with earth/polythene
		BST/BST/08	DHIMAN CHANDRA DAS	PASCHIM BASANTI	Breach of pond dyke	5. Repair of pond dyke with earth/polythene
		BST/BST/09	TAPAN MONDAL	SRIRAMPUR	Breach of pond dyke, Escape of fish stock from the pond	5. Repair of pond dyke with earth/polythene
		BST/BST/10	DIBYENDU MONDAL	RADHABALLAVPUR	Breach of pond dyke	5. Repair of pond dyke with earth/polythene
		BST/BST/11	KHOKA HALDER	PURBA BASANTI	Breach of pond dyke	8. Increase of pond dyke height to prevent entry of saline water
		BST/BST/12	DULAL BAR	KALIDANGA	Ingression of saline water into the pond, Breach of pond dyke	5. Repair of pond dyke with earth/polythene, 8. Increase of pond dyke height to prevent entry of saline water

Block	Gram Panchayat	Farmer Code	Farmer Name	Village	Promblems Due to Cyclone	Coping Measures Taken By Farmers
		BST/BST/13	MALI SHIKDAR	KALIDANGA	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	5. Repair of pond dyke with earth/polythene
		BST/BST/14	APILUDDIN KHAN	KALIDANGA	Breach of pond dyke, Escape of fish stock from the pond	5. Repair of pond dyke with earth/polythene, 8. Increase of pond dyke height to prevent entry of saline water
		BST/BST/15	AKHIL NASKAR	KALIDANGA	Breach of pond dyke, Escape of fish stock from the pond	5. Repair of pond dyke with earth/polythene, 8. Increase of pond dyke height to prevent entry of saline water
		BST/BST/16	PROBHAT HALDER	KALIDANGA	Breach of pond dyke, Escape of fish stock from the pond	5. Repair of pond dyke with earth/polythene, 8. Increase of pond dyke height to prevent entry of saline water
		BST/BST/17	GOPAL NASKAR	KALIDANGA	Any other	8. Increase of pond dyke height to prevent entry of saline water
		BST/BST/18	PREMANANDA NASKAR	SRIRAMPUR	Entry of other (unwanted) fish species	5. Repair of pond dyke with earth/polythene, 8. Increase of pond dyke height to prevent entry of saline water
		BST/BST/19	PRADIP DEBNATH	RADHABALLAVPUR	Breach of pond dyke	5. Repair of pond dyke with earth/polythene
		BST/BST/20	TAPAN DAS	PRIYANATH PALLY	Breach of pond dyke, Escape of fish stock from the pond	5. Repair of pond dyke with earth/polythene
No. of families covered in the Gram Panchayat		**20**				
	Bharat Garh					
		BST/BTR/01	ARJUN CHANDRA SARDAR	GARANBOSE 2NO	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond, Entry of other (unwanted) fish species	11.No measures taken
		BST/BTR/02	MRITUNJAY SARDAR	BHARATGARH NO 7	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond, Entry of other (unwanted) fish species	5. Repair of pond dyke with earth/polythene

Block	Gram Panchayat	Farmer Code	Farmer Name	Village	Promblems Due to Cyclone	Coping Measures Taken By Farmers
		BST/BTR/03	RANJAN MONDAL	MAHESHPUR	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	4. Dewatering, 5. Repair of pond dyke with earth/polythene
		BST/BTR/04	SHAMIR HAIT	BHARATGARH NO 7	Ingression of saline water into the pond, Breach of pond dyke	5. Repair of pond dyke with earth/polythene, 7. Plantation in pond dyke, 8. Increase of pond dyke height to prevent entry of saline water
		BST/BTR/05	NAKUL CHANDRA MONDAL	BHARATGARH N0 6	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	11.No measures taken
		BST/BTR/06	HARAN CHANDRA MONDAL	BHARATGARH NO 1	Not affected	12.Not affected in cyclone
		BST/BTR/07	GOLOKBARI SARKAR	GARANBOSE NO 2	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	11.No measures taken
		BST/BTR/08	BABLU MOLLA	GARANBOSE NO 2	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond, Entry of other (unwanted) fish species	5. Repair of pond dyke with earth/polythene, 7. Plantation in pond dyke, 8. Increase of pond dyke height to prevent entry of saline water
		BST/BTR/09	LAXMAN MONDAL	BHARATGARH NO 7	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond, Entry of other (unwanted) fish species	11.No measures taken
		BST/BTR/10	BHANU KANTA MAHAKUR	GARANBOSE NO 4	Not affected	12.Not affected in cyclone
		BST/BTR/11	BHARAT MAHAKUR	GARANBOSE NO 4	Not affected	12.Not affected in cyclone
		BST/BTR/12	AMULLYA MAHAKUR	GORANBOSE NO 4	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	4. Dewatering, 5. Repair of pond dyke with earth/polythene
		BST/BTR/13	JATIN MAHATO	BHARATGARH NO 5	Ingression of saline water into the pond, Breach of pond dyke	5. Repair of pond dyke with earth/polythene
		BST/BTR/14	NIRANJAN MAHAKUR	GARANBOSE	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	11.No measures taken

Block	Gram Panchayat	Farmer Code	Farmer Name	Village	Promblems Due to Cyclone	Coping Measures Taken By Farmers
		BST/BTR/15	SAHEB ALI LASKAR	GARNBOSE NO 3	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	5. Repair of pond dyke with earth/polythene
		BST/BTR/16	SWAPAN MONDAL	BHAGAR GHERI NO 6	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	5. Repair of pond dyke with earth/polythene
		BST/BTR/17	DIBAKAR SARKAR	BHARATGARH NO 5	Not affected	5. Repair of pond dyke with earth/polythene, 8. Increase of pond dyke height to prevent entry of saline water
		BST/BTR/18	ABHIMUNYA MAHATO	BHARATGARH	Not affected	12.Not affected in cyclone
		BST/BTR/19	PROSAD NASKAR	BHARATGARH N0 7	Breach of pond dyke, Escape of fish stock from the pond	5. Repair of pond dyke with earth/polythene, 8. Increase of pond dyke height to prevent entry of saline water
		BST/BTR/20	JADAB HALDER	BHARATGARH	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	11.No measures taken
		BST/BTR/21	RATAN BAR	BHARATGARH NO 7	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	5. Repair of pond dyke with earth/polythene, 8. Increase of pond dyke height to prevent entry of saline water
No. of families covered in the Gram Panchayat		**21**				
Chara Bidya						
		BST/CBY/01	MIR MAFIJUL ISLAM	CHARABIDYA	Not affected	12.Not affected in cyclone
		BST/CBY/02	MAZIBAR LASKAR	3 NO CHARABIDYA	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond, Entry of other (unwanted) fish species	11.No measures taken
		BST/CBY/03	RUHUL AMIN GAZI	4 NO PATUAKHALI	Not affected	12.Not affected in cyclone
		BST/CBY/04	SURAJ SARKAR	6 NO CHARABIDYA	Not affected	12.Not affected in cyclone
		BST/CBY/05	ISMAIL MAJHI	CHARABIDYA	Not affected	12.Not affected in cyclone

Block	Gram Panchayat	Farmer Code	Farmer Name	Village	Promblems Due to Cyclone	Coping Measures Taken By Farmers
		BST/CBY/06	SAFIRULA GAZI	PETUAKHALI	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond, Entry of other (unwanted) fish species	11.No measures taken
		BST/CBY/07	HAJARI LAL MONDAL	6 NO CHARABIDYA	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond, Entry of other (unwanted) fish species	11.No measures taken
		BST/CBY/08	UJIR SARDAR	CHARABIDYA	Ingression of saline water into the pond	11.No measures taken
		BST/CBY/09	MRINAL KANTI NASKAR	6 NO CHARABIDYA	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	11.No measures taken
		BST/CBY/10	MOHAMOOD MOLLA	4 NO PETUAKHALI	Not affected	12.Not affected in cyclone
		BST/CBY/11	SANNYASI SRADAR	2 NO CHARABIDYA	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond, Entry of other (unwanted) fish species	5. Repair of pond dyke with earth/polythene
		BST/CBY/12	GOUR CHANDRA SANFUI	1 NO CHARABIDYA	Not affected	12.Not affected in cyclone
		BST/CBY/13	SANKARINDU NASKAR	CHARABIDYA	Not affected	12.Not affected in cyclone
		BST/CBY/14	MAHABUB HASAN MOLLA	4 NO PETUAKHALI	Not affected	12.Not affected in cyclone
		BST/CBY/15	SUROJ HALDER	CHARABIDYA	Not affected	12.Not affected in cyclone
		BST/CBY/16	NILMONI SARKAR	2 NO CHARABIDYA	Not affected	12.Not affected in cyclone
		BST/CBY/17	ABU JAFAR MOLLA	CHARABIDYA	Not affected	12.Not affected in cyclone
		BST/CBY/18	TUSHAR KANTI HALDER	CHARABIDYA	Not affected	12.Not affected in cyclone
		BST/CBY/19	GOBINDA SARKAR	CHARABIDYA	Not affected	12.Not affected in cyclone
		BST/CBY/20	TIMIR SARDAR	CHARABIDYA	Not affected	12.Not affected in cyclone

No. of families covered in the Gram Panchayat 20

Block	Gram Panchayat	Farmer Code	Farmer Name	Village	Promblems Due to Cyclone	Coping Measures Taken By Farmers
Chunakhali						
		BST/CKL/01	CHATTAR LASKAR	UTTAR CHUNAKHALI	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond, Entry of other (unwanted) fish species	11.No measures taken
		BST/CKL/02	MD. ABUL HASHIM MOLLA	UTTAR CHUNAKHALI	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond, Entry of other (unwanted) fish species	5. Repair of pond dyke with earth/polythene, 8. Increase of pond dyke height to prevent entry of saline water
		BST/CKL/03	MIR JIAUR RAHAMAN	UTTAR CHUNAKHALI	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond, Entry of other (unwanted) fish species	11.No measures taken
		BST/CKL/04	RAMESH SARDAR	UTTAR CHUNAKHALI	Not affected	12.Not affected in cyclone
		BST/CKL/05	MEHIRUL MOLLA	UTTAR CHUNAKHALI	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond, Entry of other (unwanted) fish species	11.No measures taken
		BST/CKL/06	MIR SAH ALAM	UTTAR CHUNAKHALI	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	11.No measures taken
		BST/CKL/07	MIR ABDUL KARIM	UTTAR CHUNAKHALI	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	11.No measures taken
		BST/CKL/08	MIR NURUJJAMAN	UTTAR CHUNAKHALI	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	11.No measures taken

