IMPACT OF FISH SANCTUARY ON FISH PRODUCTION AND BIODIVERSITY CONSERVATION: A CASE STUDY IN GRATER KHULNA REGION

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January 2009

IMPACT OF FISH SANCTUARY ON FISH PRODUCTION AND BIODIVERSITY CONSERVATION: A CASE STUDY IN GRATER KHULNA REGION

A Thesis

By

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The thesis submitted to the Fisheries and Marine Resource Technology Discipline in partial fulfillment of the requirements for the Degree of

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In

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IMPACT OF FISH SANCTUARY ON FISH PRODUCTION AND BIODIVERSITY CONSERVATION: A CASE STUDY IN GRATER KHULNA REGION

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January 2009

Declaration

Impact of fish sanctuary on fish production and biodiversity conservation: A case study in grater Khulna region

The results submitted in this thesis are entirely of the candidate's own investigation and no part of the results has been accepted for any degree, nor is it being concurrently submitted for any degree.

(Signature of the candidate)

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Session: 2006-2007

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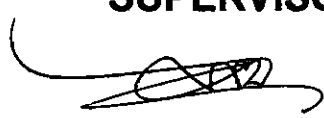

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Dedicated to

The Fisher's Community of the Sanctuary area, those who sacrificed their valuable time, physical labor and intelligence cordially to provide me the required data as well as many other supports to complete this study.

Acknowledgement

It is my gratification for being able to complete this study, so first of all my appreciation and gratitude go for the creator of this universe, the almighty God.

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The Author

January, 2009

ABSTRACT

Fisheries production has experienced a significant decline of during last four decades due to manmade and natural causes such as over fishing, destructive fishing, loss and destruction of fish habitats, poor policy, planning and management etc. As a result fish production, biodiversity and fishing community have been affected. Government has taken different measures for protection, conservation and management of the fisheries resources for sustainable production. Of them fish sanctuary has been considered as an important tool.

A study was conducted on the impact of the community based sanctuary management in greater Khulna region from September, 2007 to June 2008. The study mainly focused on the change of yearly fish catch or production indicating the status of stock biomass in the sanctuary before and after the sanctuary establishment and also showing the increasing or decreasing trend of fish production along with any change of recovery of endangered fish species and the socio-economic condition of the fisher's community living in and around the sanctuary. The result shows that the total catch has become more than double to five times higher than the base line production. The result also shows that production of air, boal, chital, baily, rani, kajli, shing, pabda, piali etc. remarkably increased after the sanctuary establishment. Some other species like puti, chingri, chanda, baim and many other small species in different area reduced to some extent after the sanctuary management. It might happen due to increase of predatory species like air, boal, pungus and chital after the sanctuary. From this survey one thing is clear that a strong management support is needed to obtain full potential and achieve success from a sanctuary. For strong management the local community especially fishers should be involved in sanctuary management with required sustainable institutional arrangements. It can be concluded that fish sanctuary is one of the most effective tool for open water management to boost up its production.

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LIST OF ABBREVIATIONS

BBS	Bangladesh Bureau of Statistics.
BRAC	Bangladesh Rural Advancement Committee
CBFM	Community Based Fisheries Management
CBO	Community Based Organization
CAS	Catch Assessment Survey.
CPUE	Catch Per Unit Effort
MACH	Management of Aquatic Resources through Community Husbandry.
CNRS	Centre For Natural Resource Studies.
DCHDO	Dustha Child and Health Development Organization
DoF	Department of Fisheries.
FMC	Fisheries Management Committee.
FMP	Fish Monotoring Plan
FSC	Fisheries Subcommittee.
FFP	Fourth Fisheries Project.
FGD	Fisher's Grouped Discussion
NGO	Non Government Organization
PRA	Participatory Rural Appraisal
UNO	Upazilla Nirbahi Officer
UNDP	United Nations Development Program

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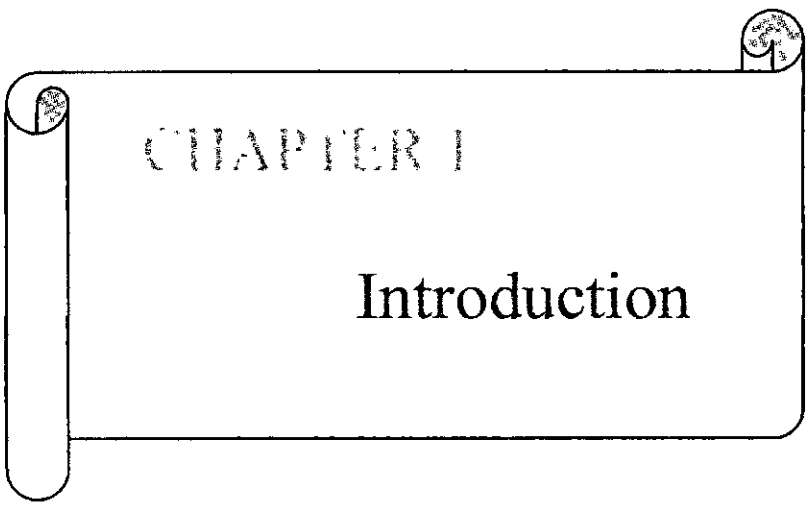

CHAPTER 1

Introduction

CHAPTER 1

Introduction

1. 1 Background of the study

Bangladesh is an agro-based and reverine country where the fisheries resources play a vital role in the socio-economic development of the country. Fisheries sectors provide fulltime employment about 1.2 million and part time employment facilities to about 10.8 million people. The fisheries resources contribute 63% of the national animal protein intake, about 5.24% of the total GDP (gross domestic product) and 4.76% of the total foreign earning majority of which comes from exporting of shrimp (DOF 2003).

The fisheries sector in Bangladesh can be broadly divided into four major sub-sectors:

(1) Inland capture or open-water fisheries,

(2) Inland culture or closed-water fisheries,

(3) Marine industrial (trawling) fisheries and

(4) Marine artisanal fisheries.

Bangladesh is situated in the delta of the Brahamaputra, the Jamuna, the Padma (Ganges) and the Meghna River and with their tributaries and distributaries; Bangladesh's floodplain is one of the richest aquatic systems in the world. It is uniquely endowed with freshwater resources. The inland open water fishery of Bangladesh is composed of highly diverse and unique aquatic systems; it has an extensive network of water bodies comprising large and small rivers, ponds, haors, baors, floodplains and beels that offer tremendous scope and potential for fish production. The country has about 4.05 million ha of inland open waters in the form of rivers, canals, beels (floodplain depression), haor (deeply flooded basin in the northeast) and vast seasonal flood plains with high potentials of fish production. It has also large impounded water areas in manmade ponds, ditches, oxbow lakes, borrow pits, enclosures amounting about 0.5 million ha for aquaculture. In addition, Bangladesh has a large complex of marine and estuarine waters with use right for 1,66,000 km^2 area extending up to 200 nautical miles in the EEZ in the Bay of Bengal with production potential of fish and other important aquatic animal of commercial importance (DOF 2005).

Sanctuary means a holy or sacred place especially church, temple of mosque, where in former time, a person running away from the law or his creditor was secure by church

law, against arrest or violence (IUCN 2000). Place of refuge or a place/area where by law it is forbidden to kill birds, rob their nests etc. or shoot animals etc. Thus a fish sanctuary is a water body/area where catching/killing of fishes is prohibited by law and order of competent authority for all the times to come or for a specified period mainly with objective of protecting/conserving the fish to grow longer to breed and grow. For fisheries resource conservation sanctuary is a very important tool in the exploited state and when under heavy fishing pressure. It is in some situation is also called reserve or no-take zone.

Under the provision of the Fish Act 1950 that fishing can be prohibited in any water body for any period, the Government of Bangladesh has established fish sanctuaries in different water bodies from time to time. Based on this provision seasonal closing of fishing/catching of certain species of fishes in certain water bodies was imposed by the Government in 1952, mainly for protecting the brood and hatchling (small fry). Catching of carp fishes i.e. rui, catla, mrigal, kaliboush and ghonia of any size in 27 water bodies (rivers and canals) are prohibited during the period from March to July every year, except for the purpose of pisciculture with license from competent authority (DOF Officers). In the context of limited legislation and general fishing rules that are difficult to enforce, intense fishing pressure, complex local power structure and use rights, continuing loss of dry season fish refuges, fish sanctuaries have received recent emphasis. Sanctuaries, reserves and "no-take zones" have been proved effective tools for conservation of fish resources in many countries both in inland and marine waters. They now appear to be the most effective mechanism for protection, conservation and management of inland fisheries in Bangladesh. The establishment and management of fish sanctuaries appear to be easier than most other management interventions and they are popular with fishing communities.

However, the effectiveness of sanctuaries depends on several key factors such as identification of the type of sanctuary needed, selection of water body, based on technical and social issues, appropriateness and compliance with the rules introduced. Depending on the purpose, the sanctuary may be seasonal/ temporary or permanent. One factor is the lifecycle of the main species being protected, fish species that attain maturity within a year or even spawn twice a year need only few months' refuge in the dry season and then they are capable of repopulating seasonally flooded land. The refuges for these species need only be seasonal to ensure that they survive to reproduce; this is mainly the case for

Table 1: Different types of fish sanctuary

Type of sanctuary	Objective/Purpose	Characteristics
Seasonal / temporary	Protect short lived species at a vulnerable stage in their life cycle	Fishing may be closed for breeding season in the breeding ground to allow successful spawning, or in the dry season to project brood stock.
Permanent	Protect brood stock of long lived species as well as of short lived species.	Fishing is closed for the whole year for all species to develop/ protect brood stock.
Species specific	To replenish any endangered/ depleted species of fish.	To protect a particular species in its preferred habitat for all or a major part of its life cycle (fishing for other species may or may not be allowed within the sanctuary)
Harvest reserve	To increase catch and to conserve brood stock.	Fishing is closed for a certain period in a given area - say 3 or 5 years - primarily so that those who stop fishing can at the end of this time get an increased catch but it also helps some fish to breed.

Many co-management efforts have been practiced in different floodplains including many dead rivers and semi-closed water bodies of Bangladesh to boost up natural production. A lot of management tools and intervention have been incorporated in this co-management system. Establishment of aquatic sanctuary in the open water system has been considered as one of the most effective tool or intervention to boost up natural fish production. In the past 10 years about 228 sanctuaries have been established in 176 water bodies under different development project of the DoF (WFC 2007). Fish production has been increased in these water bodies in a wide range of varying percentage along with the reappearance of a good number of fish species. But in almost all the cases, each sanctuary was supported many other tools and interventions. So it is difficult to determine the exclusive role of the sanctuary on fish production and biodiversity conservation. In fact, in our country, a good quality, regular catch data are not available for making conclusion exclusively on sanctuary in open water. Present study has focused on it. This study has been conducted to determine effectiveness of an aquatic sanctuary to boost up fish production in open water. Through this study, if this aquatic sanctuary proved fruitful, then it will increase the confidence of the planner as well as the community involved in planning and management in a water body.

Fish and fisheries have been an integral part of life of the people of Bangladesh from time immemorial; many aspects of the culture, economy and tradition are based around fisheries activities. Fisheries sector plays a vital role in the country's economy,

employment generation, animal protein supply, and foreign currency earning and poverty alleviation. Fish is a natural complement to rice in the national diet, giving rise to the adage "*Maache-Bhate Bangali*". Fisheries, second only to agriculture in the overall economy of Bangladesh, contribute nearly 5.0% to the gross domestic product (GDP), 23% of gross agriculture products and 5.71% to the total export earnings. It accounts for about 6% of the total protein intake and about 63% of animal protein intake in the diet of the people of Bangladesh (DOF 2005).

The fisheries sector provides full-time employment to an estimated 1.2 million fishermen (Sultana and Faisal 2005; DOF 2005) and an estimated 10 million households or about 64% of all households are partly dependent on fishing, e.g. part time fishing for family subsistence in flooded areas (BFRSS 1986; DOF 1997). Another 10% poor and middle class of people are engaged in part-time fishing, aquaculture, fish seed production and collection of shrimp seed, fish handling, processing and marketing; net making, input supply etc.

In the past, the major source of fish production in Bangladesh was the inland open water fisheries that even during 1960s, would contribute about 90% of the country's total fish production. Plenty of fishes were available in the past for the existing population. But rapid growth of population created increasing pressure on fish resources and environment in absence of proper management. The inland capture fisheries have always played a very important role in employment generation, livelihoods and animal protein supply in rural Bangladesh. About 60-70% rural households undertake some sort of fishing either for own consumption or for livelihoods. About 0.77 million full time fishers depend on inland fisheries for their livelihoods (Minkin *et al.*, 1997 and Thompson *et al.*, 1999).

But due to over fishing including use of harmful fishing gears and system (fishing by dewatering), degradation and loss of fish habitats, obstruction of fish migration routes by construction of embankment and water control structures to increase agriculture production, siltration of water bodies by natural process, and water pollution by industry and agro-chemicals, the natural inland fish stocks have declined significantly and biodiversity has been affected seriously (Ali 1997). The poor fishers' livelihoods have been affected. According to a study by IUCN, some 54 fish species are endangered, of which 12 species are either critically endangered or extinct (IUCN 2000).

.Fish production (catch) from inland capture fisheries declined significantly during 1970's and 1980's, after which there has been an increasing trend in fish catch (table-2). But there has been a qualitative degradation of catch in terms of valued species like Indian Major Carp, air breathing fishes (Koi, Magur, Singhi etc.), Sarputi, Pabda etc. (Tsai *et al.*, 1985).

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Table 2: Fish production by types of fisheries at 5 years intervals

Type of water/ fisheries		Fish production in m.ton									
		1960-61	1965-66	1970-71	1975-76	1980-81	1985-86	1990-91	1995-96	2000-01	2005-06
1	Inland capture fisheries	613	676	672	469	425	442	443	610	689	957
2	Aquaculture	33	44	61	76	100	145	211	379	713	892
3	Marine Fisheries	42	81	85	95	125	207	242	270	380	480
COUNTRY TOTAL		688	801	814	640	650	794	896	1,258	1,781	2,329

Source., World Fish Centre, 2007

However, aquaculture production both in fresh water and brackish water has significantly increased during the last two and a half decades with development of technology. Presently aquaculture contributes about 40% of the total fish production of the country.