Block	Gram Panchayat	Farmer Code	Farmer Name	Village	Promblems Due to Cyclone	Coping Measures Taken By Farmers
		BST/CKL/09	ALAUDDIN MOLLA	UTTAR CHUNAKHALI	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	11.No measures taken
		BST/CKL/10	KUTUBUDDIN MOLLA	UTTAR CHUNAKHALI	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond, Entry of other (unwanted) fish species	11.No measures taken
		BST/CKL/11	PRAKASH SARDAR	UTTAR CHUNAKHALI	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond, Entry of other (unwanted) fish species	11.No measures taken
		BST/CKL/12	BIMAL MISRTY	UTTAR CHUNAKHALI	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond, Entry of other (unwanted) fish species	11.No measures taken
		BST/CKL/13	UTTAM SARDAR	UTTAR CHUNAKHALI	Ingression of saline water into the pond, Escape of fish stock from the pond	1. Application of lime
		BST/CKL/14	PABITRA SARDAR	UTTAR CHUNAKHLAI	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	1. Application of lime, 5. Repair of pond dyke with earth/polythene
		BST/CKL/15	GOUTAM SARDAR	BORIA	Not affected	12.Not affected in cyclone
		BST/CKL/16	MAHABUB MOLLA	UTTAR CHUNAKHALI	Not affected	12.Not affected in cyclone
		BST/CKL/17	LOTEMAN MOLLA	UTTAR CHUNAKHALI	Not affected	12.Not affected in cyclone
		BST/CKL/18	BIMAL SARDAR	UTTAR CHUNAKHALI	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	5. Repair of pond dyke with earth/polythene

No. of families covered in the Gram Panchayat 18

Jharkhali

Block	Gram Panchayat	Farmer Code	Farmer Name	Village	Promblems Due to Cyclone	Coping Measures Taken By Farmers
		BST/JKL/01	DEBDAS MONDAL	2ND SCHEME	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond, Entry of other (unwanted) fish species	4. Dewatering, 5. Repair of pond dyke with earth/polythene
		BST/JKL/02	AMAL MONDAL	TRIDIBNAGAR BLOCK-1	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond, Entry of other (unwanted) fish species	4. Dewatering, 5. Repair of pond dyke with earth/polythene
		BST/JKL/03	NIRMAL SARKAR	TRIDIBNAGAR C	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond, Entry of other (unwanted) fish species	4. Dewatering, 5. Repair of pond dyke with earth/polythene
		BST/JKL/04	GOURANGA DAS	JHARKHALI NO - 4	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond, Entry of other (unwanted) fish species	11.No measures taken
		BST/JKL/05	BABLU MAJHI	JHARKAHLI 2ND SCHEME	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	11.No measures taken
		BST/JKL/06	BIMAL HALDER	JHARKHALI NO - 3	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond, Entry of other (unwanted) fish species	5. Repair of pond dyke with earth/polythene
		BST/JKL/07	KHOKAN GAYEN	LASKARPUR - 1	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	5. Repair of pond dyke with earth/polythene
		BST/JKL/08	NIRUPAM MONDAL	JHARKHALI NO - 3	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond, Entry of other (unwanted) fish species	4. Dewatering, 5. Repair of pond dyke with earth/polythene

Block	Gram Panchayat	Farmer Code	Farmer Name	Village	Promblems Due to Cyclone	Coping Measures Taken By Farmers
		BST/JKL/09	SAMAR DHALI	TRIDIBNAGAR B	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond, Entry of other (unwanted) fish species	4. Dewatering, 5. Repair of pond dyke with earth/polythene
		BST/JKL/10	BIJOY MISTRY	TRIDIBNAGAR BLOCK - C	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	4. Dewatering, 5. Repair of pond dyke with earth/polythene
		BST/JKL/11	KARTIK HALDER	TRIDIBNAGAR - A	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	4. Dewatering, 5. Repair of pond dyke with earth/polythene
		BST/JKL/12	BICHITRA BISWAS	jharkhali	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	4. Dewatering, 5. Repair of pond dyke with earth/polythene
		BST/JKL/13	ASIT RANA	2ND SCHEME	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	4. Dewatering, 5. Repair of pond dyke with earth/polythene
		BST/JKL/14	BIKASH MONDAL	2ND SCHEME	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	4. Dewatering
		BST/JKL/15	AMAL MALLICK	4 NO JHARKAHLI	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	4. Dewatering, 5. Repair of pond dyke with earth/polythene
		BST/JKL/16	RAJESWAR MONDAL	PROJA GHERI	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	4. Dewatering
		BST/JKL/17	BIMAL HLADER	JHARKHALI NO - 3	Ingression of saline water into the pond, Breach of pond dyke	11.No measures taken
		BST/JKL/18	BHAJAHARI MONDAL	JHARKHALI NO- 3	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond, Entry of other (unwanted) fish species	11.No measures taken

Block	Gram Panchayat	Farmer Code	Farmer Name	Village	Promblems Due to Cyclone	Coping Measures Taken By Farmers
		BST/JKL/19	DHIRENDRANATH SARDAR	JHARKHALI NO - 3	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	4. Dewatering, 5. Repair of pond dyke with earth/polythene
		BST/JKL/20	ARABINDA SARDAR	TRIDBNAGAR - A	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	4. Dewatering, 5. Repair of pond dyke with earth/polythene
No. of families covered in the Gram Panchayat		**20**				
	Jyotishpur					
		BST/JTR/01	DHANANJOY MONDAL	JYOTISHPUR	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond, Entry of other (unwanted) fish species	11.No measures taken
		BST/JTR/02	HALADHAR BAR	JOYGOPALPUR	Ingression of saline water into the pond, Breach of pond dyke	4. Dewatering, 5. Repair of pond dyke with earth/polythene
		BST/JTR/03	UDAY CHANDRA MONDAL	JOYGOPALPUR	Not affected	12.Not affected in cyclone
		BST/JTR/04	NARAYAN BISWAS	3 NO RANIGARH	Not affected	12.Not affected in cyclone
		BST/JTR/05	JAGADISH MONDAL	JYOTISHPUR	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	4. Dewatering, 5. Repair of pond dyke with earth/polythene
		BST/JTR/06	DILIP ADHIKARI	JYOTISHPUR	Not affected	12.Not affected in cyclone
		BST/JTR/07	TAPAN KUMAR SARDAR	RADHARANIPUR	Breach of pond dyke	5. Repair of pond dyke with earth/polythene, 7. Plantation in pond dyke
		BST/JTR/08	UTTAM SARDAR	JOYGOPALPUR	Not affected	12.Not affected in cyclone
		BST/JTR/09	PROVAS HALDER	JYOTISHPUR	Not affected	12.Not affected in cyclone
		BST/JTR/10	AMAL DAS	RADHARANIPUR	Not affected	12.Not affected in cyclone
		BST/JTR/11	BIRENDRANATH GOAL	RADHARANIPUR	Not affected	12.Not affected in cyclone
		BST/JTR/12	SANTOSH MONDAL	JYOTISHPUR	Not affected	12.Not affected in cyclone
		BST/JTR/13	SUJATA MONDAL	JYOTISHPUR	Not affected	12.Not affected in cyclone

Block	Gram Panchayat	Farmer Code	Farmer Name	Village	Promblems Due to Cyclone	Coping Measures Taken By Farmers
		BST/JTR/14	ANANTA SAMANTA	RADHARANIPUR	Not affected	12.Not affected in cyclone
		BST/JTR/15	KABIRANJAN NASKAR	JOYGOPALPUR	Not affected	12.Not affected in cyclone
		BST/JTR/16	BINOD BIHARI DAS	HAREKRISHNAPUR	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	4. Dewatering, 5. Repair of pond dyke with earth/polythene
		BST/JTR/17	BIJOYKRISHNA CHOUDHURY	HAREKRISHNAPUR	Breach of pond dyke, Escape of fish stock from the pond	4. Dewatering, 5. Repair of pond dyke with earth/polythene
		BST/JTR/18	HARASIT ROY	JOYGOPALPUR	Not affected	12.Not affected in cyclone
		BST/JTR/19	DULAL GHARAMI	JYOTISHPUR	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	4. Dewatering, 5. Repair of pond dyke with earth/polythene
		BST/JTR/20	NAKUL HALDER	JYOTISHPUR	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	4. Dewatering, 5. Repair of pond dyke with earth/polythene
		BST/JTR/21	SONATAN NASKAR	RANIGARH NO 2	Not affected	12.Not affected in cyclone
		BST/JTR/22	JOYDEB MONDAL	JYOTISHPUR	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	4. Dewatering, 5. Repair of pond dyke with earth/polythene
		BST/JTR/23	SUKDEB AGUAN	RADHARANIPUR	Ingression of saline water into the pond, Breach of pond dyke	4. Dewatering, 5. Repair of pond dyke with earth/polythene
		BST/JTR/24	MRITTYUNJAY PATTANAYEK	RADHARANIPUR	Not affected	12.Not affected in cyclone
		BST/JTR/25	BHOLANATH HALDER	4 NO HAREKRISHNAPUR	Not affected	12.Not affected in cyclone
No. of families covered in the Gram Panchayat		25				
	Masjidbati					
		BST/MSB/01	AJIT HAZRA	MOKAMBERIA	Not affected	7. Plantation in pond dyke, 8. Increase of pond dyke height to prevent entry of saline water