Fish Act 1950 does not give provision for restriction of fishing efforts in any water body though it is the focal point of biological management of a fishery. Of course, control of fishing efforts in inland fisheries of Bangladesh is very difficult because of the complexity of inland fisheries and socio-economic condition of the people. Implementation of fisheries regulations has been difficult due to institutional weakness of implementing agencies and the socio-economic areas. However, the Fish Act 1950 element – "closure of fishing in specific area for specific period" as may be termed as fish sanctuary is easier than other regulations of the Fish Act. Sanctuary has been tested and found as a powerful tool for protection and conservation fish stock globally including Bangladesh.

Most of the floodplains have been brought under Flood Control and Drainage projects, which have drastically reduced dry season water areas leaving almost no suitable water body for survival of fish. Embankments and sluices have obstructed fish migration from the main rivers to the floodplains for breeding and feeding resulting in a decline of the

fish stock in the floodplains. Most of the rivers of Bangladesh is controlled outside the country. The activities outside the country are affecting the water bodies of Bangladesh. For example, the diversion of the Ganges water at Farakka in India has drastically reduced the dry season water flow in the Ganges system within Bangladesh affecting the environment and aquatic resources particularly fish stock and fish production. Livelihoods of those who would depend on inland fisheries have been affected and fish consumption has fallen.

The dry season is the critical time for fishes, when water levels in the rivers, canals, beels etc. reduce drastically leaving less refuge of the fishes and the fishes become increasing vulnerable to intensive/harmful fishing and thereby the fish stock particularly the brood stock has depleted to such level as cannot sustain the fisheries and gradually production and fishers catch have declined. So the major issue for sustainability is to protect sufficient brood stock to maintain the population at sustainable level. Among all measures, fish sanctuary has been apparently found most effective for protection of broods, when other management measures are difficult to implement in the face of administrative and social contexts. With this idea, Govt. has established fish sanctuaries under different development projects and normal programmed following different management approaches since 1960 and more intensively in last one decade. Govt. is also planning for more fish sanctuaries in the country. But in many cases sanctuaries could not be sustainable in the earlier days due to lack of proper planning and lack of capability of the implementing agency, lack of cooperation/involvement of the local community, financial and manpower constraints etc. Presently over 400 fish, sanctuaries have been established in inland open waters of the country under different development projects of DoF and other agencies. Recently a marine reserve has been setup in the Bay of Bengal for protection and conservation of marine fisheries resource in addition to seasonal closing of fishing by commercial fleet (trawler) in order to ensure sustainability. There was also no proper monitoring system to assess the management performance and impact including problems and constraints of sanctuary. It is therefore necessary to have better understanding of the management performance and impact of the sanctuaries established in the country for further measures towards sustainability.

In view of the above, the Bangladesh Fisheries Research Forum (BFRF) has taken an initiative for study/research on the impact of fish sanctuaries on fish production and bio

diversity in Bangladesh. The study/research sponsored by BFRF has been implemented jointly by BCAS, BAU & TARA. Under this research project, attempts have been made to review and assess the impacts and status of sustainability of the fish sanctuaries established during the recent years under different projects of the Govt. and other agencies including problems of the constraints faced and to recommend measures for improvement of management and for their sustainability.

1.2 Objectives of the study

By this study, impacts will be evaluated based on trend of fish production or year wise catch, recovery of any endangered fish species and socioeconomic change of fish if any. Hence, the study was conducted with a view to fulfill the following specific objectives.

1. To find out the increasing or decreasing trend of fish production before and after selling up the sanctuary in the selected water body,
2. To observe the recovery of endangered fish species, if any, and
3. To determine the change of socio-economic status of the fishermen for drawing conclusion on acceptability of the sanctuary to them.

CHAPTER 2

Review of literature

CHAPTER 2

Review of literature

Fish sanctuaries are types of aquatic protected or no-take fishing areas. Found throughout the world, they are most-often associated with marine habitats (Uychiaoco *et al.*, 2000; Francis. *et al.*, 2002; Benedetti-Cecchi *et al.*, 2003), although they are also known for freshwater environments (Hoggarth *et al.*, 1999). Despite their prevalence, little has been documented about how fish sanctuaries that encompass deep-water pools function in tropical rivers, streams and other types of inland wetlands (Poulsen *et al.*, 2002).

Rahman (1989) reported that there are 260 species of freshwater indigenous fish in Bangladesh. In the past, most of these have been classified as small and of little commercial or economic value (Ali, 1997).

Many freshwater fisheries management systems in the tropics, including ones in Laos, rely on strategies to protect fish during the spawning-season (Bush 2003), which is generally in the rainy season. However, fishers realize that when water levels are high, fish are much less vulnerable than during the low water dry season, and concentrate their protection efforts in the latter period (Baird *et al.*, 2001b; Baird & Flaherty, 2005).

53 sanctuaries were established under 45 water body (rivers and beals) by the Department of Fisheries through their 4th Fisheries Project from 2001 to 2003 (DoF 2005). Because of establishment of sanctuary, the production of fish increased at the rate of 15% to 200%. Among 27 sanctuaries, number of species increased in 23 sanctuaries (DoF 2005). In 1998, there were 73 sanctuaries established under 36 water bodies through the MACH project of Government (DoF 2005).

Hossain *et al.* (1997) have warned to the dangers of a shrinking gene pool, and loss of genetic diversity. The depletion of stocks and the loss of species reduce biodiversity, change the biological and tropic structure of the ecosystem, increases vulnerability and undermine sustainability. It also leads to increase fishing pressure being placed on the remaining species. He identified the following causes for the loss of biodiversity, such as Reduction in floodplain ecosystems, expansion in HYV rice production, indiscriminate use of pesticides, and pollution and siltration of the river system. As a result of their

cumulative impact, several species of floodplain, riverine and brackish water fish are threatened.

Rahman *et al.* (1993) reported 60 (Sixty) species of fish belonging to 18 families were identified in the catches in those three floodplains (Chanda, BSKB and Halti beel). Haque *et al.,* (1996) identified 50 species in two oxbow lakes in south western Bangladesh with weight ranging from 78 kg/ ha/ month to 32 kg/ ha/ month. MACH (2001) reported catch per unit area (kg/ha) in different locations of 'Hail haor' (April, 1999-March, 2000) and recorded 112.8 kg, 393.64 kg, 69.82 kg, 278.21 kg, 248.12 kg, 158.87 kg and 35.57 kg in baseline catches of Jethua beel ,Gopla river(Beel), Boulashir Floodplain, Cheruadubi beel, 62-beel Complex, Rustompur complex beel and balla beel respectively but in impact study (April, 200-March, 2001) the recorded catches were190.55 kg, 465.73 kg, 78.01 kg, 322.9 kg 7, 442.58 kg, 176.04 kg and 87.15 kg respectively in above mentioned beels. Again in base line survey no catches were recorded in Shananda beel, Kazura beel, Koraiya beel, and Agrari beel but in impact study recorded catches were 148.40 kg, 97.85 kg, 18.03 kg and 121.47 kg in these four beels respectively. Overall catch was 1092.13kg in baseline study but in impact study, it was 2248.78 kg.

Rahman *et al.* (1993) recorded 20 species of fish in the catches of punti jal (2.5-3.18 cm mesh) in Chanda beel. The compositions of dominant species were punti (24.22), Kholisha (19.68), shing (16.21%), tengra (8.24%), taki (8.23%), koi (8.07%) and baila (6.12%). But in the catches of koi jal (3.18-3.8 cm, mesh) composed of 15 species and dominant species were punti (25.25%), khoilsha (17.42%), shing (17.01%), and koi (15.46%).

Tsai and Ali (1985) stated that Farakka dam; embankments and sedimentation are the three major factors causing the decreases in the habitats available for major carps. Over fishing is the most important factor linked to decline of major carps in the inland open waters of the river system.

Kibria (1983) reported 34 species of fish and seven species of prawn were recorded from the jag fishery (brush park) in the Dakatia River. *Chanda (Chanda spp), Puntius sophore* and *Rohtee cotio* were the most abundant fish species by number. While *Wallago attu, Notopterus Chitala, Puntius sophore* and *Channa striata* were the most important species

by weight. He also investigated the species composition, abundance and standing crop of jag fishery of the Dhakatia River. The standing corp determined ranged from 83 kg/hf to 1608 kg/ha.

Rahman *et al.* (1999) carried a study on fish catch in three floodplain beels within the Bangshi-Dhaleswari floodplain in north-central Bangladesh during April-October1996, demonstrated a depth based floodplain fisheries assessment methodology. They recorded 96 species and categorized them in to 16 similar groups. Ranking of concentration (m^3) by guild resulted in: prawn 44%, perch and gourami 17%, glassfish 12%, barb 11%, cyprineid 6%, snakehead 4%, gobidae3%, eel 2% and other cyprinidae 1%. They recorded more species in deeper waters (depth>90cm) than in shallower depth classes.

MACH (2001) recorded species diversity by location in Turag-Bangshai river during April"2000 to December"2000 were 50 in Mokesh beel (South), 56 in Mokesh beel(North), 51 in Kalidaha beel, 46 in Mokash *khal*/Solhati *khal* (Canal), 52 in Turag river (River section 2 km), 47 in Anowla *khal*(canal), 58 in Aowla beel, 73 in Bangshi river. In Serpur site the diversity was 36 in Baila beel, 42 in Takimari beel, 37 in *Kewla*, 26 in Nijla beel, 38 in Bagadubi *khal*, 19 in Bahar Alikur (Malijhi River), 21 in Saitandaha beel and 23 in Bailasha beel.

MACH (2001) also observed species diversity in Hail *haor* and rercorded 40 fish species in Jethua beel, 41 in Gopla river (Inside Hail *haor*), 50 in Boulashir floodplain, 40 in Cheruadubi beel, 58 in Bashotti beel, 49 in Rustompur, 35 in Sanonda beel, 19 in Kazura beel, 31 in Kakia and Kauter beel, 17 in Borokuma beel, 25 in Balania beel, 45 in Bailla beel, 38 in Maura gopla, 26 in Sonamua beel, 32 in Aagari beel and 26 in Baika beel. Overall the base line species diversity as 71 in Hail-Haor, 82 in Turag-Bangshi basin and 64 in the Kongsha-Malijhee river basin, which after 5 years of intervention of MACH project increased to 85, 86 and 70 respectively.

BFRI (2002) recorded 92 fish and prawn species from fish stock assessment study of Sylhet-Mymensingh basin and reported that Barbs (*Puntius spp.*) were most dominant comprising 19% of total catch, Catfishes were widely and uniformly available in all habitats comprising about 18% of total catch, Minnows were 13%, Snakeheads 11%, contribution of Perches, Gouramies, Prawns, freshwater spiny eels, shads and

miscellaneous mixed species were 6%, 5%, 3%, 3%, 2% and 4% respectively in Sylhet sub-basin. In Mymensingh sub-basin, catfishes, the Gangetic major carps and various kinds of prawn were the dominant species in the catch.

Shafi and Quddus (1982) described 148 species of freshwater fishes and 10 species freshwater prawn of Bangladesh and the names of gears used to catch each species in their book "Bangladesh Mathsya Shampad" (Fisheries Resources of Bangladesh).

Rahman *et al.* (1993) recorded 18 species of fishes in Halti beel in the catches of seine net. The contribution of dominant species in the catches of this gear were tengra (31.71%), rikhor (22.60%), punti (14.24%), chanda (9.86%) and stocked fishes i.e. major carps (8.23%). But they recorded 28 species of fishes in the catches of cast net. The percent compositions of dominant species recorded by them in the same beel were 13.17-49.59% tengra, 20.28-40.72% punti and 3.4-24.5% baila from August to March. They also recorded 27 species of fishes in the catches of lift net in the Chanda beel. They recorded punti (30.18%) as the most dominant species in their study. The next dominant species recorded by them were kakila (20.08%), kholisha (8.8%), tengra (6.4%) and chanda (5.7%).

Fish aggregating devices and harvest reserves need to be distinguished from sanctuaries but involve techniques that have been adapted to use in sanctuaries. Periodical closing of fishing in some specified area of a water body that is protected by making brush piles with branches of trees and bamboos (locally called *katha*) to attract fish thereby increasing the harvest is a traditional practice in Bangladesh and in other tropical countries of the world. If the closed period is long enough then short lived species get a chance to breed and grow before they are harvested (although in Bangladesh brushpiles are not major locations for fish breeding). But if, as is more often the case, the period is shorter and almost all fish are caught from the katha leaving almost none, then it is harmful for the fish stock. In Indonesia harvest reserves are established in rivers with main objective of harvesting after one year for increased catch. Studies showed that catch in those rivers with harvest reserves has increased many times compared to that in rivers with no harvest reserves (Hoggarth, 2004). In Bangladesh numerous katha are placed in rivers, canals and beels for harvesting fish. These are harvested several times in a year

and almost all the fishes are taken out giving them no chance to breed (Tsai and Ali, 1987).

In 1967, an 80 ha reserve fishery named Gacherdahor Fishery in Kishoreganj district by private party was harvested after a fishing closure for five years. Species-wise fish catch was recorded by the Fisheries Research Station, Chandpur and gives a picture of what the Bangladesh inland fisheries in an almost undisturbed state must once have been like. The estimated catch was an unbelievable figure of 5,134 kg/ha, with major carp (rui, katla and mrigal) constituting 35%, minor carp (calboush, ghania, nandil) 33%, catfish 18% and shorpunti 4%. (Tsai Chu Fa., *et al* 1985). Sadly the inland fisheries are now heavily depleted, some of these species are even threatened with extinction within Bangladesh (IUCN 2000), and the reserve fishery system is no longer practiced.

Marine Reserves have been widely introduced all over the world during the last 30 years for protection and conservation of marine fisheries and marine habitats/ecosystems, particularly coral reefs. Definitions vary and are somewhat confusing. For example, any marine habitat in which human activity is managed has been termed a marine protected area although this allows fishing within the management plan, while areas where no extractive use of any resource (living, fissile or mineral) nor any habitat destruction are allowed have been called fully protected marine reserves (Palumbi, 2002).

However, the total area of marine reserves in the world is a small fraction of one percent of the world's ocean area while the land area protected in terrestrial protected areas (such as national parks and other reserves) is about 4% (Primack, 2000). Most marine reserves are claimed to have impacted positively on the fish stock. In a review of 104 reserves by Halpern (2002), it was found that the fish population density increased by from 60% to 150% across a wide range of countries in North America, the tropical Pacific and Africa.

Ahmad, K.; and Ahmed, M. (2002) reported from empirical knowledge and experience that the area required for fish sanctuaries may be 25% of the dry season area in case of beels and 10% in case rivers. They opined that the area might vary according to geographic condition, physiographic condition, hydrological condition, river network, species composition, target species, and fishing pressure on the aquatic resource. But they also claimed that protecting a 20 decimal (0.08 ha) *kua* (ditch in floodplain beel) could

support the fishery in a seasonal beel covering 200 ha in the wet season (protected area of 0.004% of the wet season beel area). Under the CBFM project, communities in one seasonal floodplain have protected several *kuas* –average total per dry season of 0.16 ha, compared with a total dry season water area of 2.9 ha (6%) and wet season area of 250 ha (0.006%), with positive impacts (Sultana, p. and faisal, I. M., 2005). Under CBFM-2 project as a whole individual sanctuary sizes vary from *kuas* of about 8 decimals (0.03 ha) to 20 acres (8 ha), in all cases covering part of a water body (World Fish Center 2003), on average about 1% of the estimated total wet season area of the water bodies comprises sanctuaries.

Fish sanctuaries in the Fourth Fisheries Project sites cover a reported total area of 1022 ha compared with a dry season water area of 8,502 ha or 11% of the dry season area and 2.3% of wet season area (unpublished data, pers. comm.), but about half of this total sanctuary area is in five main river sites that reported large sanctuaries and it is uncertain if these are being fully observed.

More than 70% of households fish in the floodplains either for income or food (Minkin *et al.*, 1997; Thompson *et al.*, 1999). In Bangladesh poverty is understood to be multidimensional and has many roots. A household is considered welfare-poor if its assets do not allow the generation of adequate income (in money or in kind) to satisfy food needs. On the other hand, a household is investment-poor if its assets fail to generate an adequate flow of money or services to support investments (Bahamondes, 2003). In Bangladesh, various forms of co-management arrangements have been experienced more than a decade. These are: (1) NGO led strategies; (2) Government led strategies, and (3) Government and NGO partnerships (Ahmed *et al.*, 1997).

Community based management of natural resources or common pool resources has become a strategy for improving resource management and empowering local communities in the past two decades based on the concepts such as co-management, using local knowledge, recognizing local institutions and establishing common property regimes (Berkes *et al.*, 1989; Ostrom, 1990; Pomeroy and Berkes, 1997). Although there has been a focus on design principles for community management institutions (Ostrom 1994) and on identifying factors linked with sustainable common property regimes and institutions (Agarwal, 2001).

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Shankar (2002) based on modeling of the fishery in Pabna floodplains found that while closing 30-40% of the dry season water area from all fishing was optimal for catch, setting aside 10% as sanctuaries would sustain a productive fishery. DOF's draft strategy paper for inland capture fisheries management (DOF 2005) adopts this last figure and suggests that the sanctuary area should be around 10% of dry season area of water bodies. In Bangladesh, most of the fishermen are illiterate and few have primary level of education (Rahman, 1994a). Coastal fishermen of Bangladesh have a low level of education (Bailey and Doulman, 1994).

Fishing is considered as a low-class profession and fishermen are traditionally poor. They lived from hand to mouth (Hannan, 1994). These fishermen are socially, economically and educationally disadvantaged communities and lack their own financial resources (Rahman, 1994 b). Fishermen and their families in the South and South East Asia often are considered to be among the poorest of the poor (Bailey, 1994).

DOF (1997) further conducted a survey on the socioeconomic conditions of the fishermen in eleven upzillas of the district of Patuakhali and Barguna under Fisheries Extension Development Project and reported that rate of literacy among fishing communities was far less than other areas. Their economic condition was so bad that they often could not afford educational expenses for their children. This study reportd that about 70-80% fishermen were laborers (work in other gear and boats); about 70% of fishermen had an average daily income of taka 20-25, and the rest 30% taka 25-40.

A vast majority (90% and 91.66%) fisherman of the Dhaleswari River is engaged in full time fishing. This study also revealed that maximum fishermen caught fish individually, and more than 97% fishermen were members of different associations (Al-Muhit, 2000).

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occupation, 81% were found fishing throughout the year and 92% were member of some associations, clubs and co-operatives.

Mannu (1999) obtained data on the sea going fishermen at Kuakata and reported that 72% were full time fishermen, 89% earned an average 25000 taka per year, 2% were owners of a trawler, and 4% carried out fishing during winter and rainy season. Ahmed (1999) studied the socioeconomic conditions of the coastal fishermen and reported that 73.33% earned taka 50 per day.

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Mahabubullah (1986) studied the polder fishing community of Bangladesh. He reported that among the polder fishing community 64% had no boat and 61 % had no gear. While, 98% reported, fishing as their main source of income and 71% earned 400 taka per month or above. A similar study was conducted by DOF (1993) on fishermen community of the chanda beel and revealed that there were 22% professional and 74% non-professional fishermen. 85% carried out fisheries activities individually, 5% were members of cooperatives, 34% aware of NGO programs. Average household income was 15000 taka per year.

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Chantarasri (1994) reported about the Sunderbans Reserve Forest (SRF) fishermen community. Fishing was carried out in-groups. Most fishermen own their fishing gears with which they caught less than 40-kg fish per month. Typically monthly earning was between 2000 and 3000 taka.

CHAPTER 3

Materials and Methods

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Materials and Methods

3.1 Overall/general review of sanctuary

This activity/component of the study includes an overall review of all fish sanctuaries established under different projects of DoF and other organizations in respect of physical, biological, social, management performance, impact of fish production and biodiversity, problems, constrains etc.

For overall review of all the sanctuaries in greater Khulna region so far established under different development projects and programmed of DoF and other GO/NGO organizations, relevant information have been collected from secondary sources (DoF and other relevant organization) and also on personal contact/correspondence.

3.2 Case study (Detail study of sanctuary performance)

Detail information of the sanctuaries has been collected through field visits, personal contact with the community people of different professions. The sanctuaries for detailed study are listed in Table-4 below and shown in the location Map in Figure 1.

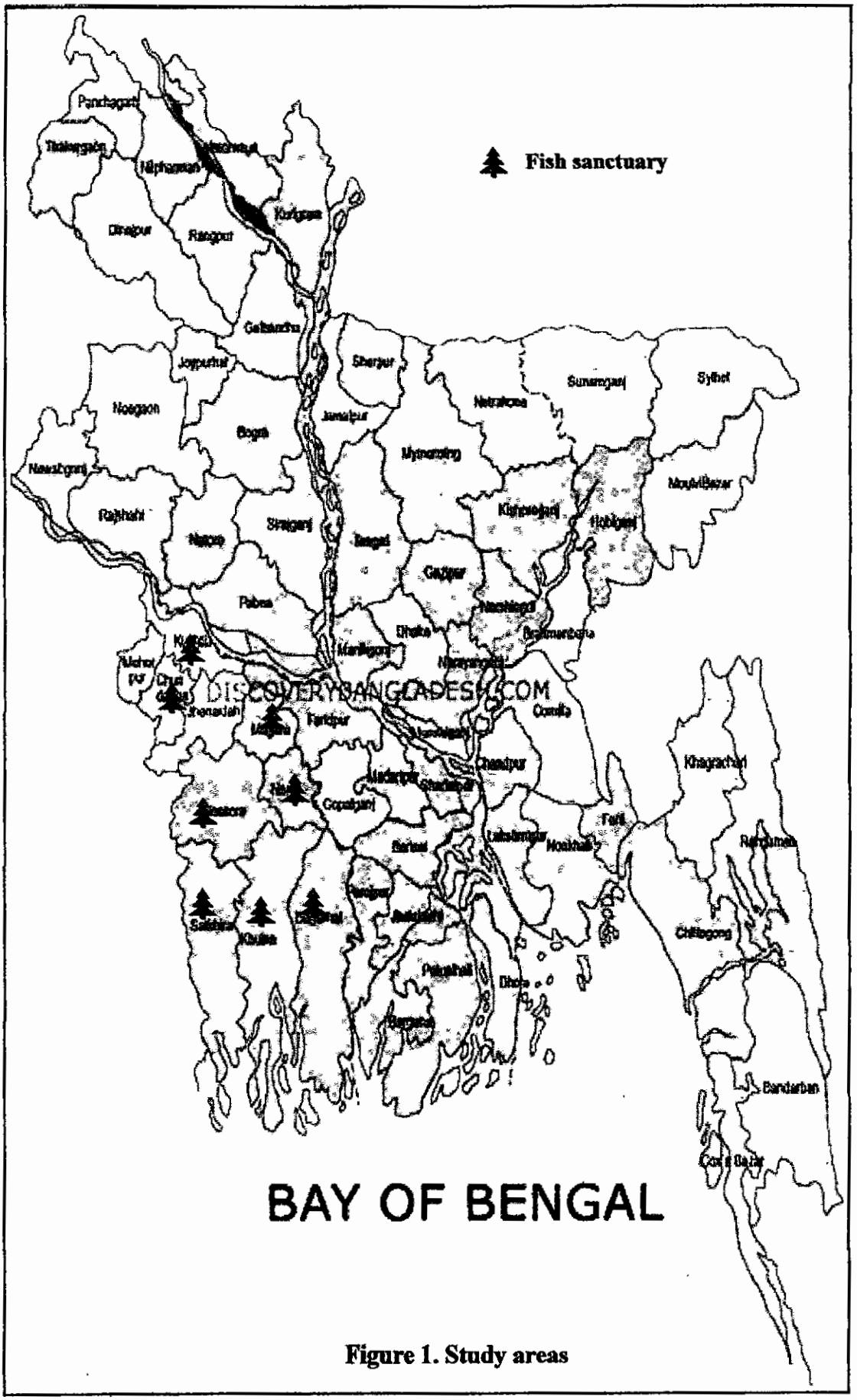

Figure 1. Study areas

(4) Social parameters

- Community organization
- Community capacity/empowerment and involvement in fisheries management
- Access right to resources
- Conflict
- Benefit distribution
- Income of the fishing community
- Community attitude towards sanctuary

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Data/information on social aspects was gathered through personal interview with local elites/people and through FGD with the community as per prescribed checklist.

3.4 Study period

The study was conducted from September, 2007 to June 2008. Details plan and design of the works were set up in a participatory approach with the community. During 2002/2003 most of the sanctuaries were established. Hence, the catch data have been considered as base line production while the catch data of closed year has been considered as impact on fish production.

3.5 Data collection

3.5.1 Data collection & entry

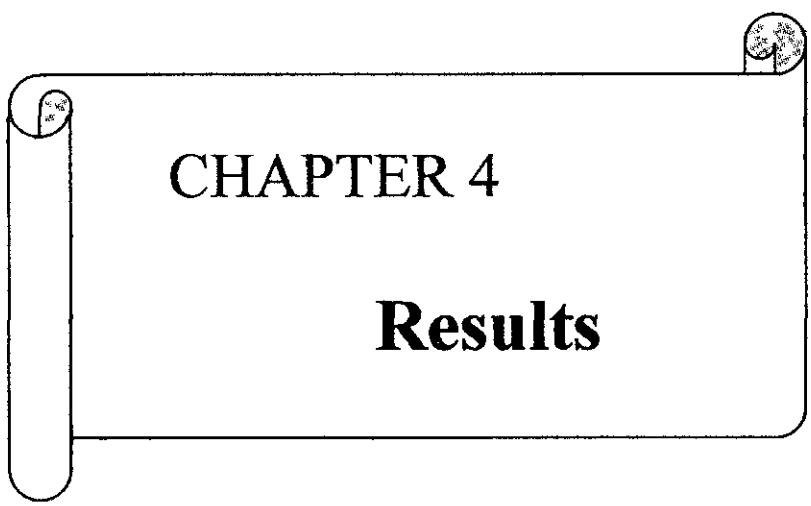
We developed a questionnaire and format for data collection in participatory approach with the NGO and community members. Some NGO and CBO workers were trained on catch assessment survey (CAS). They assist us in data collection. We made a plan and collect data as per plan. Collected data were put in to a format for estimation.

3.5.2 Secondary Source of information

Necessary relevant information on sanctuary history, fish availability and management system were collected from the Fisheries Management Committee (FMC), NGO, Local DoF office and Fourth Fisheries Project Documents. Sometimes cross check was made on different information with the secondary data.

3.6 Data Analysis

Collected information obtained from the survey were accumulated, grouped and interpreted according to the objective as well as parameters. Some data contained numeric and some contained narrative facts. The data were then presented in graphs and tabular forms. All processing and analysis was done by using MS Excel and MS Word.



CHAPTER 4

Results

CHAPTER 4
Results

4.1 JESSORE DISTRICT

4.1.1 Bhairab River sanctuary, Jessore Sadar.

Fishery activities are directed with the Bhairab River mainly in this Thana. All native species are exclusively available in this region, but day by day a great number of native fish species extinct and some are in endangered condition. The fish production and the biodiversity have been affected over the years in the area due to change in water unavailability, unstable condition of the water level and the increasing pressure of fishing activity. Different Government organizations and Non-government organizations are workings for sustainable fisheries development in this region. Department of fisheries (DoF) took all the initiatives to install the fish sanctuary in this river. Two sanctuaries were established in this river in 2006-2007 seasons at **Pagladah** and **Nurpur** in **Jessore.**

4.1.1.1 Pagladah, Jhumjhumpur, Jessore Sadar

The site Pagladah fish sanctuary is situated at Jhumjhumpur in Jessore sadar. The area of the Pagladah fish sanctuary is 0.53 hac and the depth reaches its highest point 20-25 feet at the rainy season and the lowest point 5-6 feet at the winter season. Bamboo leafs and branches of trees, kolmi, water hyacinth, red flag etc. are usually used to make the sanctuary. Porous bamboos and Conceit pillars were used for establishing the sanctuary, which may dish up as secure place to protect the fish beyond catching. Some particular fishing gear is strictly prohibited in this region, which is mosquito net and current jal. Before establishing the sanctuary, all the professional fishers, boatmen and local people living around the river (both side) were contacted and they were made aware about the intention of the project – the proposed sanctuary in a series of meetings and focus group discussion. An informal committee was formed by the representatives from fishers and two executive officers were subsequently elected by the group members.