Block	Gram Panchayat	Farmer Code	Farmer Name	Village	Promblems Due to Cyclone	Coping Measures Taken By Farmers
		BST/MSB/02	NITAI SARDAR	Uttar Mokamberia	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond, Entry of other (unwanted) fish species	5. Repair of pond dyke with earth/polythene, 7. Plantation in pond dyke, 8. Increase of pond dyke height to prevent entry of saline water
		BST/MSB/03	KAJAL MAITY	MASJIDBATI	Ingression of saline water into the pond	7. Plantation in pond dyke, 10.Not applicable as it is saline/brackish water pond
		BST/MSB/04	CHAMPA DEBNATH	DAKSHIN BAT TALA	Ingression of saline water into the pond, Escape of fish stock from the pond	4. Dewatering, 5. Repair of pond dyke with earth/polythene
		BST/MSB/05	GOPAL MONDAL	GODKHALI	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	4. Dewatering, 5. Repair of pond dyke with earth/polythene, 8. Increase of pond dyke height to prevent entry of saline water
		BST/MSB/06	PARAN MONDAL	GODKHALI	Not affected	12.Not affected in cyclone
		BST/MSB/07	DIPAK MONDAL	GODKHALI	Not affected	12.Not affected in cyclone
		BST/MSB/08	TAPAS MONDAL	MASJIDBATI	Not affected	7. Plantation in pond dyke, 8. Increase of pond dyke height to prevent entry of saline water
		BST/MSB/09	SHIPRA MONDAL	RAMKRISHNAPUR	Not affected	12.Not affected in cyclone
		BST/MSB/10	GANESH SANA	GODKHALI	Breach of pond dyke, Escape of fish stock from the pond	5. Repair of pond dyke with earth/polythene
		BST/MSB/11	KAJAL MONDAL	RAMKRISHNAPUR	Ingression of saline water into the pond, Breach of pond dyke	4. Dewatering, 5. Repair of pond dyke with earth/polythene, 7. Plantation in pond dyke
		BST/MSB/12	CHAMPA PAIK	DAKSHIN BAT TALA	Not affected	12.Not affected in cyclone
		BST/MSB/13	PRITYLATA GAIN	DAKSHIN BAT TALA	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond, Entry of other (unwanted) fish species	11.No measures taken
		BST/MSB/14	TAPAS MISHRA	GODKHALI	Not affected	12.Not affected in cyclone
		BST/MSB/15	ASHIM MONDAL	GODKHALI	Not affected	12.Not affected in cyclone
		BST/MSB/16	KAMAL MONDAL	GODKHALI	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	1. Application of lime, 5. Repair of pond dyke with earth/polythene

Block	Gram Panchayat	Farmer Code	Farmer Name	Village	Promblems Due to Cyclone	Coping Measures Taken By Farmers
		BST/MSB/17	AMITABHA MAITY	MASJIDBATI	Ingression of saline water into the pond, Breach of pond dyke	4. Dewatering, 5. Repair of pond dyke with earth/polythene, 7. Plantation in pond dyke, 8. Increase of pond dyke height to prevent entry of saline water
		BST/MSB/18	MAMATA SARKAR	DAKSHIN BAT TALA	Not affected	12.Not affected in cyclone
		BST/MSB/19	ANUP MAITY	MASIJDBATI	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	4. Dewatering, 5. Repair of pond dyke with earth/polythene, 8. Increase of pond dyke height to prevent entry of saline water
		BST/MSB/20	ARATI PAL	MASJIDBATI	Ingression of saline water into the pond, Breach of pond dyke	4. Dewatering, 5. Repair of pond dyke with earth/polythene, 8. Increase of pond dyke height to prevent entry of saline water
No. of families covered in the Gram Panchayat		**20**				
	Nafargunj					
		BST/NFR/01	RADHA GOBINDA BARIK	BIRINCHI BARI	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	11.No measures taken
		BST/NFR/02	PHATIK MONDAL	HIRONMOYPUR	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	5. Repair of pond dyke with earth/polythene, 8. Increase of pond dyke height to prevent entry of saline water
		BST/NFR/03	TARAN SARDAR	BIRINCHI BARI	Ingression of saline water into the pond, Breach of pond dyke	11.No measures taken
		BST/NFR/04	UTTAM DAS	BIRINCHI BARI	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	4. Dewatering, 5. Repair of pond dyke with earth/polythene
		BST/NFR/05	NANDARAM JANA	BIRINCHI BARI	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	5. Repair of pond dyke with earth/polythene, 8. Increase of pond dyke height to prevent entry of saline water
		BST/NFR/06	MURARI DEBSHARMA	BIRINCHI BARI	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	11.No measures taken

Block	Gram Panchayat	Farmer Code	Farmer Name	Village	Promblems Due to Cyclone	Coping Measures Taken By Farmers
		BST/NFR/07	LABA KUMAR MONDAL	BIRINCHI BARI	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	4. Dewatering, 5. Repair of pond dyke with earth/polythene, 8. Increase of pond dyke height to prevent entry of saline water
		BST/NFR/08	ANUPAM JANA	NAFARGAUNJ	Breach of pond dyke	5. Repair of pond dyke with earth/polythene
		BST/NFR/09	SUPRABHAT DAS	NAFARGANJ	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	11.No measures taken
		BST/NFR/10	RAMKRISHNA MAITY	NAFARGUNJ	Ingression of saline water into the pond, Escape of fish stock from the pond	11.No measures taken
		BST/NFR/11	SUPRABHAT DAS	BIRINCHIBARI	Ingression of saline water into the pond, Breach of pond dyke	11.No measures taken
		BST/NFR/12	SHUKDEB HALDER	BIRINCHIBARI	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	11.No measures taken
		BST/NFR/13	SUNIL BAIDYA	NAFARGAUNJ	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	8. Increase of pond dyke height to prevent entry of saline water
		BST/NFR/14	BISWAJIT BERA	BIRINCHI BARI	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	5. Repair of pond dyke with earth/polythene
		BST/NFR/15	BIJON BIHARI MONDAL	BIRINCHIBARI	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	5. Repair of pond dyke with earth/polythene
		BST/NFR/16	KHUDIRAM KARAN	NAFARGAUNJ	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	11.No measures taken
		BST/NFR/17	SANTANU SARDAR	NAFARGAUNJ	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	11.No measures taken
		BST/NFR/18	SUBHAS MISTRI	HIRANMAYPUR	Ingression of saline water into the pond, Escape of fish stock from the pond	11.No measures taken

Block	Gram Panchayat	Farmer Code	Farmer Name	Village	Promblems Due to Cyclone	Coping Measures Taken By Farmers
		BST/NFR/19	GAZI SARDAR	BIRINCHIBARI	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond, Entry of other (unwanted) fish species	11.No measures taken
		BST/NFR/20	SUDHIR CHNADRA MONDAL	BIRINCHIBARI	Ingression of saline water into the pond, Breach of pond dyke	13.Does not know
No. of families covered in the Gram Panchayat		**20**				
	Phul Malancha					
		BST/PML/01	ROHIDUL LASKAR	NIRDESHKHALI	Not affected	12.Not affected in cyclone
		BST/PML/02	SIRAJUL MONDAL	PANIKHALI	Not affected	12.Not affected in cyclone
		BST/PML/03	KARIMULLA MOLLA	CHATRAKHALI	Not affected	12.Not affected in cyclone
		BST/PML/04	UCHHUP MOLLA	CHATRAKHALI	Not affected	12.Not affected in cyclone
		BST/PML/05	RAFIKUL LASKAR	NIRDESHKHALI	Not affected	12.Not affected in cyclone
		BST/PML/06	ABDULLA SEIKH	NIRDESHKHALI	Ingression of saline water into the pond, Escape of fish stock from the pond	4. Dewatering, 5. Repair of pond dyke with earth/polythene
		BST/PML/07	EYAR ALI SEIKH	NIRDESHKHALI	Not affected	12.Not affected in cyclone
		BST/PML/08	HADAY TULLA LASKAR	NIRDESHKHALI	Not affected	12.Not affected in cyclone
		BST/PML/09	MANIRUJJAMAN MOLLA	CHATRAKHALI	Not affected	12.Not affected in cyclone
		BST/PML/10	SABIYUR HOSSEIN MOLLA	CHATRAKHALI	Not affected	12.Not affected in cyclone
		BST/PML/11	UTTAM SARDAR	NIRDESHKHALI	Not affected	12.Not affected in cyclone
		BST/PML/12	FARUK SARDAR	CHATRAKHALI	Not affected	12.Not affected in cyclone
No. of families covered in the Gram Panchayat		**12**				
	Ramchandrakhali					

Block	Gram Panchayat	Farmer Code	Farmer Name	Village	Promblems Due to Cyclone	Coping Measures Taken By Farmers
		BST/RCK/01	KALIDAS NASKAR	RAMCHANDRAKHALI	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond, Entry of other (unwanted) fish species	1. Application of lime, 4. Dewatering, 5. Repair of pond dyke with earth/polythene, 7. Plantation in pond dyke, 9. Application of cow dung for saline water treatment
		BST/RCK/02	ABDUR RAHAMAN MOLLA	KALAHATRA	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	4. Dewatering, 5. Repair of pond dyke with earth/polythene
		BST/RCK/03	SANTANU MRIDHA	SONAKHALI	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond, Entry of other (unwanted) fish species	4. Dewatering, 5. Repair of pond dyke with earth/polythene
		BST/RCK/04	BIKASH MAITY	SONAKHALI	Not affected	12.Not affected in cyclone
		BST/RCK/05	DIPANKAR PUNI	6 NO SONAKHALI	Not affected	12.Not affected in cyclone
		BST/RCK/06	MONOJ PRAMANIK	SONAKHALI	Not affected	12.Not affected in cyclone
		BST/RCK/07	MONORANJAN NASKAR	RAMCHANDRAKHALI	Not affected	12.Not affected in cyclone
		BST/RCK/08	JYOTIRMOY MONDAL	SONAKHALI	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	4. Dewatering
		BST/RCK/09	CHORAP MOLLA	KHIRISH KHALI	Not affected	12.Not affected in cyclone
		BST/RCK/10	AVIMUNYA GAYEN	KHIRISHKHALI	Not affected	12.Not affected in cyclone
		BST/RCK/11	DIPAK KUMAR BARUI	SONAKHALI N0 6	Not affected	12.Not affected in cyclone
		BST/RCK/12	ARATI CHATUI	KHIRISH KHALI	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	4. Dewatering
		BST/RCK/13	SUJAUDDIN MOLLA	SONAKHALI N0 6	Not affected	12.Not affected in cyclone
		BST/RCK/14	ABDUR SALAM SARDAR	RAMCHANDRAKHALI	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond, Entry of other (unwanted) fish species	4. Dewatering, 5. Repair of pond dyke with earth/polythene