There are two main seasons of fishing. One is termed as peak season when the majority fishing occurs. The major catches (more than 65% of the total catch) come in this season. The peak season for this sanctuary is from mid September to mid November. The other season is the lean season when the least fishing occurs. Generally professional fishers do not fishing during this period. The lean season for the site is from mid February to mid April.

Changes in Biodiversity

The production of the sanctuary gradually decreasing due to environmental degradation and lack of awareness among the fishers to protect the endangered or valuable species. Fishers' catch small sized fry of large fish and by-catch of other species is another important reason. But after the sanctuary environmental condition of the sanctuary is suitable to regain the endangered and extinct species. Breeding ground of the sanctuary is developed enough to breed in natural condition. Along with fish catch, species diversity also increased which is related with age of sanctuary in the habitat After sanctuary boal, rani, kajoli, gutum, maya, gongonia, deshi puti, air, foli, and pabda are newly recruited which were previously extinct or severely endangered. Different types of aquatic weeds such as different types of water hyacinth, pata shela, kolmi, water lily, helencha, maloncha were available in this area that were almost extinct. The other interesting organisms as turtle, guishap, crabs, different types of small Shrimp and Prawn were found for establishing the sanctuary. Breeding ground of this river is good after establishing the sanctuary but this river still in vulnerable condition for the recruitment of endangered species and sustainable condition of biodiversity. The production of baim, gozar, pabda, royna, kholisa, gutum, gongonia, shol etc increased severely, which were previously decreasing day-by-day and almost endangered condition and some are near to extinct. To increase production, they release the fry of rui, katol and grass carp.

Table 4: Species that have appeared or disappeared after the Pagladah sanctuary

Category type	Appear or increase substantly	Disappear or decrease substantly
Fish	Gutum, Nundabele, Kuiba, Batashi and Khorsula	Ilish substantly decrease
Other species	Turtle, Guishap	Snake
Aquatic weeds	Water hyacinth, Pata shela, Kolmi, Water lily,	-

Table 5: Changes in production of the Pagladah sanctuary

Species name	Production (Kg)	
	2006-2007	2007-2008
Rui *(Labeo rohita)*	1229	1752
Catla *(Catla catla)*	1320	1679
Grass carp *(Ctenopharyngodon idellus)*	851	1084
Shol *(Channa striata)*	484	727
Taki *(Channa punctata)*	537	942
Deshi puit *(Puntius ticto)*	245	584
Air *(Sperata aor)*	367	421
Foli *(Notopterus notopterus)*	374	673
Pabda *(Ompok pabda)*	271	472
Gozar *(Channa marulius)*	185	309
Royna *(Nandus nandus)*	418	542
Kholisa *(Colisa fasciata)*	341	483

Goinna (*Labeo gonius*)	63	106
Baim *(Mastacembelus spp)*	581	942
Chingri *(Palemon spp.)*	659	1047
Tengra *(Mystus vittatus)*	846	1037
Bata *(Labeo ariza)*	540	712
Baila *(Glossogobius giuris)*	265	461
Mola *(Amblypharyngodon mola)*	98	236
Chela *(Salmostoma bacaila)*	113	264
Others	1376	1787
Total	11163	16270

In the table 5 other species point includes Maya *(Amblypharyngodon mola)*, Prawn *(Penaeus spp)*, Crab *(Scylla spp)*, Koi *(Anabas testudineus)*, Rani *(Batia dario)*, Kajoli (*Ailia coila*), Pungus *(Pangasius pangasius)*, Tit puti *(Puntius ticto)*, Boal *(Wallago attu)*, Chanda *(Chanda spp)*, Black carp (*Mylopharyngodon piceus*), Gutum *(Lepidocephalus guntea)*, Rita (*Rita rita*), Nunda Bele *(Glossogobius giuris)*, Batashi (*Pseudontropius atheronoids*) and Khorsula *(Rhinomugil corsula)* etc. fish species.

After establishing sanctuary, total fish and non-fish production in this region are strongly influenced. Before establishing the sanctuary, the base line production went down to 4000-4500 Kg. This is due to random fishing at that area and absence of authority organization or Government implication of rules. However, after establishing the sanctuary under DoF different strategies were taken to increase the production of available and endangered fish species and further to reappearing the extinct species. To increase production fry of different fishes like Rui, Katol, Shol, Grass carp etc. was released in the open water and fishing was totally forbidden for 60-70 days. So, the production was increased and in 2007-2008 the highest production obtained which is 16270 kg.

Socio-economic condition

Most of the fishermen in this area are poor. Some of them have no land for cultivation, so they completely have to depend on the sanctuary to maintain their family. Due to poor, they have to engage their women and children in fish catching, harvesting and marketing. That is their children cannot go to school. Nevertheless, after establishing the sanctuary, due to increasing their income, they send their children to school. Each farmer earned about 55-70 Tk/day before the sanctuary and 115-175 Tk/day after the sanctuary.

Occupation of the fishermen

Fishing cannot provide full time employment, and the income derived therefore may be insufficient to provide adequate means of livelihood. As such, secondary occupations are involved. The professional fishermen around the sanctuary area is 63%, most of them are

depend only fishing rest of the fishermen have alternative livelihood. The overall status of the occupations of the fishermen is given below:

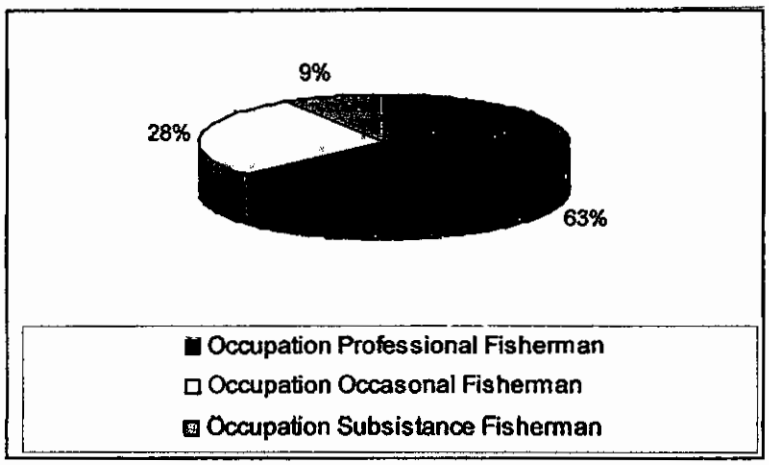


Figure 2: Occupation of the fishermen

Woman participation

Women are the half of our population. Without their active participation no development activities would be done. But, it is a great regret that about 12% women involvement was found in this sanctuary. This is because they have alternative livelihood. Another important reason is there is no more chance of entering themselves into the sanctuary committee. It was shown below the table:

Table 6. Participation of woman in pagladak Sanctuary

Man	Woman	Total
88%	2%	100%

Education status

Educational attainments help to develop conceptual skill and facilitate the acquisition of technical skill, which can have direct bearing on income generation, expenditure and saving activities. If fishermen should be properly educated with respect to the importance of management then it helps to improve the efficiency of rural household's in production. But in this survey it was seen that most of the fishermen are illiterate or got sign only, 16% of them were completed primary education but forgotten all, 6% of them were in up to secondary level and rest 3% were in up to HSC, which were shown below the table:

Table 7. Educational Background of Fishermen

Education				Total
Sign only	Up to Primary	Up to secondary	Up to HSC	
75%	16%	6%	3%	100%

4.1.1.2 Nurpur, Jhumjhumpur, Jessore Sadar

The area of the Nurpur fish sanctuary is 10.0 ha from which the sanctuary occupied 0.72 ha and the depth reaches its highest point 20-24 feet at the rainy season and it reaches its lowest point 5-6 feet at the winter season. Bamboo leafs and branches of trees, kolmi, water hyacinth and red flag are usually used for making the sanctuary. The red flags indicate no fishing within the prohibited or marked area. Usually 150 meters around the sanctuary was prohibited for fishing. Some particular fishing gear is strictly banned in this region which is mosquito net and current jal. Utilization of poisons or chemicals for fishing in the river is totally banned.

Changes in Biodiversity

Different types of native valuable species were disappearing gradually from this area due to bio-diversity degradation and careless fishing of the fisherman. The water became polluted for jute retting in the river. But after sanctuary boal, rani, kajoli, gutum, maya, goinna, air, foli, pabda, shol, taki and deshi puti are rising amusingly which were previously extinct or severely endangered in condition. Different types of aquatic weeds such as different types of water hyacinth, grass, kata shela, pata shela, kolmi, water lily, helencha and maloncha were grown in this area which was almost extinct or rarely found. The other interesting organisms as turtle, crabs and different types of small Shrimp were found for establishing the sanctuary. Breeding ground of this river is good after establishing the sanctuary but this river is still in vulnerable condition for the recruitment of endangered species and sustainable condition of biodiversity.

Table 8. Species that have appeared or disappeared after the sanctuary

Category type	Appear or increase substantly	Disappear or dencrease substantly
Fish	Royna, Piali, Gutum, Nundabele, Prawn, Batashi and Khorsula.	Ilish decrease substantly
Other species	Turtle, Snail	-
Aquatic weeds	Pata shela, Kolmi, Helencha, Maloncha	-

Table 9. Production of the sanctuary

Species name	Production (Kg)	
	2006-2007	2007-2008
Rui *(Labeo rohita)*	342	397
Grass carp *(Ctenopharyngodon idellus)*	351	334
Catla *(Catla catla)*	213	278
Shol *(Channa striata)*	210	276
Taki *(Channa punctata)*	215	315
Tit puti *(Puntius ticto)*	317	424
Air *(Sperata aor)*	213	201
Foli *(Notopterus notopterus)*	174	245
Pabda *(Ompok pabda)*	54	109
Gozar *(Channa marulius)*	47	82
Royna (*Nandus nandus*)	59	72
Goinna (*Labeo gonius*)	23	18
Baim *(Mastacembelus spp)*	124	158
Chingri *(Palemon spp.)*	409	586
Tengra *(Mystus vittatus)*	414	591
Bata *(Labeo ariza)*	136	189
Baila *(Glossogobius giuris)*	127	143
Mola *(Amblypharyngodon mola)*	109	147
Chela *(Salmostoma bacaila)*	82	98
Others	445	489
Total	**4064**	**5152**

In the table 9 **others** point includes Koi *(Anabas testudineus)*, Rani *(Batia dario)*, Piali *(Aspidoparia morar)*, Royna (*Nandus nandus*), Sarputi puti *(Puntius sophore)*, Kajoli (*Ailia coila*), Chanda *(Chanda spp)*, Gutum *(Lepidocephalus guntea)*, Rita (*Rita rita*), NundaBele *(Glossogobius giuris)*, Batashi (*Pseudontropius atheronoids*), Khorsula *(Rhinomugil corsula)*, Prawn (*Panuos spp.*) and Crab (*Scylla spp.*) etc. fish species.

Before establishing the sanctuary the fish production gradually decrease and went down to 1500-1800 Kg. Jute retting in this area is strongly responsible for the decreasing of base line production. Arbitrary fishing at that area and no authority organization or Government implication of rules is also responsible. However, after establishing the sanctuary under DoF, different strategies were taken to increase the production of available and endangered fish species and further reappearing the extinct species. So, the production was increased and in 2007-2008 the highest production obtained which is 5152 kg.

Table 10. Biodiversity of the Pagladah and Nurpur Sanctuary in Bhairab River

Description	Pagladah Sanctuary	Nurpur Sanctuary
Species composition	Abundance of large sized fishes such as Rui, Katol, Grass carp, Air, Boal etc. is more (30%)	Abundance of large sized fishes such as Rui, Katol, Grass carp, Air, Boal etc. is more (20%)
Fishing pattern	Fishing is done by different methods and gear such as- Push Net, Seine Net, Lift Net, Hook & lines, Traps, Boat – Kata, Hand fishing,	Fishing is done by different methods and gear such as- Cast Net, Push Net, Lift Net, Hook & lines, Traps, Hand fishing,
Access status to resource	Access to fishing in the Jalmohal is limited to the community members. Non-members are deprived.	Access to fishing in the Jalmohal is limited to the community members. Non-members are deprived.
Community organization	There is a community organization for management of fisheries resource including sanctuary	There is also a community organization for management of fisheries
Conflict	There is no conflict in the organization nor in the community	There is also no conflict between the fishers and influential people of the locality.
Benefit distribution	Benefit is distributed to the fishermen	Benefit is distributed to the fishermen
Fishers income	Fishers' catch and income have increased	Fishers' catch and income have also increased
Pollution factors	No pollution factors present	Jute retting cases sever problem

Socio-economic condition

Some of the fishermen in this area have land for cultivation, so others completely have to be depending on the sanctuary to maintain their family. Due to poverty, they have to engage their women and children in fish catching, harvesting and marketing. Before the sanctuary they earned about 40-75 Tk. per day, but after the sanctuary 125-210 Tk. Now they wish to send their children to the school.

Occupation of the fishermen

Due to poverty and absence of land most of the fishermen are professional fishermen that is 72%, most of which are depend only on fishing but some of the fishermen have alternative livelihood That is agricultural related. The overall status of the occupation of the fishermen is given in table 11.

Table 11. Occupation of Fishermen

Occupation			Total
Professional Fisherman	Occasonal Fisherman	Subsistance Fisherman	
72%	18%	10%	100.00%

Woman participation

Women are unwilling to involve in fishing in this area. But sometimes they participate only to help their husband. Besides this only 10% woman was under the committee member.