Block	Gram Panchayat	Farmer Code	Farmer Name	Village	Promblems Due to Cyclone	Coping Measures Taken By Farmers
		BST/RCK/15	ARABINDA NASKAR	HOGOLDURI	Ingression of saline water into the pond	10.Not applicable as it is saline/brackish water pond
		BST/RCK/16	SANAT NAIYA	RAMCHANDRAKHALI	Ingression of saline water into the pond, Breach of pond dyke	5. Repair of pond dyke with earth/polythene
No. of families covered in the Gram Panchayat 16						
	Uttar Mokamberia					
		BST/UMB/01	PARIMAL HALDER	UTTAR MOKAMBERIA	Not affected	12.Not affected in cyclone
		BST/UMB/02	SWAPAN SRADAR	3 NO SONAKHALI	Not affected	12.Not affected in cyclone
		BST/UMB/03	JOYDEB GHARAMI	HARBHANGI	Not affected	12.Not affected in cyclone
		BST/UMB/04	HAREKRISHNA BARMAN	UTTAR MOKAMBERIA	Not affected	12.Not affected in cyclone
		BST/UMB/05	DHANANJOY NASKAR	3 NO SONAKHALI	Not affected	12.Not affected in cyclone
		BST/UMB/06	BIKASH MONDAL	CHARANEKHALI	Ingression of saline water into the pond, Breach of pond dyke	4. Dewatering, 5. Repair of pond dyke with earth/polythene
		BST/UMB/07	DEBASISH MONDAL	SONAKHALI NO 2	Not affected	12.Not affected in cyclone
		BST/UMB/08	BADAL NASKAR	2 NO SONAKHALI	Not affected	12.Not affected in cyclone
		BST/UMB/09	TIMIR HALDER	2 NO SONAKHALI	Not affected	12.Not affected in cyclone
		BST/UMB/10	PABAN SARDAR	UTTAR MOKAMBERIA	Not affected	12.Not affected in cyclone
		BST/UMB/11	DILIP SAMANTA	5 NO SONAKHALI	Not affected	12.Not affected in cyclone
		BST/UMB/12	BISWAJIT SANFUI	UTTAR MOKAMBERIA	Not affected	12.Not affected in cyclone
		BST/UMB/13	GOUR CHANDRA MONDAL	UTTAR MOKAMBERIA	Not affected	12.Not affected in cyclone
		BST/UMB/14	GOBINDA MONDAL	BATTALA	Ingression of saline water into the pond	4. Dewatering
		BST/UMB/15	BARUN GHARAMI	HARINBHANGI	Not affected	12.Not affected in cyclone
No. of families covered in the Gram Panchayat 15						
No. of families covered in the Block 207						

Impacts of High Intensity Weather Event (Cyclone) on Aquaculture

SAGAR BLOCK

Block	Gram Panchayat	Farmer Code	Farmer Name	Village	Promblems Due to Cyclone	Coping Measures Taken By Farmers
Sagar						
	Daspara Sumati Nagar - I					
		SAG/DSN-I/01	MONORANJAN DAS	DHOSPARA	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	2. Addition of fresh/rain water, 7. Plantation in pond dyke
		SAG/DSN-I/02	HIMANGSHU SEKHAR DAS	DHOSPARA	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	2. Addition of fresh/rain water, 5. Repair of pond dyke with earth/polythene, 7. Plantation in pond dyke, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/DSN-I/03	SUKESH SAHU	DHOSPARA	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	1. Application of lime, 2. Addition of fresh/rain water, 5. Repair of pond dyke with earth/polythene, 7. Plantation in pond dyke
		SAG/DSN-I/04	SANKAR DAS	DHOSPARA	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond, Entry of other (unwanted) fish species	1. Application of lime, 5. Repair of pond dyke with earth/polythene, 7. Plantation in pond dyke, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/DSN-I/05	PRODDYOT DAS	DHOSPARA	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond, Entry of other (unwanted) fish species	1. Application of lime, 2. Addition of fresh/rain water, 3. Application of chemicals/fertilizers, 4. Dewatering, 5. Repair of pond dyke with earth/polythene, 7. Plantation in pond dyke
		SAG/DSN-I/06	SAROJ KUMAR DAS	DHOSPARA	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	1. Application of lime, 2. Addition of fresh/rain water, 3. Application of chemicals/fertilizers, 7. Plantation in pond dyke
		SAG/DSN-I/07	SUDARSHAN DAS	DHOSPARA	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	1. Application of lime, 2. Addition of fresh/rain water, 4. Dewatering, 7. Plantation in pond dyke
		SAG/DSN-I/08	MENOKA DAS	DHOSPARA	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond, Entry of other (unwanted) fish species	1. Application of lime, 2. Addition of fresh/rain water, 3. Application of chemicals/fertilizers, 4. Dewatering, 5. Repair of pond dyke with earth/polythene, 6. Addition of tree branches in the pond for fish aggregation

Block	Gram Panchayat	Farmer Code	Farmer Name	Village	Promblems Due to Cyclone	Coping Measures Taken By Farmers
		SAG/DSN-I/09	SHYAMAPADA CHAKRABORTI	DHOSPARA	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	1. Application of lime, 2. Addition of fresh/rain water, 5. Repair of pond dyke with earth/polythene
		SAG/DSN-I/10	SATYA RANJAN DINDA	MAHENDRA GAUNJ	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	1. Application of lime, 2. Addition of fresh/rain water, 5. Repair of pond dyke with earth/polythene, 7. Plantation in pond dyke, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/DSN-I/11	SATYAHARI PATRA	MAHENDRA GAUNJ	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	1. Application of lime, 2. Addition of fresh/rain water, 3. Application of chemicals/fertilizers, 4. Dewatering, 7. Plantation in pond dyke
		SAG/DSN-I/12	TARUN KUMAR PATRA	MAHENDRA GAUNJ	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond, Entry of other (unwanted) fish species	1. Application of lime, 2. Addition of fresh/rain water, 3. Application of chemicals/fertilizers, 4. Dewatering, 7. Plantation in pond dyke
		SAG/DSN-I/13	TAPAN KUMAR PATRA	MAHENDRA GAUNJ	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	1. Application of lime, 2. Addition of fresh/rain water, 3. Application of chemicals/fertilizers, 5. Repair of pond dyke with earth/polythene, 7. Plantation in pond dyke
		SAG/DSN-I/14	GOURHARI ROY	DHOSPARA	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	1. Application of lime, 2. Addition of fresh/rain water, 3. Application of chemicals/fertilizers, 4. Dewatering, 5. Repair of pond dyke with earth/polythene, 7. Plantation in pond dyke, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/DSN-I/15	KHOKAN BHUINYA	GOBINDAPUR	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	1. Application of lime, 2. Addition of fresh/rain water, 3. Application of chemicals/fertilizers, 4. Dewatering, 7. Plantation in pond dyke
		SAG/DSN-I/16	GANGADHAR MONDAL	NAGENDRA GAUNJ	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	1. Application of lime, 4. Dewatering, 5. Repair of pond dyke with earth/polythene, 7. Plantation in pond dyke, 8. Increase of pond dyke height to prevent entry of saline water

Block	Gram Panchayat	Farmer Code	Farmer Name	Village	Promblems Due to Cyclone	Coping Measures Taken By Farmers
		SAG/DSN-I/17	GOUTAM MONDAL	GOBINDAPUR	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	3. Application of chemicals/fertilizers, 4. Dewatering, 5. Repair of pond dyke with earth/polythene, 7. Plantation in pond dyke, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/DSN-I/18	BALAI DAS	DHOSPARA	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	1. Application of lime, 4. Dewatering, 5. Repair of pond dyke with earth/polythene, 7. Plantation in pond dyke, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/DSN-I/19	KANAKALATI PATRA	MAHENDRA GAUNJ	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond, Entry of other (unwanted) fish species	1. Application of lime, 4. Dewatering, 5. Repair of pond dyke with earth/polythene, 7. Plantation in pond dyke, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/DSN-I/20	SATADAL DAS	DHOS PARA	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond, Entry of other (unwanted) fish species	1. Application of lime, 2. Addition of fresh/rain water, 4. Dewatering, 5. Repair of pond dyke with earth/polythene, 7. Plantation in pond dyke
		SAG/DSN-I/21	NIKHIL DAS	DHOSPARA	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond, Entry of other (unwanted) fish species	1. Application of lime, 2. Addition of fresh/rain water, 3. Application of chemicals/fertilizers, 5. Repair of pond dyke with earth/polythene, 7. Plantation in pond dyke, 8. Increase of pond dyke height to prevent entry of saline water
No. of families covered in the Gram Panchayat		**21**				
	Daspara Sumati Nagar - II					
		SAG/DSN-II/01	AMIYA PARUA	SUMATI NAGAR	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	

Block	Gram Panchayat	Farmer Code	Farmer Name	Village	Promblems Due to Cyclone	Coping Measures Taken By Farmers
		SAG/DSN-II/02	NUR MOHAMMAD KHAN	SUMATI NAGAR	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond, Entry of other (unwanted) fish species	2. Addition of fresh/rain water, 3. Application of chemicals/fertilizers
		SAG/DSN-II/03	SEIKH AKBAR	SUMATI NAGAR	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	2. Addition of fresh/rain water, 4. Dewatering
		SAG/DSN-II/04	SUKUMAR MANNA	BANKIM NAGAR	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	1. Application of lime, 2. Addition of fresh/rain water
		SAG/DSN-II/05	PREMANANDA JANA	BANKIM NAGAR	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	1. Application of lime, 3. Application of chemicals/fertilizers, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/DSN-II/06	TAPAN MANNA	BANKIM NAGAR	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	1. Application of lime, 6. Addition of tree branches in the pond for fish aggregation
		SAG/DSN-II/07	SWAPAN MONDAL	BANKIM NAGAR	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	1. Application of lime, 2. Addition of fresh/rain water, 4. Dewatering
		SAG/DSN-II/08	TAPAN BARIK	BANKIM NAGAR	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	1. Application of lime, 2. Addition of fresh/rain water
		SAG/DSN-II/09	CHITTARANJAN DAS	BANKIM NAGAR	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	1. Application of lime, 4. Dewatering
		SAG/DSN-II/10	SANKAR BHUINYA	BANKIM NAGAR	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond, Entry of other (unwanted) fish species	1. Application of lime, 4. Dewatering, 7. Plantation in pond dyke

Block	Gram Panchayat	Farmer Code	Farmer Name	Village	Promblems Due to Cyclone	Coping Measures Taken By Farmers
		SAG/DSN-II/11	LAXMAN BARIK	BANKIM NAGAR	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond, Entry of other (unwanted) fish species	1. Application of lime, 2. Addition of fresh/rain water, 4. Dewatering
		SAG/DSN-II/12	UTTAM PATRA	UTTAR HARADHANPUR	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	5. Repair of pond dyke with earth/polythene
		SAG/DSN-II/13	SURAPATI KUILLYA	UTTAR HARADHANPUR	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	12.Not affected in cyclone
		SAG/DSN-II/14	SANJOY BERA	UTTAR HARADHANPUR	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	11.No measures taken
		SAG/DSN-II/15	PRADIP DAS	UTTAR HARADHANPUR	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	8. Increase of pond dyke height to prevent entry of saline water
		SAG/DSN-II/16	SAHADEB MANNA	UTTAR HARADHANPUR	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	12.Not affected in cyclone
		SAG/DSN-II/17	ANANDA KUMAR PARIA	DAKSHIN HARADHANPIUR	Escape of fish stock from the pond, Entry of other (unwanted) fish species	12.Not affected in cyclone
		SAG/DSN-II/18	NIRANJAN PATTA	DAKSHIN HARADHANPUR	Breach of pond dyke	11.No measures taken
		SAG/DSN-II/19	GHANASHYAM BHUINYA	SUMATI NAGAR	Breach of pond dyke	11.No measures taken
		SAG/DSN-II/20	NAREN CHANDRA MONDAL	SUMATI NAGAR	Breach of pond dyke, Escape of fish stock from the pond, Entry of other (unwanted) fish species	11.No measures taken, 12.Not affected in cyclone
		SAG/DSN-II/21	NIBAS KUMAR SAU	BANKIM NAGAR	Breach of pond dyke, Escape of fish stock from the pond	2. Addition of fresh/rain water, 7. Plantation in pond dyke
		SAG/DSN-II/22	SUKUMAR BHUINYA	BANKIM NAGAR	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	5. Repair of pond dyke with earth/polythene, 8. Increase of pond dyke height to prevent entry of saline water

Block	Gram Panchayat	Farmer Code	Farmer Name	Village	Promblems Due to Cyclone	Coping Measures Taken By Farmers
		SAG/DSN-II/23	DIBAKAR BHANDARI	BANKIM NAGAR	Ingression of saline water into the pond, Breach of pond dyke	11.No measures taken
		SAG/DSN-II/24	NIRANJAN PRAMANIK	BANKIM NAGAR 3 NO LOHACHORA	Ingression of saline water into the pond, Breach of pond dyke	5. Repair of pond dyke with earth/polythene, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/DSN-II/25	TAPAN PATLA	MRITUNJOY NAGA	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	3. Application of chemicals/fertilizers, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/DSN-II/26	APU KUMAR BERA	MRITTUNJOY NAGA	Escape of fish stock from the pond, Entry of other (unwanted) fish species	8. Increase of pond dyke height to prevent entry of saline water
No. of families covered in the Gram Panchayat		**26**				
	Dhablat					
		SAG/DBL/01	NIRANJAN MONDAL	BASANTAPUR	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	11.No measures taken
		SAG/DBL/02	JHARESWAR MONDAL	DHOBLAT BASANTAPUR	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	4. Dewatering, 5. Repair of pond dyke with earth/polythene, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/DBL/03	RAMKRISHNA MONDAL	CHEMAGURI	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	5. Repair of pond dyke with earth/polythene, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/DBL/04	GOBINDA MONDAL	DHABLAT KEDARPUR	Ingression of saline water into the pond	11.No measures taken
		SAG/DBL/05	SUKUMAR KALSA	SHIBPUR	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	5. Repair of pond dyke with earth/polythene, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/DBL/06	PRAVASH KUMAR BERA	SHIBPUR	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	4. Dewatering, 5. Repair of pond dyke with earth/polythene, 8. Increase of pond dyke height to prevent entry of saline water

Block	Gram Panchayat	Farmer Code	Farmer Name	Village	Promblems Due to Cyclone	Coping Measures Taken By Farmers
		SAG/DBL/07	DILIP DAS	SHIBPUR	Ingression of saline water into the pond, Escape of fish stock from the pond	5. Repair of pond dyke with earth/polythene, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/DBL/08	ANANTA PATRA	SHIBPUR	Breach of pond dyke, Escape of fish stock from the pond	8. Increase of pond dyke height to prevent entry of saline water
		SAG/DBL/09	SAHADEB MAITY	CHEMAGURI	Breach of pond dyke, Escape of fish stock from the pond	8. Increase of pond dyke height to prevent entry of saline water
		SAG/DBL/10	KANAI LAL KOYAL	CHEMAGURI	Ingression of saline water into the pond, Breach of pond dyke	7. Plantation in pond dyke, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/DBL/11	LAL MOHAN DAS	CHEMAGURI	Ingression of saline water into the pond, Breach of pond dyke	5. Repair of pond dyke with earth/polythene, 7. Plantation in pond dyke, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/DBL/12	BAGAMBAR MONDAL	BASANTAPUR	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	5. Repair of pond dyke with earth/polythene, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/DBL/13	LALMOHAN JINDAL	BASANTAPUR	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	11.No measures taken
		SAG/DBL/14	DEEPNARAYAN DAS	SHIBPUR	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	5. Repair of pond dyke with earth/polythene, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/DBL/15	MANINDRANATH KARAN	SHIBPUR	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	8. Increase of pond dyke height to prevent entry of saline water
		SAG/DBL/16	BADAL KUMAR MONDAL	CHEMAGURI	Ingression of saline water into the pond, Escape of fish stock from the pond	11.No measures taken
		SAG/DBL/17	LALMOHAN KARAN	SHIBPUR	Ingression of saline water into the pond, Breach of pond dyke	5. Repair of pond dyke with earth/polythene, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/DBL/18	PRADIP MRIDHYA	DHABLAT SHIB PUR	Escape of fish stock from the pond, Entry of other (unwanted) fish species	4. Dewatering, 5. Repair of pond dyke with earth/polythene, 8. Increase of pond dyke height to prevent entry of saline water

Block	Gram Panchayat	Farmer Code	Farmer Name	Village	Promblems Due to Cyclone	Coping Measures Taken By Farmers
		SAG/DBL/19	NARENDRA NATH MONDAL	LALPUR	Ingression of saline water into the pond, Breach of pond dyke	11.No measures taken
		SAG/DBL/20	BHAGIRATH MAITY	PURUSHOTTOMPUR	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond, Entry of other (unwanted) fish species	5. Repair of pond dyke with earth/polythene, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/DBL/21	SUBHAS JANA	PURUSHOTTOMPUR	Escape of fish stock from the pond	8. Increase of pond dyke height to prevent entry of saline water
		SAG/DBL/22	SOURAJIT DAS	PURUSHOTTOMPUR	Ingression of saline water into the pond, Breach of pond dyke	10.Not applicable as it is saline/brackish water pond, 11.No measures taken
		SAG/DBL/23	ANANDA SHIT	PURUSHOTTOMPUR	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	7. Plantation in pond dyke, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/DBL/24	AJOY NANDI	CHEMAGURI	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	1. Application of lime, 5. Repair of pond dyke with earth/polythene
		SAG/DBL/25	GOBINDA PRASAD SHIT	CHEMAGURI	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	8. Increase of pond dyke height to prevent entry of saline water
		SAG/DBL/26	RATAN SHIT	CHEMAGURI	Ingression of saline water into the pond, Breach of pond dyke	7. Plantation in pond dyke, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/DBL/27	ASHOK MANNA	CHEMAGURI	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	5. Repair of pond dyke with earth/polythene, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/DBL/28	AMIT PATRA	CHEMAGURI	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	8. Increase of pond dyke height to prevent entry of saline water
		SAG/DBL/29	SUBOL MANNA	CHEMAGURI	Ingression of saline water into the pond, Escape of fish stock from the pond	5. Repair of pond dyke with earth/polythene, 8. Increase of pond dyke height to prevent entry of saline water, 9. Application of cow dung for saline water treatment

Block	Gram Panchayat	Farmer Code	Farmer Name	Village	Promblems Due to Cyclone	Coping Measures Taken By Farmers
		SAG/DBL/30	AMIYA DAS	CHEMAGURI	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	5. Repair of pond dyke with earth/polythene, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/DBL/31	ANUP KUMAR KARAN	CHEMAGURI	Any other	10.Not applicable as it is saline/brackish water pond, 11.No measures taken
		SAG/DBL/32	AJOY NANDI(24)	CHEMAGURI	Ingression of saline water into the pond, Breach of pond dyke	11.No measures taken
No. of families covered in the Gram Panchayat		**32**				
	Gangasagar					
		SAG/GNS/01	SWADESH KHAMARI	CHANDIPUR	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	5. Repair of pond dyke with earth/polythene, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/GNS/02	KRISHNA PRASAD JANA	MAHISHMARI	Escape of fish stock from the pond, Entry of other (unwanted) fish species	11.No measures taken
		SAG/GNS/03	ROBIN MONDAL	BISHNUPUR	Ingression of saline water into the pond, Breach of pond dyke	11.No measures taken
		SAG/GNS/04	SUKUMAR DAS	BISHNUPUR	Escape of fish stock from the pond	11.No measures taken
		SAG/GNS/05	KALIPADA PATRA	BISHNUPUR	Ingression of saline water into the pond, Breach of pond dyke	5. Repair of pond dyke with earth/polythene
		SAG/GNS/06	SUBODH KUMAR DAS	BISHNUPUR	Breach of pond dyke, Escape of fish stock from the pond	11.No measures taken
		SAG/GNS/07	SITARAM BARUI	BISHNUPUR	Ingression of saline water into the pond, Breach of pond dyke	11.No measures taken
		SAG/GNS/08	ANANTA SAHU	BISHNUPUR	Ingression of saline water into the pond, Breach of pond dyke	11.No measures taken
		SAG/GNS/09	TAPAN KUAMR BHUINYA	BISHNUPUR	Breach of pond dyke	5. Repair of pond dyke with earth/polythene, 8. Increase of pond dyke height to prevent entry of saline water