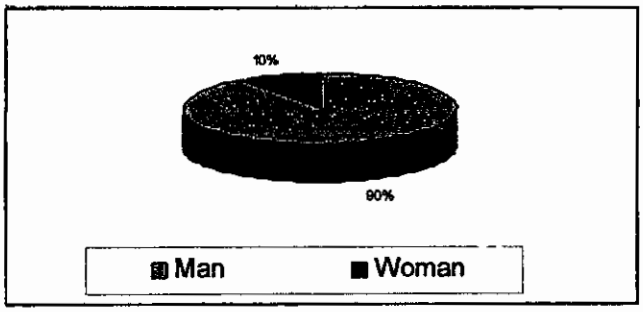


Figure 3: Participation of women

Education status

This survey described that most of the fishermen were illiterate or got sign only, 10% of them were completed primary education but forgotten all, 4% of them were in up to secondary level and rest 2% were in up to HSC, which were shown in table 12.

Table 12. Educational Background of Fishermen

Education				Total
Sign only	Up to Primary	Up to secondary	Up to HSC	
84%	10%	4%	2%	100%

4.1.2 Teka- Mukteshari River, Monirampur Thana

For establishing a sanctuary, site has been selected in the deeper part of the Mukteshari River near Nehalpur with easy access so that it retains sufficient water in dry season. The sanctuary site is 200 meter long across the river. However, fishing is prohibited up to 200 meter from the sanctuary boundary at both ends. Bamboo poles and branches of tree have been placed along one side of the river section for shelter of fish and for safe guard against poaching/ unauthorized fishing. The other side of the river section is free for navigation. During rainy season when water level and current velocity become very high the bamboos and branches have been taken out from the river and kept on river bank. Sufficient awareness has been made among the local people/fishers about the need and importance of fish sanctuary so that no unauthorized/illegal fishing is done. Both in Bangla and in English signboards have been fixed on both sites of the river section. Sanctuary area has been demarcated with red flags at four corners of the sanctuary and in between. Another two sanctuaries are established in Beel Kadaria near about Pachakori

village and Lokhai Danga Bridge near about Sashan ghat. The total area is 640 ha but in dry season, it becomes an area of 403 ha.

Changes in Biodiversity

Due to bio-diversity degradation and careless fishing of the fisherman different types of native valuable species were disappearing gradually from this area. The water became polluted because of jute retting in the river. But after sanctuary baim, rani, kajoli, parsia, gutum, maya, foli, pabda, shol, and taki are rising amusingly which were severly endangered before. Different types of aquatic weeds such as different types of water hyacinth, grass, kata shela, pata shela, kolmi, water lily, helencha and maloncha were grown in this area which was almost extinct or rarely found. The other interesting organisms as turtle, crabs, snail and mussel etc. were found for establishing the sanctuary. Breeding ground of this river is developed after establishing the sanctuary but this river is still in vulnerable condition for the recruitment of endangered species and sustainable condition of biodiversity.

Table 13. Production of Beel Kadaria, Mukteshari River and Lokhaidanga Bridge sanctuaries

Species name	Production (Kg)			
	2004-2005	2005-2006	2006-2007	2007-2008
Air *(Sperata aor)*	251	275	112	187
Shol *(Channa striata)*	6245	8471	7956	9834
Taki *(Channa punctata)*	7105	7084	10952	10547
Tengra *(Mystus vittatus)*	4125	4510	5635	8423
Royna (*Nandus nandus*)	702	712	1005	1357
Koi *(Anabas testudineus)*	684	714	1002	1289
Shing *(Heteropneustes fossilis)*	1520	1641	2523	2403
Small Chingri *(Palemon spp.)*	5861	6210	7252	9154
Baila *(Glossogobius giuris)*	1315	1208	1550	2012
Baim *(Mastacembelus spp)*	6521	256	8323	10305
Pangus *(Pangasius pangasius)*	203	9103	123	198
Chital *(Chital chitala)*	81	79	52	61
Deshi sarputi *(Puntius sarana)*	95	102	75	93
Others	1398	1401	1512	1621
Total	**36106**	**41766**	**48072**	**57484**

In the table 13 other species point includes Gozar *(Channa marulius)*, Gutum *(Lepidocephalus guntea)*, Foli *(Notopterus notopterus)*, Pabda *(Ompok pabda)*, Kucia (*Monopterus cuchia*), Bata *(Labeo ariza)*, Vetki *(Lates calcarifer)*, Parshia *(Mugil cephalus)*, Rui *(Labeo rohita)* , Katla *(Catla catla)*, Kalbasu (*Labeo calbasu*), Mrigel *(Cirrhinus cirrhosus)*, Chela *(Salmostoma bacaila)*, Mola *(Amblypharyngodon mola)*, Rani *(Batia dario)*, Kakila *(Xenentodon cancila)* etc. fish species.

Table 14. Species that have appeared or disappeared after the three sanctuary

Category type	Appear or increase substantly	Disappear (decrease substantly)
Fish	Kuchia, Royna, Kajoli, Air, Chital and Sarputi	Pungus, Bata, Vetki and Parshia
Other species	Snail, Mussel and Crab	Turtle and Guisap
Aquatic weeds	Algae, Pata shela, Water lily, Helencha, Maloncha	-

Table 15. Biodiversity of the Teka-Mukteshairy, Beal Kaderia and Lokhya danga bridge sanctuary in Monirampur thana

Description	Teka-Mukteshairy	Beal Kaderia	Lokhya danga bridge
Species composition	Abundance of large sized fishes such as Air, Boal etc. is more (37%)	Abundance of large sized fish is less (5%)	Abundance of large sized fishes such as Air, Boal etc. is average (28%)
Fishing pattern	Fishing is done by different methods and gear such as- Push Net, Cast Net, Moi Jal (Drag Net) Seine Net, Lift Net, Hook & lines, Traps, Boat – Kata, Hand fishing,	Fishing is done by different methods and gear such as- Cast Net, Push Net, Lift Net, Hook & lines, Traps, Hand fishing,	Fishing is done by different methods and gear such as- Push Net, Cast Net, Seine Net, Lift Net, Hook & lines, Traps,
Access status to resource	Access to fishing in the Jalmohal is limited to the community members. Non-members are deprived.	Access to fishing is nearly open for all. Influence of powerful people affects the interest of the poor fishers.	Access to fishing is nearly open for all.
Community organization	A community organization for management of fisheries resource including sanctuary	No community organization for management of fisheries	A community organization for management of fisheries resource including sanctuary
Conflict	No conflict in the organization nor in the community	Some conflict between the fishers and influential people of the locality.	Some conflict between the fishers and influential people of the locality
Benefit distribution	Benefit is distributed to limited people	Benefit goes to wider scale	Benefit goes to wider scale
Fishers income	Fishers' catch and income have increased	Fishers' catch and income have declined	Fishers' catch and income have not properly increased
Pollution factor	Jute retting	Jute retting	Absence

Fish production was strongly influenced in this area after establishing the sanctuary. Total fish productions were given in table 13 with the help in baseline survey. Before establishing the sanctuary, the base line production was about 12000 Kg. Jute retting in the Teka nodi and Kedaria beel is strongly responsible for the decreasing of base line production. Sluice operation was not enough to maintain the water quality. Random

fishing and no authority organization or Government implication of rules is also responsible. However, after establishing the sanctuary under DoF and CBFM different strategies were taken to increase the production of available and endangered fish species and further reappearing of extinct species. So, the production was increased and in 2007-2008 the highest production obtained which is 57484 kg.

Table 16. Catch per unit area (kg/ha) in three sanctuaries in Monirampur thana

Name of sanctuary	Base Year	Impact Year-1	Impact Year-2	Impact Year-3	Impact Year-4	Overall average	Change (%)*
Teka-Mukteshairy	31.1	105.1	190.3	287.3	161.8	211	123
Beal Kaderia	27.8	94.8	104.8	140.1	315.2	171	296
Lokhya danga bridge	35.2	149.0	273.4	295.6	-	246	164

* Average of four impact years as a percentage of the baseline year.

In the Conservation Teka area in Mukteshari River during dry season (November to February) Chingree, Puti were more. Among non-fish organisms mussel, snail and algae were also present. Baila fish were more outside the sanctuary but near to it. Again, in far distance number of species was less compared to nearer area. This was scenario in end of dry season. But in early dry season numbers of fish species in Teka and nearby were nearly same. Compared to this site number of species were less than half in control site. Similarly numbers of small snails were more at nearby and very less in far distance. In the conservation site major species were reported as chingree, puti, chanda, tengra, gulsha, gochi baim, gutum, kakila, boal, rui, mrigel, kalbasu, catla, chital, chela, kholisa, shol, taki, and some exotic species. However, existence of these fishes were observed and reported by the people, as experimental netting was not done within the conservation. Practically, as there was no fishing, the number of species and population were more near to the site as fishing tendency near to conservation site is usually high.

In Pre-monsoon, similar trend was observed that more species near conservation compared to far distance and in control site, it was very less. Major difference between dry and pre-monsoon is that in pre-monsoon, younger staged fish was there and number of adult fish was more also. In wet season, difference between near sanctuary and far distance was less. Thus, difference was not that much in control site also. Similar trend showed in post monsoon but density of fish (and number of species) was more in this period. In control site fish is abundant both in population and in species were high compared to other season in this site though over all it was less than sanctuary site's river.

Women participation

Women can play an important role for the increment of the production. This area is an important example for the participation of women. But in most cases it was seen that they involved in the sanctuary for the poverty. In this survey, it was clearly seen that women were directly involved in sanctuary like fishing, removing aquatic weeds or guarding. 29 women within 567 farmers were involved in this sanctuary.

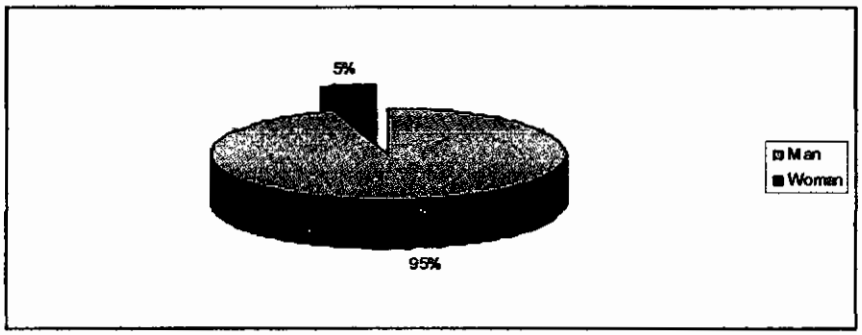


Figure 4: Participation of woman

Education status

This survey described that about 75% of the fisherman who were able to sign only, 16% of them were completed their education up to primary level and rest 7% were continued up to secondary. Only 2% were found whose educational qualification was up to HSC, which were shown in table 16.

Table 17. Educational background of fisherman in Monorampur Thana

Education				Total
Sign only	Up to Primary	Up to Secondary	Up to HSC	
75%	16%	7%	2%	100%

Occupation of the fishermen

The professional fisherman around the sanctuary area is 60%, most of them are depend only fishing rest of the fishermen have alternative livelihood. The overall status of the occupations of the fishermen is given in the table 18.

Table 18. Occupation of Fishermen Monorampur Thana

Occupation			Total
Professional Fisherman	Occasonal Fisherman	Subsistance Fisherman	
60%	23%	17%	100.00%

4.1.3 Dhoakhola fish sanctuary, Baghar para

In 2003, a sanctuary was established in the Chitra River near Dhoakhola village of Baghar para in Jessore district. It is a community based fish sanctuary. People of about three villages were directly involved in this sanctuary. Total area of the water body is near about 55.04 ha and the sanctuary area is near about 4.04 ha. By the proper management of the sanctuary fish production and biodiversity of Chitra River has increased. The amounts of total catch of fish were increased after the establishment of the sanctuary. In this sanctuary about 261 fishermen were directly involved of them 210 were Hindus and rest 51 were Muslims. This sanctuary closed in 2007 but is still running by the supervision of community people. Porous bamboos were used for establishing the sanctuary that may serve as safe guard of fish from predator. The average depth of the river is near about 4.0 m in rainy season and 1.0 m in dry season. About 120 boats were engaged in this area and mainly following nets were used for fishing seine net, lift net, doar, puti jal, coach, cast net etc. are used for fishing. Fishing gears such as current jal, fash jal, moshari jal etc. are prohibited in this sanctuary.

Changes in Biodiversity

Environmental condition of the sanctuary was average that should be increase to regain the endangered and extinct species. Breeding ground of the sanctuary was not properly developed enough to breed in natural condition. Along with fish catch species diversity also increased which is related with age of sanctuary in the habitat. Comparatively less pollution factors is found here. Only jute retting create severe problem. Training was provided by Fourth Fisheries Extension officer. Credit program was run through by various NGO.

Species which are available in the sanctuary are rui, katol, baim, tengra, shol, taki, puti etc. after the establishment of sanctuary, few species are regained such as boal, chapila, thai sarputi, poa, kalbasu, gonnia, gachua, kholisa and koi etc. that were severely endangered in condition. Different types of aquatic weeds were available in this area. Some time prawn, golda, crabs etc. were also found in this sanctuary, but its production is very low.