Block	Gram Panchayat	Farmer Code	Farmer Name	Village	Promblems Due to Cyclone	Coping Measures Taken By Farmers
		SAG/GNS/10	KALIPADA JANA	BISHNUPUR	Breach of pond dyke	5. Repair of pond dyke with earth/polythene, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/GNS/11	ABANI GIRI	BISHNUPUR	Ingression of saline water into the pond, Breach of pond dyke	7. Plantation in pond dyke
		SAG/GNS/12	SUKHDEB KHATUA	BISHNUPUR	Ingression of saline water into the pond	4. Dewatering, 7. Plantation in pond dyke
		SAG/GNS/13	SRIKRISHNA SINHA	BISHNUPUR	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	7. Plantation in pond dyke
		SAG/GNS/14	ANIL KHATUA	BISHNUPUR	Breach of pond dyke	11.No measures taken
		SAG/GNS/15	MAHIRUDDIN SAHA	BISHNUPUR	Breach of pond dyke	5. Repair of pond dyke with earth/polythene, 7. Plantation in pond dyke, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/GNS/16	DEBKUMAR MAITY	NATENDRAPUR	Breach of pond dyke, Escape of fish stock from the pond	7. Plantation in pond dyke, 11.No measures taken
		SAG/GNS/17	PARITOSH MONDAL	NATENDRAPUR	Ingression of saline water into the pond	8. Increase of pond dyke height to prevent entry of saline water
		SAG/GNS/18	KESHAB CHANDRA DOLUI	CHANDIPUR	Breach of pond dyke, Escape of fish stock from the pond	5. Repair of pond dyke with earth/polythene, 7. Plantation in pond dyke, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/GNS/19	PANKAJ JANA	BISHNUPUR	Ingression of saline water into the pond	7. Plantation in pond dyke, 10.Not applicable as it is saline/brackish water pond
		SAG/GNS/20	MRITYUNJOY DAS	NATENDRAPUR	Breach of pond dyke	5. Repair of pond dyke with earth/polythene, 7. Plantation in pond dyke, 8. Increase of pond dyke height to prevent entry of saline water
No. of families covered in the Gram Panchayat		**20**				
	Ghoramara					
		SAG/GHM/01	ARUP MONDAL	ROYPARA	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	5. Repair of pond dyke with earth/polythene, 8. Increase of pond dyke height to prevent entry of saline water

Block	Gram Panchayat	Farmer Code	Farmer Name	Village	Promblems Due to Cyclone	Coping Measures Taken By Farmers
		SAG/GHM/02	KANAI BHUINYA	ROYPARA	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	5. Repair of pond dyke with earth/polythene, 7. Plantation in pond dyke, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/GHM/03	BIJOY SINGH	BAGPARA	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	1. Application of lime, 5. Repair of pond dyke with earth/polythene
		SAG/GHM/04	S.K. IDRISH	CHUNGURI	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	8. Increase of pond dyke height to prevent entry of saline water
		SAG/GHM/05	SEIKH MAJAHAR	CHUNPURI	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	5. Repair of pond dyke with earth/polythene
		SAG/GHM/06	SEIKH MONTAJ	CHUNPURI	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	5. Repair of pond dyke with earth/polythene, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/GHM/07	HEMANTA KHANRA	CHUNPURI	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	7. Plantation in pond dyke, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/GHM/08	SEIKH ABDUL GONI	CHUN PURI	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	5. Repair of pond dyke with earth/polythene, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/GHM/09	SEIKH KABIRUDDIN	CHUNPURI	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	5. Repair of pond dyke with earth/polythene
		SAG/GHM/10	BABLU KHAN	CHUNPURI	Ingression of saline water into the pond, Breach of pond dyke	11.No measures taken
		SAG/GHM/11	AJOY PATRA	CHUNPURI	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	8. Increase of pond dyke height to prevent entry of saline water
		SAG/GHM/12	SEIKH ROBIUL	CHUNPURI	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	11.No measures taken

Block	Gram Panchayat	Farmer Code	Farmer Name	Village	Promblems Due to Cyclone	Coping Measures Taken By Farmers
		SAG/GHM/13	JAMSHED KHAN	CHUNPURI	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	5. Repair of pond dyke with earth/polythene, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/GHM/14	AMALENDU DAS	MANDIRTALA	Ingression of saline water into the pond, Breach of pond dyke	5. Repair of pond dyke with earth/polythene, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/GHM/15	SEIKH JAMSHED ALI	MANDIRTALA	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	5. Repair of pond dyke with earth/polythene, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/GHM/16	AMIT GURIA	MANDIRTALA	Ingression of saline water into the pond, Escape of fish stock from the pond	5. Repair of pond dyke with earth/polythene, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/GHM/17	ARUN KANTI HALDER	MANDIRTALA	Ingression of saline water into the pond, Breach of pond dyke	5. Repair of pond dyke with earth/polythene, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/GHM/18	BISWANATH DAS	MANDIRTALA	Ingression of saline water into the pond, Breach of pond dyke	5. Repair of pond dyke with earth/polythene
		SAG/GHM/19	SANTOSH BHUINYA	MANDIRTALA	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	5. Repair of pond dyke with earth/polythene, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/GHM/20	NARENDRA NATH KARAK	MANDIRTALA	Breach of pond dyke	5. Repair of pond dyke with earth/polythene
		SAG/GHM/21	RABINDRANATH JANA	MANDIRTALA	Breach of pond dyke	5. Repair of pond dyke with earth/polythene
		SAG/GHM/22	NARAYAN KARAK	MANDIRTALA	Breach of pond dyke	5. Repair of pond dyke with earth/polythene
		SAG/GHM/23	SACHIN JANA	MANDIRTALA	Ingression of saline water into the pond, Breach of pond dyke	5. Repair of pond dyke with earth/polythene
		SAG/GHM/24	DAMODOR KARAK	MANDIRTALA	Ingression of saline water into the pond, Breach of pond dyke	5. Repair of pond dyke with earth/polythene
		SAG/GHM/25	JOYDEV BHUINYA	MANDIRTALA	Ingression of saline water into the pond, Breach of pond dyke	5. Repair of pond dyke with earth/polythene
		SAG/GHM/26	AMALENDU GURIA	MANDIRTALA	Ingression of saline water into the pond, Breach of pond dyke	5. Repair of pond dyke with earth/polythene
		SAG/GHM/27	KHOKAN JANA	MANDIRATLA	Ingression of saline water into the pond, Breach of pond dyke	5. Repair of pond dyke with earth/polythene

Block	Gram Panchayat	Farmer Code	Farmer Name	Village	Promblems Due to Cyclone	Coping Measures Taken By Farmers
		SAG/GHM/28	SRISTIDHAR KANDAR	MANDIRTALA	Ingression of saline water into the pond, Breach of pond dyke	11.No measures taken
		SAG/GHM/29	KRITTIBAS DOLUI	HATKHOLA	Ingression of saline water into the pond, Breach of pond dyke	5. Repair of pond dyke with earth/polythene, 7. Plantation in pond dyke
		SAG/GHM/30	KALIPADA HALDER	HATKHOLA	Ingression of saline water into the pond, Breach of pond dyke	5. Repair of pond dyke with earth/polythene, 7. Plantation in pond dyke, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/GHM/31	UDAY HALDER	HATKHOLA	Ingression of saline water into the pond, Breach of pond dyke	5. Repair of pond dyke with earth/polythene, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/GHM/32	RAJARAM JANA	HATKHOLA	Ingression of saline water into the pond, Breach of pond dyke	7. Plantation in pond dyke, 8. Increase of pond dyke height to prevent entry of saline water
No. of families covered in the Gram Panchayat		**32**				
	MuriGanga - I					
		SAG/MG-1/01	Sasanka Sekhar Jana	Sapkhali	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond, Entry of other (unwanted) fish species	1. Application of lime, 2. Addition of fresh/rain water
		SAG/MG-1/02	KANAI PRAMANIK	KHEER KUL TALA	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond, Entry of other (unwanted) fish species	1. Application of lime, 2. Addition of fresh/rain water
		SAG/MG-1/03	LAXMI KANTA DAS	FULLBARI	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond, Entry of other (unwanted) fish species	1. Application of lime, 3. Application of chemicals/fertilizers

Block	Gram Panchayat	Farmer Code	Farmer Name	Village	Promblems Due to Cyclone	Coping Measures Taken By Farmers
		SAG/MG-1/04	RAM JANA	FULLBARI	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond, Entry of other (unwanted) fish species	1. Application of lime, 3. Application of chemicals/fertilizers, 4. Dewatering
		SAG/MG-1/05	ASHOK JANA	FULLBARI	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond, Entry of other (unwanted) fish species	12.Not affected in cyclone
		SAG/MG-1/06	TAPAN KUMAR KHANRA	KACHUBERIA	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond, Entry of other (unwanted) fish species	3. Application of chemicals/fertilizers
		SAG/MG-1/07	NATENDRA NATH GHOSH	KACHUBERIA	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond, Entry of other (unwanted) fish species	1. Application of lime, 2. Addition of fresh/rain water
		SAG/MG-1/08	SEIKH ABDUL JABBAR	KASH TALA	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond, Entry of other (unwanted) fish species	1. Application of lime, 2. Addition of fresh/rain water
		SAG/MG-1/09	SHAYAMAL PAHARI	KOSH TALA	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond, Entry of other (unwanted) fish species	1. Application of lime, 2. Addition of fresh/rain water, 5. Repair of pond dyke with earth/polythene
		SAG/MG-1/10	MODHUSUDHAN GAYEN	PAKHIRALA	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	1. Application of lime, 6. Addition of tree branches in the pond for fish aggregation

Block	Gram Panchayat	Farmer Code	Farmer Name	Village	Promblems Due to Cyclone	Coping Measures Taken By Farmers
		SAG/MG-1/11	HAREKRISHNA GIRI	SILPARA	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond, Entry of other (unwanted) fish species	5. Repair of pond dyke with earth/polythene
		SAG/MG-1/12	JHANTU PONDA	SILPARA	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond, Entry of other (unwanted) fish species	4. Dewatering
		SAG/MG-1/13	SRI BRINDABAN PATI	SILPARA	Ingression of saline water into the pond, Breach of pond dyke	10.Not applicable as it is saline/brackish water pond
		SAG/MG-1/14	ASOK GIRI	HENDEL KETKI	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond, Entry of other (unwanted) fish species	1. Application of lime, 6. Addition of tree branches in the pond for fish aggregation
		SAG/MG-1/15	GURUPADA PATRA	COLLECTOR GAUNJ	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond, Entry of other (unwanted) fish species	1. Application of lime, 5. Repair of pond dyke with earth/polythene
		SAG/MG-1/16	GOPAL DAS	COLLECTOR GAUNJ	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond, Entry of other (unwanted) fish species	2. Addition of fresh/rain water, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/MG-1/17	SARATHI MONDAL	COLLECTOR GAUNJ	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond, Entry of other (unwanted) fish species	1. Application of lime, 8. Increase of pond dyke height to prevent entry of saline water

Block	Gram Panchayat	Farmer Code	Farmer Name	Village	Promblems Due to Cyclone	Coping Measures Taken By Farmers
		SAG/MG-1/18	ASOK KUMAR DOLUI	SHIBPUR	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond, Entry of other (unwanted) fish species	2. Addition of fresh/rain water
		SAG/MG-1/19	PIJUS KUMAR PAL	PATHAR PRATIMA	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond, Entry of other (unwanted) fish species	5. Repair of pond dyke with earth/polythene
		SAG/MG-1/20	NARAYAN MONDAL	KACHUBERIA	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond, Entry of other (unwanted) fish species	9. Application of cow dung for saline water treatment
No. of families covered in the Gram Panchayat		**20**				
	MuriGanga - II					
		SAG/MG-II/01	SUBHASH DAS	BAMANKHALI	Any other	12.Not affected in cyclone
		SAG/MG-II/02	RABIN TIWARI	BAMANKHALI	Escape of fish stock from the pond	11.No measures taken
		SAG/MG-II/03	PRANAB MONDAL	BAMANKHALI	Escape of fish stock from the pond, Entry of other (unwanted) fish species	8. Increase of pond dyke height to prevent entry of saline water
		SAG/MG-II/04	GOLAM MOHIT	BAMANKHALI	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	11.No measures taken
		SAG/MG-II/05	DUT KUMAR JANA	BAMANKHALI	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond, Entry of other (unwanted) fish species	7. Plantation in pond dyke, 8. Increase of pond dyke height to prevent entry of saline water

Block	Gram Panchayat	Farmer Code	Farmer Name	Village	Promblems Due to Cyclone	Coping Measures Taken By Farmers
		SAG/MG-II/06	DULAL BERA	BAMANKHALI	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond, Entry of other (unwanted) fish species	8. Increase of pond dyke height to prevent entry of saline water
		SAG/MG-II/07	SEIKH MANIRUL	CHAMPATALA	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond, Entry of other (unwanted) fish species	12.Not affected in cyclone
		SAG/MG-II/08	RADHESHYAM PRAMANIK	BAMANKHALI	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond, Entry of other (unwanted) fish species	4. Dewatering, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/MG-II/09	NIRMAL BERA	BAMANKHALI	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	5. Repair of pond dyke with earth/polythene, 7. Plantation in pond dyke
		SAG/MG-II/10	ABDUL AKBAR	BAMANKHALI	Ingression of saline water into the pond, Breach of pond dyke	11.No measures taken
		SAG/MG-II/11	HASIKUL KHAN	BAMANKHALI	Escape of fish stock from the pond, Entry of other (unwanted) fish species	11.No measures taken
		SAG/MG-II/12	ANARUL ISLAM KHAN	BAMANKHALI	Breach of pond dyke, Entry of other (unwanted) fish species	11.No measures taken
		SAG/MG-II/13	KAMAL BERA	BAMANKAHLI	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	4. Dewatering, 5. Repair of pond dyke with earth/polythene
		SAG/MG-II/14	BINOY DAS	MANDIR TALA	Ingression of saline water into the pond, Breach of pond dyke	10.Not applicable as it is saline/brackish water pond
		SAG/MG-II/15	ANUP KUMAR BAR	MANDIR TALA	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	7. Plantation in pond dyke

Block	Gram Panchayat	Farmer Code	Farmer Name	Village	Promblems Due to Cyclone	Coping Measures Taken By Farmers
		SAG/MG-II/16	BASUDEB PRADHAN	MANDIR TOLA	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	7. Plantation in pond dyke
		SAG/MG-II/17	BROJEN MRIDHA	CHAK FULL DUBI	Ingression of saline water into the pond, Breach of pond dyke	5. Repair of pond dyke with earth/polythene, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/MG-II/18	DIPAK BERA	CHAK FULL DUBI	Ingression of saline water into the pond, Breach of pond dyke	5. Repair of pond dyke with earth/polythene, 7. Plantation in pond dyke, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/MG-II/19	GURUPADA MRIDHA	CHAK FULL DUBI	Ingression of saline water into the pond, Breach of pond dyke	10.Not applicable as it is saline/brackish water pond
		SAG/MG-II/20	NASIR ALI MOLLA	CHAK FULL DUBI	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond, Entry of other (unwanted) fish species	10.Not applicable as it is saline/brackish water pond, 12.Not affected in cyclone
No. of families covered in the Gram Panchayat		20				
	Ramkarchar					
		SAG/MKR/01	AMIT KUMAR GURIA	KRISHNANAGAR	Ingression of saline water into the pond	8. Increase of pond dyke height to prevent entry of saline water
		SAG/MKR/02	BHAGIRAT JANA	KHASRAMKAR	Ingression of saline water into the pond	10.Not applicable as it is saline/brackish water pond
		SAG/MKR/03	SANJOY DAS	KRISHNANAGAR	Ingression of saline water into the pond, Breach of pond dyke	5. Repair of pond dyke with earth/polythene, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/MKR/04	ASIT BARAN PATRA	KHASRAMPUR	Breach of pond dyke, Escape of fish stock from the pond	11.No measures taken
		SAG/MKR/05	TAPAS KUMAR TRIPATHI	KRISHNANAGAR	Ingression of saline water into the pond, Breach of pond dyke	5. Repair of pond dyke with earth/polythene, 7. Plantation in pond dyke, 8. Increase of pond dyke height to prevent entry of saline water

Block	Gram Panchayat	Farmer Code	Farmer Name	Village	Promblems Due to Cyclone	Coping Measures Taken By Farmers
		SAG/MKR/06	RABINDRANATH PRADHAN	KRISHNANAGAR	Ingression of saline water into the pond, Breach of pond dyke	5. Repair of pond dyke with earth/polythene, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/MKR/07	MALA MILAN SANGHA	RAMKARCHAR	Entry of other (unwanted) fish species	8. Increase of pond dyke height to prevent entry of saline water
		SAG/MKR/08	DIPAK MAHATA	KHASRAMKARCHAR	Entry of other (unwanted) fish species	5. Repair of pond dyke with earth/polythene, 7. Plantation in pond dyke, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/MKR/09	DIPAK KUMAR PATRA	KRISHNANAGAR	Ingression of saline water into the pond, Breach of pond dyke	5. Repair of pond dyke with earth/polythene, 7. Plantation in pond dyke, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/MKR/10	BADAL CHANDRA DAS	KRISHNANAGAR	Ingression of saline water into the pond, Breach of pond dyke	5. Repair of pond dyke with earth/polythene, 9. Application of cow dung for saline water treatment
		SAG/MKR/11	SRITANGSHU SEKHAR NATH	KRISHNANAGAR	Ingression of saline water into the pond, Breach of pond dyke	8. Increase of pond dyke height to prevent entry of saline water
		SAG/MKR/12	BIBEKANANDA DAS	KRISHNANAGAR	Escape of fish stock from the pond, Entry of other (unwanted) fish species	11.No measures taken
		SAG/MKR/13	SANJIB DOLUI	KRISHNANAGAR	Breach of pond dyke, Escape of fish stock from the pond	11.No measures taken
		SAG/MKR/14	PULAK PRADHAN	KRISHNANAGAR	Ingression of saline water into the pond, Breach of pond dyke	11.No measures taken
		SAG/MKR/15	MUKUL PRAMANIK	KRISHNANAGAR	Ingression of saline water into the pond, Breach of pond dyke	7. Plantation in pond dyke, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/MKR/16	AMIT GURIA	KRISHNANAGAR	Ingression of saline water into the pond	10.Not applicable as it is saline/brackish water pond
		SAG/MKR/17	TAPAS JANA	KRISHNANAGAR	Ingression of saline water into the pond, Breach of pond dyke	1. Application of lime, 7. Plantation in pond dyke, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/MKR/18	TAPAS KUMAR DAS	KRISHNANAGAR	Ingression of saline water into the pond, Escape of fish stock from the pond	7. Plantation in pond dyke, 8. Increase of pond dyke height to prevent entry of saline water