Table 19. Species that have appeared or disappeared after the sanctuary

Category type	Appear or increase substantly	Disappear or decrease substantly
Fish	Boal, Chapila, Thai-sarputi, Poa, Kalbasu, Gonnia, Ghaura, Darkina and Koi.	Boro Baim (*Mastacembelus panculus*) Gura Ichra (*Nematopalaemon panculus*) Gozar (*Channa marulius*) Jat Puti (*Puntius sophore*) Tengra (*Mystus vittatus*)
Other species	Snail, Mussel	Turtle, carabs and Guisap
Aquatic weeds	Algae, Pata shela, Kolmi, Water lily, Helencha, Maloncha	Topa pana

Table 20. Production of the sanctuary

Species name	Production (Kg)					
	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007	2007-2008
Rui *(Labeo rohita)*	510	529	557	498	771	828
Catla *(Catla catla)*	228	351	316	389	579	682
Mrigel *(Cirrhinus cirrhosus)*	264	211	345	328	501	527
Guchi baim *(Mastacembelus panacalus)*	1249	1147	1072	1329	1572	1490
Tara baim *(Macrognathus aculeatus)*	127	543	510	449	713	691
Boro Baim *(Mastacembelus armatus)*	106	101	92	87	85	71
Gura Ichra *(Nematopalaemon tenuipes)*	1247	1027	847	379	429	394
Small Shrimp *(Penaeus monodon)*	551	989	1159	1021	1628	1847
Lomba Chanda *(Chanda spp)*	261	657	901	1203	1189	1074
Shol *(Channa striata)*	641	989	1203	1653	1898	1954
Gozar *(Channa marulius)*	351	310	294	210	194	108
Taki *(Channa punctata)*	1319	2547	3265	2849	3552	3497
Shing *(Heteropneustes fossilis)*	219	434	451	421	456	579
Magur *(Clarias batrachus)*	152	189	294	268	325	369
Baila *(Glossogobius giuris)*	523	949	836	1295	1327	1274
Chapila *(Gudusia chapra)*	12	19	15	13	13	15
Bojuri Tengra *(Mystus tengra)*	869	1571	1612	1567	1898	2274
Tengra *(Mystus vittatus)*	2174	2018	1843	1320	1493	1124
Deshi sar puti *(Puntius sarana)*	139	389	462	751	705	692
Tit puti *(Puntius ticto)*	614	1924	1849	2094	2397	2708
Jat Puti *(Puntius sophore)*	2569	2157	2049	1347	1842	1702
Gutum *(Lepidocephalus guntea)*	46	115	138	184	284	316
Kakila *(Xenentodon cancila)*	215	153	423	314	394	402
Chela *(Salmostoma bacaila)*	45	209	271	392	597	615
Foloi *(Notopterus notopterus)*	49	148	118	165	201	325
Others	1011	1919	2202	1753	2346	2554
Total	**15491**	**21595**	**23124**	**22279**	**27389**	**28112**

In the table 20 other species point includes Pabda *(Ompok pabda)*, Bata *(Labeo ariza)*, Parshia *(Mugil spp.)*, Kalbasu (*Labeo calbasu*), *Mola (Amblypharyngodon mola)*, Goinna *(Labeo gonius)*, Grass carp *(Ctenopharyngodon idellus)*, Golda *(Macrobrachium rosenburgii)*, Chingri *(Palemon spp.)*, Chital (*Chital chitala)*, Kholisa *(Colisa fasciatus)*, Poa *(Pama pama)*, Koi *(Anabas testudineus)*, Modhu Pabda *(Ompok pabo)*, Common carp *(Cyprinus carpio)*, Chapila *(Gudusia chapra)*, Dimua *(Macribrachium villosimanus)*, Boal (*Wallago attu*) etc. fish species.

Before establishing the sanctuary the base line production was about 9000-9500 Kg. Jute retting, random fishing and absence of authority organization or implication of rules by Government is also responsible. However, after establishing the sanctuary under DoF and CBFM different strategies were taken to increase the production of available and endangered fish species and further reappearing of extinct species. To increase production fry of different fishes was released in the open water and fishing was totally forbidden for 2-2.5 months. So, the production was increased and in 2007-2008 the highest production obtained which is 28112 kg but in 2005-2006 production were demolished due to heavy rainfall.

Education status

Although literacy and education help for developing conceptual skill and facilitate the acquisition of technical skill, which may have direct bearing on fish production and income generation, expenditure and saving activities, in this survey area no one was found above higher secondary level of education.

Table 21. Educational Background of Fishermen

Education				Total
Sign only	Up to Primary	Up to secondary	Up to HSC	
78%	15%	5%	2%	100%

Women participation

Participation of women at this area is played an important example for the increment of the production. In most cases, it was seen that they involved in the sanctuary by fishing not in organizing or managing water body. Total number of women participate were near about 29% of the total fishermen.

Table 22. Women participation

Man	Woman	Total
71%	29%	100%

Occupation of fishermen

Fishing is considered as a low-class profession and fishermen are traditionally poor. They lived from hand to mouth. These fishermen are socially, economically and educationally disadvantaged communities and lack their own financial resources. The professional fisherman in this is about 70%. The overall status of the occupations of the fishermen is given in the below figure:

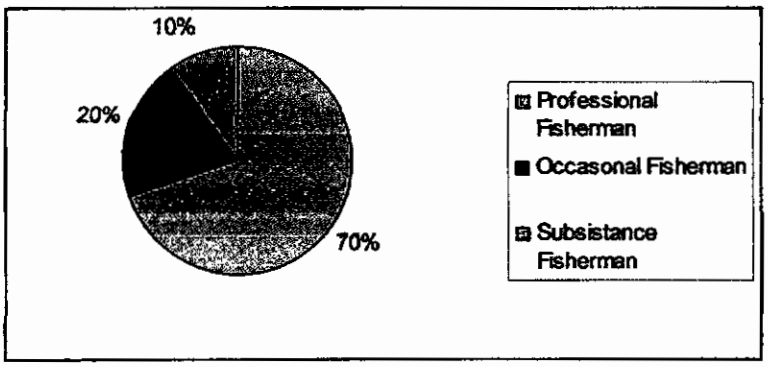


Figure 5: Occupation of fishermen

4.1.4 Kabtak River, Jhikorgasa

Kabtak River is one of the important rivers in Jessore district. This river was abundant in fisheries resources. The total biodiversity was rich but day after day, the excessive fish harvesting and jute retting destroy the fisheries resources and biodiversity. In this river, sanctuary was established in different perennial Chanels or in perennial and seasonal kol's. Two sanctuaries in this river are Mistridayra and Panchnagar shasan ghat.

4.1.4.1 Mistridayra sanctuary

This sanctuary is situated at the lower stream part of the Kabtak River at Jikorgasha Thana in Jessore district. It was established in 2003 under the super vision of 4th fisheries project and with the help of a NGO (Padokkep Manob Unnaon Sangsta) and closed in 2007. The local jalmahal community now managed it. The area of the sanctuary is 0.72 ha. The average depth of the sanctuary is 8-10 feet. Sanctuary was made porous bamboo for the safeguard of the fish from predator. After made the sanctuary fish under threat of predator can take shelter into the sanctuary made of porous bamboo poles when attacked. The number of beneficiaries is 17 from which two are Hindus.

The fishing occurs round the year in this sanctuary. Still there is seasonality of fishing. There are two main seasons of fishing. One is termed as peak season when the majority fishing occurs. The major catches (more than 65% of the total catch) come in this season. The peak season for this sanctuary is from mid September to mid November. The other season is the lean season when the least fishing occurs. Generally professional fishers do not fishing during this period. The lean season for the site is from mid February to mid April.

Changes in Biodiversity

Different types of fishes are available in this river, but day after day, they were threatened due to the environmental degradation. But after establishing sanctuary different types of

species were regained such as shing, royna, pabda, kholisha, desi tengra, batashi, kakila, airetc. The gears that were used to catch fish are *tana jal, khabla jal, pati jal, Dhela (Rohtee cotio), hip, nathra* and the prohibited gears are current jal and *fash jal* (mesh size below 4.5 inch). Different types of aquatic weeds were grown after the sanctuary. The 70 % of the area is covered with *Katuri pana.* The helps the authoriy from unintentional fishing. Pollution factors are dumping of poultry waste. The biodiversity is degraded du to siltation at the downstream of *Kabtak River.*

In dry season as water availability and flow is limited so catcheable amount of fish is lower than rainy season. Fishes are harvested continually all the year round around the sanctuary. But in some cases it was seen that fisher used to catch fish from the sanctuary and katha.

Table 23. Species that have appeared or disappeared after the sanctuary

Category type	Appear or increase substantly	Disappear or decrease substantly
Fish	Tara Baim, Sal Baim, Air, Kakila, Chapila, Kholisa and Koi.	Ilish
Other species	Snail, Mussel, Crab	Turtle
Aquatic weeds	Algae, Pata shela, Kolmi.	-

Table 24. Change of production in the sanctuary

Species name	Production (Kg)			
	2004-2005	2005-2006	2006-2007	2007-2008
Mrigel *(Cirrhinus cirrhosus)*	175	291	393	462
Rui *(Labeo rohita)*	406	372	477	470
Catla *(Catla catla)*	250	270	350	332
Grass carp *(Ctenopharyngodon idellus)*	451	408	514	558
Bata *(Labeo ariza)*	19	27	49	41
Maya *(Amblypharyngodon mola)*	294	305	323	375
Puti *(Puntius ticto)*	351	502	709	784
Taki *(Channa punctata)*	326	395	521	652
Shol *(Channa striata)*	281	351	427	483
Chingri *(Palemon spp.)*	162	248	421	491
Foloi *(Notopterus notopterus)*	62	56	107	184
Royna (*Nandus nandus*)	184	171	195	232
Air *(Sperata aor)*	19	21	26	27
Gozal *(Channa marulius)*	321	395	385	469
Tengra *(Mystus vittatus)*	402	451	512	615
Kakila *(Xenentodon cancila)*	32	104	102	123
Pabda *(Ompok pabda)*	27	49	62	66
Kholisa *(Colisa fasciatus)*	302	512	618	647
Gutum *(Lepidocephalus guntea)*	67	65	83	85
Tara baim *(Macrognathus aculeatus)*	47	52	64	83
Guchi baim *(Mastacembelus panacalus)*	62	85	104	185
Chela *(Salmostoma bacaila)*	129	124	163	213
Koi *(Anabas testudineus)*	54	89	109	142
Magur *(Clarias batrachus)*	40	43	95	72
Shing *(Heteropneustes fossilis)*	53	84	63	91
Others	113	150	140	179
Total	**4538**	**5610**	**7032**	**8095**

In the table 24 other species point includes *Bata (Labeo ariza)*, Parshia *(Liza parsia)*, Kalbasu (*Labeo calbasu*), Mola *(Amblypharyngodon mola)*, Goinna *(Labeo gonius)*, Golda *(Macrobrachium rosenburgii)*, Darkina *(Esomus danricus)*, Chital *(Chital chitala)*, Kholisa *(Colisa fasciatus)* etc. fish species.

Gradually production was increased and gives a good result but it cannot meet the expected outcome. To increase production the authority released fry of rui, katol, mrigal and grass carp. The Unintentional catch of fish by the beneficiaries and the local fishermen and occasional fishermen reduce the rate of heavy production. Before establishing the sanctuary the base line production was decrease severely and it is about 3000-3200 Kg. But after the sanctuary the highest production obtained in 2007-2008 season. The highest production at this sanctuary is 8078 Kg.

Socio-economic condition

This study also revealed that maximum fishermen caught fish individually, and more than 97% fishermen were members of different associations. Some of the fishermen in this area have land for cultivation, so others completely have to be depending on the sanctuary to maintain their family. Due to poverty, they have to engage their children in fish catching, harvesting and marketing. Before the sanctuary they earned about 50-60 Tk. per day, but after the sanctuary 135-190 Tk. Now they wish to send their children to the school.

Occupation of the fishermen

Fishermen and their families in this area are considered to be among the poorest of the poor. A vast majority of 90% fisherman of this area is engaged in full time fishing. The overall status of the occupation of the fishermen is given in table 25.

Table 25. Occupation of Fishermen

Occupation			Total
Professional Fisherman	**Occasonal Fisherman**	**Subsistance Fisherman**	
72%	18%	10%	100.00%

Educational condition of the fishermen

Table-23 show different educational level of fishermen community. No one was found above secondary level of education. In Bangladesh most of the fishermen were illiterate and few had primary education. A few respondents stated that they did not appreciate the importance of educating their children due to poverty.

Table 26. Educational Background of Fishermen

Education				Total
Sign only	Up to Primary	Up to secondary	Up to HSC	
70%	22%	6%	2%	100.00%

Women participation

Women may play additional force in fishing. But there is no participation of woman in that area.

Table 27. Women participation

Man	Woman	Total
100%	0.0%	100%

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4.1.4.2 Panchnagar Sasanghat

This sanctuary is situated on the upper stream part of the Kabtak River at Jikorgasha upazila in Jessore district. This sanctuary was established in 2006-07 under the supervision of 4th fisheries project and with the help a of NGO (Paddokkep) and their activities in this sanctuary is going on. It is managed by the local Jalmahal community. The area of the sanctuary is 0.83 ha. The average depth of the sanctuary is 8-10 feet. Sanctuary was made by porous bamboos for the safeguard of the fish from predator. Red flags is also used to indicate the prohibited area. Thus the fisherman keeps themselves absence to fishing into the sanctuary. The numbers of beneficiaries are 28 from which 8 are Hindus. There is no way of women participation in this sanctuary. No training is provided to the fishermen either from the GO and NGO.

Changes in Biodiversity

Different types of fishes are available in this river which is puti, royna, shing, pabda, tengra, kholisa, koi, chela etc. but, day after day they were threatened due to the environmental degradation. However, after establishing sanctuary different types of species were regained such as shing, royna, pabda, kholisha, desi tengra. The gears that were used to catch fish are tana jal, khabla jal , pati jal Dhela *(Rohtee cotio)*, hip, nathra and the prohibited gears are current jal and fash jal (mesh size below 4.5 inch). The biodiversity degrade due to Jute retting around the sanctuary and is also the dumping of poultry waste. The biodiversity is also degraded due to siltation at the downstream of the Kabtakk River at Kesobpur upazilla in Jessore. Sometimes heavy rainfall decrease the

follow of water in the sanctuary area which makes overflow of water nearby village and make the possibility to decomposed of water hyacinth.