Block	Gram Panchayat	Farmer Code	Farmer Name	Village	Promblems Due to Cyclone	Coping Measures Taken By Farmers
		SAG/MKR/19	TAPAN JANA	NARHARIPUR	Ingression of saline water into the pond, Breach of pond dyke	1. Application of lime, 4. Dewatering, 7. Plantation in pond dyke, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/MKR/20	BHASKAR CHANDRA DAS	NARHARIPUR	Breach of pond dyke	5. Repair of pond dyke with earth/polythene, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/MKR/21	`RAICHAND MONDAL	NARHARIPUR	Escape of fish stock from the pond, Entry of other (unwanted) fish species	4. Dewatering, 7. Plantation in pond dyke, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/MKR/22	SUBHAS JANA	NARHARIPUR	Ingression of saline water into the pond, Breach of pond dyke	7. Plantation in pond dyke, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/MKR/23	PURNENDU JANA	NARHARIPUR	Entry of other (unwanted) fish species	11.No measures taken
		SAG/MKR/24	ASISH BHUINYA	NARHARIPUR	Entry of other (unwanted) fish species	11.No measures taken
		SAG/MKR/25	GOUR SANKAR BERA	NARHARIPUR	Breach of pond dyke	8. Increase of pond dyke height to prevent entry of saline water
		SAG/MKR/26	JHANTU KUMAR JANA	NARHARIPUR	Ingression of saline water into the pond, Breach of pond dyke	8. Increase of pond dyke height to prevent entry of saline water
		SAG/MKR/27	BANKIM MAITY	NARHARIPUR	Ingression of saline water into the pond, Breach of pond dyke	11.No measures taken
No. of families covered in the Gram Panchayat		27				
	Rudranagar					
		SAG/RDN/01	ARUN BEJ	JIBANTALA	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	8. Increase of pond dyke height to prevent entry of saline water
		SAG/RDN/02	SAMARENDRA NATH JANA	JIBANTALA	Ingression of saline water into the pond	4. Dewatering

Block	Gram Panchayat	Farmer Code	Farmer Name	Village	Promblems Due to Cyclone	Coping Measures Taken By Farmers
		SAG/RDN/03	DIBYENDU BERA	KAMALPUR	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond, Entry of other (unwanted) fish species	12.Not affected in cyclone
		SAG/RDN/04	SUDHIR CHANDRA GURIA	RADHAKRISHNAPUR	Ingression of saline water into the pond, Escape of fish stock from the pond	8. Increase of pond dyke height to prevent entry of saline water
		SAG/RDN/05	TAPAN GHOSH	KIRTANKHALI	Breach of pond dyke	3. Application of chemicals/fertilizers
		SAG/RDN/06	SWAPAN MAITY	RADHAKRISHNAPUR	Escape of fish stock from the pond	8. Increase of pond dyke height to prevent entry of saline water
		SAG/RDN/07	KALIPADA JANA	KIRTANKHALI	Ingression of saline water into the pond, Escape of fish stock from the pond	3. Application of chemicals/fertilizers
		SAG/RDN/08	ABHIJIT GURIA	KAMALPUR	Ingression of saline water into the pond	1. Application of lime, 2. Addition of fresh/rain water, 3. Application of chemicals/fertilizers
		SAG/RDN/09	ANUP HAZRA	RADHAKRISHNAPUR	Ingression of saline water into the pond, Breach of pond dyke	4. Dewatering
		SAG/RDN/10	SWAPAN KUMAR MAITY	KIRTANKHALI	Ingression of saline water into the pond, Breach of pond dyke	1. Application of lime, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/RDN/11	TAPAN MONDAL	JIBANTALA	Ingression of saline water into the pond, Escape of fish stock from the pond	4. Dewatering, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/RDN/12	SEIKH DULU	KAMALPUR 1 NO COLONY	Ingression of saline water into the pond, Breach of pond dyke	11.No measures taken
		SAG/RDN/13	CHINMOY JANA	JIBANTALA	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	1. Application of lime, 5. Repair of pond dyke with earth/polythene, 7. Plantation in pond dyke, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/RDN/14	SRIKANTA GURIA	RADHAKRISHNAPUR	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond, Entry of other (unwanted) fish species	8. Increase of pond dyke height to prevent entry of saline water

Block	Gram Panchayat	Farmer Code	Farmer Name	Village	Promblems Due to Cyclone	Coping Measures Taken By Farmers
		SAG/RDN/15	AMAL GURIA	RADHAKRISHNAPUR	Ingression of saline water into the pond	10.Not applicable as it is saline/brackish water pond
		SAG/RDN/16	ASHOK PRADHAN	RUDRANAGAR	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	11.No measures taken
		SAG/RDN/17	DULAL PRADHAN	JIBAN TALA	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	4. Dewatering, 7. Plantation in pond dyke, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/RDN/18	BIMAL DAS ADHIKARI	RUDRANAGAR	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond	5. Repair of pond dyke with earth/polythene, 7. Plantation in pond dyke, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/RDN/19	PARITOSH ROY	KAMALPUR	Ingression of saline water into the pond, Breach of pond dyke	3. Application of chemicals/fertilizers, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/RDN/20	HALEMA BIBI	KAMALPUR 1 NO COLONY	Ingression of saline water into the pond, Breach of pond dyke	8. Increase of pond dyke height to prevent entry of saline water
		SAG/RDN/21	NIMAI CHARAN SAHU	KAMALPUR	Ingression of saline water into the pond, Breach of pond dyke, Escape of fish stock from the pond, Entry of other (unwanted) fish species	3. Application of chemicals/fertilizers, 7. Plantation in pond dyke, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/RDN/22	ISWAR CHANDAR JANA	MANASA DWIP KHAS MOHAL	Escape of fish stock from the pond	8. Increase of pond dyke height to prevent entry of saline water
		SAG/RDN/23	SEIKH JABED	JIBANTALA	Ingression of saline water into the pond, Breach of pond dyke	1. Application of lime, 7. Plantation in pond dyke, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/RDN/24	RANJIT JANA	MANASADWIP	Ingression of saline water into the pond, Breach of pond dyke	2. Addition of fresh/rain water, 4. Dewatering, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/RDN/25	AJOY MONDAL	RUDRANAGAR	Ingression of saline water into the pond, Breach of pond dyke	5. Repair of pond dyke with earth/polythene, 7. Plantation in pond dyke, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/RDN/26	BIKASH MAITYU	MANASA DWIP	Ingression of saline water into the pond, Breach of pond dyke	8. Increase of pond dyke height to prevent entry of saline water

Block	Gram Panchayat	Farmer Code	Farmer Name	Village	Promblems Due to Cyclone	Coping Measures Taken By Farmers
		SAG/RDN/27	NIMAI MAITY	MANASA DWIP	Ingression of saline water into the pond, Breach of pond dyke	11.No measures taken
		SAG/RDN/28	AMAL SAHU	KAMALPUR	Ingression of saline water into the pond, Breach of pond dyke	7. Plantation in pond dyke
		SAG/RDN/29	BINOY MANNA	KAMALPUR	Ingression of saline water into the pond, Breach of pond dyke	7. Plantation in pond dyke, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/RDN/30	SEIKH ISAQ MOHAMMAD	KAMALAPUR	Ingression of saline water into the pond, Breach of pond dyke	7. Plantation in pond dyke, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/RDN/31	SEIKH MANIRUL	KAMALPUR	Ingression of saline water into the pond, Breach of pond dyke	4. Dewatering, 5. Repair of pond dyke with earth/polythene, 7. Plantation in pond dyke, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/RDN/32	PRABIR BALESWAR	KAMALPUR	Ingression of saline water into the pond, Breach of pond dyke	8. Increase of pond dyke height to prevent entry of saline water
		SAG/RDN/33	NISHIKANTA BALESWAR	KAMALPUR	Ingression of saline water into the pond, Breach of pond dyke	5. Repair of pond dyke with earth/polythene, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/RDN/34	SUNIL BALESWAR	KAMALPUR	Ingression of saline water into the pond, Breach of pond dyke	8. Increase of pond dyke height to prevent entry of saline water
		SAG/RDN/35	PRADIP BALESWAR	KAMALPUR	Ingression of saline water into the pond, Breach of pond dyke	7. Plantation in pond dyke, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/RDN/36	PRAJAPATI BALESWAR	KAMALPUR	Escape of fish stock from the pond, Entry of other (unwanted) fish species	11.No measures taken
		SAG/RDN/37	BIKASH DEBNATH	KAMALPUR	Ingression of saline water into the pond, Breach of pond dyke	5. Repair of pond dyke with earth/polythene, 7. Plantation in pond dyke, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/RDN/38	SWADWSH DAS	KAMALPUR	Ingression of saline water into the pond, Breach of pond dyke	11.No measures taken
		SAG/RDN/39	NIKHIL CHANDRA BALESWAR	KAMALPUR	Ingression of saline water into the pond, Breach of pond dyke	11.No measures taken
		SAG/RDN/40	NANDAGOPAL KAHTUA	KAMALPUR	Ingression of saline water into the pond, Breach of pond dyke	5. Repair of pond dyke with earth/polythene, 8. Increase of pond dyke height to prevent entry of saline water

Block	Gram Panchayat	Farmer Code	Farmer Name	Village	Promblems Due to Cyclone	Coping Measures Taken By Farmers
		SAG/RDN/41	RAM CHANDRA DAS	KAMALPUR	Ingression of saline water into the pond, Breach of pond dyke	1. Application of lime
		SAG/RDN/42	SEIKH GUL HOSSEIN	KAMALPUR	Ingression of saline water into the pond, Breach of pond dyke	11.No measures taken
		SAG/RDN/43	PRADIP SHEET	KAMALPUR	Ingression of saline water into the pond, Breach of pond dyke	1. Application of lime, 7. Plantation in pond dyke
		SAG/RDN/44	BIDHYADHAR SHIT	KAMALPUR	Ingression of saline water into the pond, Breach of pond dyke	8. Increase of pond dyke height to prevent entry of saline water
		SAG/RDN/45	BIKASH PRADHAN	KAMALPUR	Ingression of saline water into the pond, Breach of pond dyke	5. Repair of pond dyke with earth/polythene, 8. Increase of pond dyke height to prevent entry of saline water
		SAG/RDN/46	BIKASH BAURI	RUDRANAGAR	Ingression of saline water into the pond, Breach of pond dyke	5. Repair of pond dyke with earth/polythene, 8. Increase of pond dyke height to prevent entry of saline water

No. of families covered in the Gram Panchayat	46
No. of families covered in the Block	244
No. of families covered in the Survey	451

The biodiversity-rich estuarine mangrove ecosystem of Sundarban is highly vulnerable to climate-induced risks like sea level rise, salinity intrusion, temperature and rainfall variations, land erosion, cyclone, storm surge etc. These pose serious threats to the live and livelihood of over 4.5 million people in Indian side. Agriculture and aquaculture, the main economic activities of the region, are the great victims of climate change. The publication attempts to highlight the climate change vulnerabilities and coping measures of the eco-region with special emphasis on aquaculture. It also includes the results of benchmark survey conducted in Sagar and Basanti blocks to give the readers a clear understanding the problems & solutions.

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