Table 28. Species that have appeared or disappeared after the sanctuary

Category type	Appear or increase substantly	Disappear or decrease substantly
Fish	Sal Baim, Air, Kakila, Chapila, Kholisa and Koi.	Ilish, Gutum
Other species	Snail, Mussel, Crab, Snake	Turtle
Aquatic weeds	Algae, Pata shela, Kolmi, Topa shela, Large water hyacinth.	-

Table 29. Production of the sanctuary

Species name	Production (Kg)	
	2006-2007	2007-2008
Mrigel *(Cirrhinus cirrhosus)*	421	662
Rui *(Labeo rohita)*	847	1224
Catla *(Catla catla)*	350	432
Common carp *(Cyprinus carpio)*	197	183
Grass carp *(Ctenopharyngodon idellus)*	814	958
Maya *(Amblypharyngodon mola)*	423	631
Punti *(Puntius ticto)*	980	1247
Taki *(Channa punctata)*	742	1069
Shol *(Channa striata)*	627	983
Chingri *(Palemon spp.)*	421	490
Foloi *(Notopterus notopterus)*	152	294
Bata *(Labeo ariza)*	23	51
Royna (*Nandus nandus*)	231	292
Golda *(Macrobrachium rosenburgii)*	13	23
Air *(Sperata aor)*	36	74
Gozar (*Channa marulius*))	685	769
Tengra *(Mystus vittatus)*	512	600
Kakila *(Xenentodon cancila)*	129	223
Pabda *(Ompok pabda)*	72	63
Kholisa *(Colisa fasciatus)*	713	907
Gutum *(Lepidocephalus guntea)*	103	95
Tara baim *(Macrognathus aculeatus)*	84	137
Sal baim (*Mastacembelus spp*)	43	70
Guchi *baim (Mastacembelus panacalus)*	294	418
Chela *(Salmostoma bacaila)*	263	425
Koi *(Anabas testudineus)*	109	158
Magur *(Clarias batrachus)*	97	185
Shing *(Heteropneustes fossilis)*	183	391
Others	124	181
Total	9688	13235

In the table 29 other species point includes Bata *(Labeo ariza)*, Rani *(Batia dario)*, Khorsula *(Rhinomugil corsula)*, Parshe *(Liza parsia)*, Kalbasu (*Labeo calbasu*), Mola *(Amblypharyngodon mola)*, Goinna *(Labeo gonius)*, Golda *(Macrobrachium rosenburgii)*, Chingri *(Palemon spp.)*, Darkina *(Esomus danricus)*, Chital *(Chital chitala)*, Foli *(Notopterus notopterus)*, Kholisa *(Colisa fasciatus)* etc. fish species and also the mud crab (*Scylla serrata*).

In dry season as water availability and flow is limited so catchable amount of fish is lower than rainy season. Fishes are harvested continually all the year round around the sanctuary. This sanctuary is established recently but the production is amusing within one year. The main region of the high production is that the local fishermen, nearby the sanctuary are very much concern about the law and they take great care of the sanctuary. Before the sanctuary the production decrease severely and the base line production went down at 4500-5000 Kg. But after sanctuary in 2007-2008 the highest production found that was 13235 Kg.

Conflicts

The overall environment around the sanctuary is not satisfactory. Huge water hyacinth in both bank of Kabtak River near the sanctuary is decomposed and declines the broadness of this river. This problem again reduced the water flow, which also affects the breeding of different types of indigenous species. Sever jute retting pollutes the water dangerously.

Socio-economic condition of the fisherman

Most of the fishermen at this area are very poor and has no land for cultivation, so they completely have to depend on the sanctuary to maintain their family. Before the sanctuary each farmer earned 35-50 Tk/day but after the sanctuary 115-230 Tk.

Educational configuration

Table-30 show different educational level of fishermen community. Only 1.30% was found above secondary level of education. In this area most of the fishermen were illiterate and few had primary level education.

Table 30: Educational Background of Fishermen

Education				Total
Sign only	Up to Primary	Up to secondary	Up to HSC	
52.30%	42.20%	4.20%	1.30%	100.00%

Occupation of the fishermen

The professional fishermen around the sanctuary area is 53%, most of them are depend only fishing rest of the fishermen have alternative livelihood. The overall status of the occupation of the fishermen is given in table 31.

Table 31. Occupation of Fishermen

Occupation			Total
Professional Fisherman	Occasonal Fisherman	Subsistance Fisherman	
53%	36%	11%	100.00%

Women participation

In this study, no participation of woman is found in that area. However, seasonal participation is found in some cases as when it needed to remove aquatic weeds for making the fishing easier. But these women are completely the wives of the related fishermen.

4.1.5 Morshina Baor, Kesobpur

The Morshina Baor is an important fishery area at Kesobpur Thana in the district of Jessore. About the people of four villages are fully or partially dependent on it. The number of beneficiaries is 55 and there is no women participation. Both Hindus and Muslims are involved in this sanctuary. Fishing was continuing all the year round. About 70% fishermen contain of their own boat and gear and the prohibited gear is current jal and small gill net. The area of the baor is closed and the flow of water is maintained by the sluice gate. Sluice gate was operated due to

- Maintain water levels and volumes in the khal and in the beel,
- Migration of fish from river to beel and from beel to river,
- Affecting the catchability of fish within the khal and
- The volume of water available or replenished against pumping from the khal.

The total area of the baor is 21 ha of which the sanctuary occupied 1.5 ha. It was established in January of 2004. In a piece of whole bamboo pores/holes are made and placed at the bottom inside water leafs and branches of trees, kolmi, water hyacinth, red flag are usually used for making the sanctuary. The average depth of the baor is 3-4 feet in dry season whereas 3.5-6 feet in the rainy season. The sanctuary was established under the super vision of 4th fisheries project and with the help of a NGO (Padokkep Manob Unnaon Sangsta). It was managed by the local community. In this area training was provided to fishermen by Padokkep Manob Unnaon Sangsta.

Fishing activity is most intense during the post monsoon when water is draining out of the beel through the sluice. The effectiveness of the khal as a fish sanctuary is questionable giving the reported intensity of fishing along its course. However, it is believed that it would be impossible to restrict fishing activity during the post monsoon, since this is the main fishing period and this is one of the prime fishing locations. In effect, the sanctuary acts as simply a closed season for the latter half of the dry season and rising water period. Little fishing activity occurs during rising water period because fish density is low and at this time there is a high demand for agricultural labour.

Changes in Biodiversity

After establishing the sanctuary biodiversity is developed. Extinct species such as rani, kajoli, piali, pabda, maya and batashi were again seen in the sanctuary. The production of various endangered species such as small chingri, koi, shing, cuchia and shol was increased. The production gutum, air, taki was decreased. After the sanctuary Gutum is totally extinct. Pollution factors are available in the southern side of the sanctuary due to logging of the area. According to farmer, if the sluice gate is opened all the year round then it is possible to increase the agricultural production. Jute retting is a great problem besides the sanctuary.

Table 32. Species that have appeared or disappeared after the sanctuary

Category type	Appear or increase substantly	Disappear or decrease substantly
Fish	Rani, Kajoli, Piali, Pabda, Maya and Batashi	Gutum, Air, Taki
Other species	Snail, Mussel, Crab, Snake	Turtle
Aquatic weeds	Algae, Kolmi, Topa shela, Large water hyacinth.	-

Table 33. Change of production in the sanctuary

Fish species	Production(Kg)			
	2004-2005	2005-2006	2006-2007	2007-2008
Rui *(Labeo rohita)*	1235	1825	3120	3005
Katla *(Catla catla)*	957	514	714	857
Mrigel *(Cirrhinus cirrhosus)*	874	1523	2314	2472
Bighead carp (*Aristichthys nobilis*)	543	1475	2147	1904
Silvercarp*(Hypophthalmicthes molitrics)*	387	781	958	1284
Japani puti (*Puntius gonionotus*)	275	612	573	946
Tengra *(Mystus vittatus)*	42	76	145	112
Shol *(Channa striatus)*	18	79	124	85
Gogar *(Channa marulius)*	17	43	75	72
Shrimp *(Penaeus monodon)*	12	91	140	150
Rani *(Batia dario)*	17	24	31	47
Small Chingri *(Palemon spp.)*	23	36	45	71
Foloi *(Notopterus notopterus)*	13	23	21	45
Chital *(Chital chitala)*	14	29	46	37
Others	41	132	145	125
Total	4468	7263	10598	11212

In the table 33 the point other species includes Bata *(Labeo ariza)*, Mola *(Amblypharyngodon mola)*, Batashi *(Pseudeutropius atherinoides)*, Baim (*Mastacembelus spp.*), Koi *(Anabas testudineus)*, Shing *(Heteropneustes fossilis)*, Magur *(Clarias batrachus)*, Deshi sar puti *(Puntius sarana)*, Taki *(Channa punctata)*, Chela *(Salmostoma bacaila)* and Maya *(Amblypharyngodon mola)*.

It was found that normal production trend was increasing after the establishment of the sanctuary, but it was decreasing before the establishment of sanctuary. Before establishing the sanctuary the base production about 2800-3000 Kg and after the

sanctuary the highest production was found in 2007-2008 season and that was 11212 Kg. Fish production is maximum in winter and the highest catchable species are Rui, Catla, Mrigal and Silver carp. Minimum production obtained in the rainy reason. To increase production fry of Rui, Catla, Mrigal and Silver carp and Rani Species were released in the open water of the sanctuary and fishing was prohibited for 2-3 months.

Socio-economic status of the fishermen

There is an important consideration that increasing population pressures may aggravate the problem of major incomes of fishermen. The average income of the fishermen increased after the sanctuary. They earn average 35-40 Tk/day before the sanctuary and 60-125 Tk/day after the sanctuary.

Education status

In this survey area, only 1 fisherman was found above higher secondary level of education. A few respondents stated that they did not appreciate the importance of educating their children. But now they send their children to school due to increasing their income.

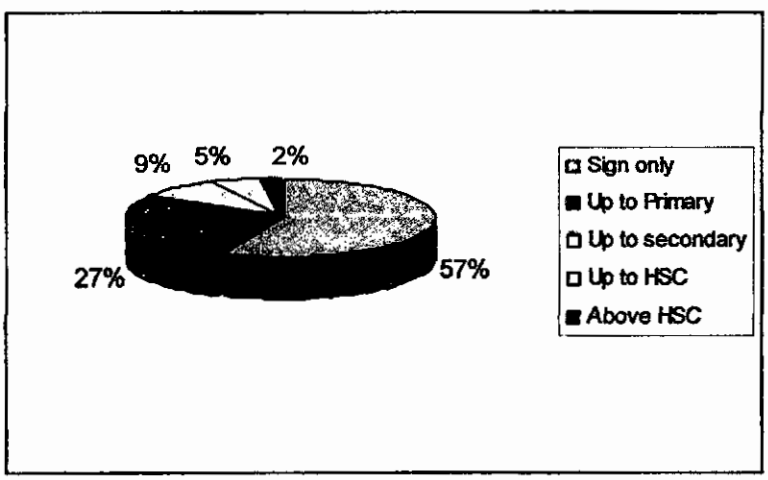

Figure 6: Educational Background of Fishermen

Woman participation

This area is not an example for the participation of women. Due to having alternative livelihood women are engaged in others work and house hold activities.

Occupation of the fishermen

It was found that the full time fishermen in this area were 84%; 24% had subsidiary occupation, 81% were found fishing throughout the year and 92% were member of some

associations, clubs and co-operatives. The overall status of the occupation of the fishermen is given in table

Table 34. Occupation of Fishermen

Occupation			Total
Professional Fisherman	Occasonal Fisherman	Subsistance Fisherman	
84%	10%	6%	100.00%

4.1.6 Beel Khukhsia, Kesobpur

The site Beel Khuksia at Kesobpur Thana in the district of Jessore plays an important role to meet the market demand. Canals and beel are included in this area. About the fishermen of ten villages are fully or partially dependent on it. The numbers of beneficiaries are 1148 of which 386 were women. The total area of the beel is 850 hac of which the sanctuary is established in 10 hac area of deep water. Average depth in dry season is 1.5-3.0feet and in rainy season about 2.5-4 feet. It was established in 2002 and closed in 2002/2003 season. Some particular fishing gear is strictly prohibited in this region which is mosquito net and current jal. The sanctuary was established under the super vision of 4th fisheries project and with the help of a NGO (Padokkep Manob Unnaon Sangsta). It was managed by the local community. Training was provided to fishermen by Padokkep Manob Unnaon Sangsta.

Fish condition is considerable but bad in dry season as water availability and flow is limited. Fishes are harvested continually all the year round around the sanctuary. But in some cases it was seen that fisher used to catch fish from the sanctuary and katha. Du to removal of water logging condition sluice gate was constructed by digging the high road. So, salt water entered into the sanctuary area which greatly deteriorates fresh water. For this reason it was closed within short time in 2003/04 season.

Changes in Biodiversity

The biodiverdity was seriously detoriorate before establishing the sanctuary. It was seen that gradually the production of native and valuable species was decreased due to having no conservation or catching rule. Most of the fishermen are poor and the try to catch fish as more as posible whether the size is large or small. Deshi sarputi and pabda were extinct in this area. baila, baim, shol, taki, deshi puti, tengra, kakila, chanda, chingri and shing

were indigenous species. However, after sanctuary different species were again appear and production of endangered species increased. After sanctuary production of koi, magur, royna, boal, sona, gozar was increased which were previously in endangered condition. Different types of aquatic weeds such as dora shela, pata shela, kolmi, sapla, nalsha shela were available in this area. The other interesting organisms as Turtle, Guishap, and Crabs were found for establishing the sanctuary.

Table 35. Species that have appeared or disappeared after the Beel Khukhsia sanctuary

Category type	Appear or increase substantly	Disappear or decrease substantly
Fish	Royna, Boal	-
Other species	Snail, Mussel	Turtle
Aquatic weeds	Kolmi,Dora shela	-

Table 36. Changes of production in Beel Khukhsia sanctuary

Species name	Production(Kg)	
	2002-2003	2003-2004
Rui *(Labeo rohita)*	65920	66285
Mrigal *(Cirrhinus cirrhosus)*	31535	32764
Puti *(Puntius spp.)*	1978	2544
Catla *(Catla catla)*	24985	25381
Grass carp *(Ctenopharyngodon idellus)*	15089	15933
Tengra *(Mystus vittatus)*	15970	16409
Chela *(Salmostoma bacaila)*	1789	1930
Small Chingree *(Palaemon spp.)*	7905	8344
Baila *(Glossogobius giuris)*	19957	20275
Guchi baim *(Mastacembelus panacalus)*	3190	3527
Mola *(Amblypharyngodon mola)*	2635	2999
Tara baim *(Macrognathus aculeatus)*	1021	2978
Shol *(Channa striata)*	22264	23435
Bata *(Labeo ariza)*	5041	5980
Taki *(Channa punctata)*	15215	16021
Silver carp *(Hypopthalmichthys molitrix)*	26680	26953
Deshiputi*(Puntius ticto)*	7394	7928
Thai sarputi *(Puntius gonionotus)*	2813	3189
Koi *(Anabas testudineus)*	4027	4343
Gozar *(Channa marulius)*	1994	2074
Royna (*Nandus nandus*)	1459	1535
Boal *(Wallago attu)*	2685	2929
Others	7982	8452
Total	**289528**	**302208**

In the table 36 the point other species include *Rani (Batia dario)*, Batashi *(Labeo ariza)*, Shing *(Heteropneustes fossilis)*, Magur *(Clarias batrachus)*, Golda *(Macrobrachium rosenburgii)*, Kajoli (*Ailia coila*), Vetki *(Lates calcarifer)*, Parsia *(Mugil cephalus)*, Pungus *(Pangasius pangasius)*, Crab (*Scylla spp.*), Kakila *(Xenentodon cancila)*, Chanda *(Chanda spp) and* Maya *(Amblypharyngodon mola)*.

In regards to total annual catch the normal production trend was decreasing before the establishment of sanctuary. But it was found increasing after the establishment of the

sanctuary. Decade wise annual catches were collected by PRA (up to 2001) and the annual catches during study period were taken by sampling method (2001- 03). It was found that the average yearly fish production before the sanctuary is 42200 Kg. After establishing sanctuary production increased. In 2002/03 the total production is 289528 Kg and in 2003/2004 the productuction is 302208 Kg.To increase production 8500 Kg fry of different species were released in the open water of this area and fishing was prohibited for 3-4 months. Finally the total production of prohibited area (10 hac) in 2002/03 is 496.5 Kg and in 2003/04 is 8021 Kg

Socio-economic status of the fishermen

Economic condition

Most of the fishermen in this area are poor. All of them have no fishing gears and boats. The average income of the fishermen increased after the sanctuary. They earn average 75-80 Tk/day before the sanctuary and 150-375 Tk/day after the sanctuary.

Education status

In this survey area only 5 fishermen was found above higher secondary level of education. A few respondents stated that they did not appreciate the importance of educating their children. But now they send their children to school due to increasing their income.

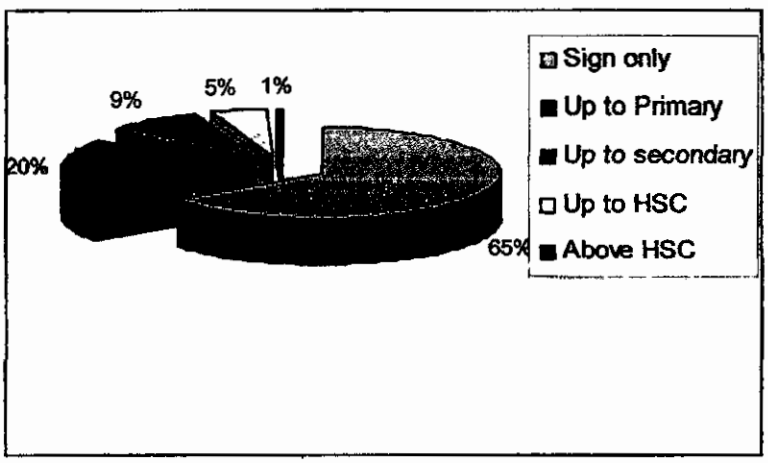

Figure 7: Educational Background of Fishermen

Women participation:

Women can play an important role for the increment of the production. This area is an important example for the participation of women. But in most cases it was seen that they

involved in the sanctuary for the poverty. These women were completely the community member.

Table 37. Participation of woman of Beel Khukhsia sanctuary

Man	Woman	Total
7988	386	1184

Occupation of the fishermen

Most of the fishermen are professional fishermen because if having no alternative livelihood works. The ovarall status of the the occupition of the fishermen is given in table 38.

Table 38. Occupation of Fishermen of Beel Khukhsia sanctuary

Occupation			Total
Professional Fisherman	Occasonal Fisherman	Subsistance Fisherman	
82%	11%	7%	100.00%

4.1.7 Purakahali Baor, Avoynagar

The Baor Purakahali is an important fishery area at Avoinagar Thana in Jessore district. Local fish markets are mainly dependent on it. The numbers of beneficiaries are 74 and among them 70 are Muslims and 4 are Hindus. There is no woman participation in the baor. Fishing was done seasonally. The baor is closed and the flow of water is maintained by the sluice gate. The total area of the baor is 21 hectors of which the sanctuary occupied 0.83 hector. It was established in January, 2003. The average depth of the baor is 4-5 feet in dry season where as 7-8 feet in the rainy season. The sanctuary was established under the super vision of 4th fisheries project and with the help of a NGO (Padokkep IFAD, *BACTE SHEKHA*.). It was managed by a committee which has one chairman and thirteen members. Training was provided to fishermen by Padokkhep.

Changes in Biodiversity

The sanctuary of purakhali baor which is constructed by bamboo, ring slab, branches of khoi babla etc. are functional and complimentary for breeding and rearing of fish fry. The area of the sanctuary which are enclosed by water hyacinth provide shelter for some fishes but sometimes the retting of these weed generate toxic gases which has a great effect on biodiversity.

Fish production is maximum in winter and the highest catch able species are rui, katol and silver carp. Minimum production obtained in the rainy reason. Extinct species were again seen in the baor such as royna after establishing the sanctuary. Cage culture is practices here and a nursery pond is established to rare the fry which are collected from the hatchery.

Pollution factor are available in the baor due to retting of water hyacinth and kata sewla. According to the farmer if the authority take proper step to repair the sanctuary and if stocking of fishes done every year which are less abundant in the baor it can increase the total production.

Table 39. Species that have appeared or disappeared after the sanctuary

Category type	Appear or increase substantly	Disappear or decrease substantly
Fish	Royna, Mola	Chingri
Other species	Mussel, Crab	-
Aquatic weeds	Kolmi, Dora shela, Nalsa shela	-

Table 40. Change of production in the sanctuary

Species name	Production(Kg)			
	2003-2004	2004-2005	2005-2006	2006-2007
Rui *(Labeo rohita)*	2216	2754	3517	4048
Catla *(Catla catla)*	1951	2246	2048	2774
Mrigal *(Cirrhinus cirrhosus)*	742	1027	1264	1842
Kalbasu (*Labeo calbasu*)	754	1245	1542	1472
Silvercarp *(Hypopthalmichthys molitrix)*	1093	1543	1734	2089
Grasscarp *(Ctenopharyngodon idellus)*	687	957	1424	1243
Bata *(Labeo ariza)*	224	345	543	649
Shol *(Channa striata)*	228	486	541	887
Taki *(Channa punctata)*	197	259	457	715
Tengra *(Mystus vittatus)*	368	578	1054	1675
Koi *(Anabas testudineus)*	146	254	487	524
Shing *(Heteropneustes fossilis)*	43	143	349	421
Magur *(Clarias batrachus)*	67	148	348	495
Puti *(Puntius ticto)*	92	178	471	726
Baim *(Macrognathus aculeatus)*	175	245	349	545
Chital *(Chital chitala)*	68	94	175	294
Chela *(Salmostoma bacaila)*	87	241	204	284
Chingri *(Palemon spp.)*	231	213	194	157
Mola *(Amblypharyngodon mola)*	49	84	243	216
Others	394	547	846	1427
Total	**9812**	**13587**	**17790**	**22483**

In the table 40 the point other species include Tapshi (*Polynemus paradiseus*), Rani *(Batia dario)*, Batashi *(Pseudeutropius atherinoides)*, Golda *(Macrobrachium rosenburgii)*, Kajoli (*Ailia coila*), Vetki *(Lates calcarifer)*, Parsia *(Mugil cephalus)*, Crab (*Scylla spp.*), Kakila *(Xenentodon cancila)*, Kachki *(Corica soborna)*, Chanda *(Chanda spp)*, Koi *(Anabas testudineus)* and Maya *(Amblypharyngodon mola)*.

Purakhali baor is a vital example of increament of fish production due to establishing senctuary. After establishing the sanctuary the average production is increased and the livelihood of the fisherman is surprisingly changed. To increase production fry of rui, katol, grass carp, mrigal and silver carp were released in the open water of the sanctuary and fishing was proscribed for 2-3 months. The overall bioderversity and the the environment is developed. Due to biodiversity degradation gradually the production is decreased to 5 Ton before the sanctuary. But after the sanctuary production increased and the utmost production was found in 2006-2007 which was 18674 Kg.

Socio-economic status of the fishermen

Economic condition

Socio economic condition of the fisherman is good. About 70% fishermen contain of their own boat and gear and also have enough opportunities to practices alternative livelihood. The typical income of the fishermen increased after the establishing of the sanctuary. They earn average 50-85 Tk/day before the sanctuary and 105-245 Tk/day after the sanctuary.

Woman participation

This area is an example for the participation of no women. Due to having alternative livelihood women are ingaged in others work.

Table 41. Woman participation

Man	Woman	Total
100%	0%	100%

Education status

Due to poverty majority of the farmer's children are involved in many works that the deprived from education. In this study, only 1% was found above the HSC level of education.

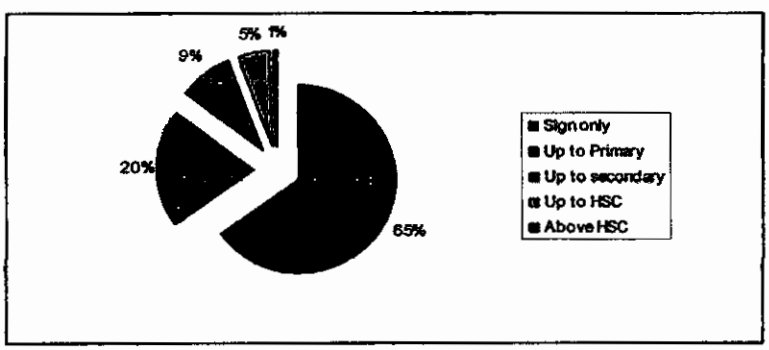

Figure 8: Educational Background of Fishermen

Occupation of the fishermen

Here, 50% professional fishermen were found. All respondents stated that their secondary occupation was agriculture, day labor, small business etc. The ovarall status of the the occupition of the fishermen is given in table 42.

Table 42. Occupation of Fishermen

Occupation			Total
Professional Fisherman	Occasonal Fisherman	Subsistance Fisherman	
50%	32%	18%	100.00%

4.2 KHULNA DISTRICT

4.2.1 Basuakhali river sanctuary, Terokhada

Terokhada upazila is on the northeast part of Khulna district. Basuakhali River is situated in the southwest part of Terokhada upazila occupying the borderline of Rupsha upazila and directly connected with Rupsha River. In 2003 three sanctuaries was established in Different parts of Basuakhali River by the direct supervision of Fisheries Management Committee (FMC) of this locality. Thaana fisheries office (Terokhada) and NGO (BRAC) also helped to manage this sanctuary. It is a community based fish sanctuary. People in about four villages were directly involved in sanctuary. Total area of the water body is near about 115 ha from which the sanctuary area is near about 1.5 ha. By the proper management of the sanctuary fish production and biodiversity has increased. The amount of total catch of fish was increased after the establishment of the sanctuary. In this sanctuary about 132 fishermen were directly involved of them 56% were Hindus and rest 44% were Muslims. This sanctuary is still running by the supervision of community people. Porous bamboos were used for establishing the sanctuary which may serve as safe guard of fish from predator. The average depth is near about 2.0 m in rainy season and 0.75 m in dry season. About 12 boats were engaged in this area and mainly following nets were used for fishing vesal jal, casal jal, behundi jal, jakhi jal, coach, cast net etc. Fishing gears such as current jal, fash jal, moshari jal etc. are totaly prohibited in this sanctuary. Training of fishermen was provided by Fourth Fisheries Extension officer. Credit program was run through by various NGO such as Gramen bank, BRAC etc.

Changes in Biodiversity

Environmental condition of the sanctuary was typical that is suitable to increase or to regain the endangered and extinct species. Breeding ground of the sanctuary was not properly developed enough to breed in natural condition. Along with fish catch species diversity also increased which is related with age of sanctuary in the habitat. Comparatively less pollution factors are found here. Only jute retting create severe problem.

Species which are available in the sanctuary are puti, bain, shol, gozar, taki, shing, magur, tengra, rui, catla, kolisa, kakila etc. After the establishment of sanctuary production of few species such as foli, kalbasu, deshi sarputi, tatkini etc. are increased in this area, chital and pabda are extinct before establishing the sanctuary. But after sanctuaey they were seen sometime in the sanctuary. Different types of aquatic weeds such as water hyacinth, kolmi, santi, shapla, shela were available in this area. Sometime snail, crab, mollusks, snakes and toad are found in this sanctuary.

Table 43. Species that have appeared or disappeared after the sanctuary

Category type	Appear or increase substantly	Disappear or decrease substantly
Fish	Chital, Pabda, Taposhi	Chingri
Other species	Mussel, Snail	-
Aquatic weeds	Dora shela, Nalsa shela	-

Table 44. Change of production in the sanctuary

Species name	Production (Kg)			
	2004-2005	2005-2006	2006-2007	2007-2008
Rui *(Labeo rohita)*	1816	3014	2841	3554
Catla *(Catla catla)*	1394	2153	2178	2479
Mrigal *(Cirrhinus cirrhosus)*	1367	1759	1547	1754
Silver carp *(Hypopthalmichthys molitrix)*	1082	2019	1742	1547
Grass carp *(Ctenopharyngodon idellus)*	943	1347	1467	2354
Kalbasu (*Labeo calbasu*)	792	1024	857	1482
Bata *(Labeo ariza)*	204	379	324	421
Chingri *(Palemon spp.)*	1526	2781	2947	3512
Tengra *(Mystus vittatus)*	2703	4501	4251	5781
Taki *(Channa punctatus)*	206	367	324	311
Shing *(Heteropneustes fossilis)*	29	84	81	87
Chanda *(Chanda spp)*	24	146	157	121
Baila *(Glossogobius giuris)*	184	314	375	310
Gulay (*Anguila spp.*)	47	41	51	49
Baim *(Mastacembelus pancalus)*	158	194	146	123
Parsea *(Mugil cephalus)*	419	648	724	1054
Vetki *(Lates calcarifer)*	421	1048	933	1487
Golda *(Macrobrachium rosenburgii)*	26	64	57	52
Pungus *(Pangasius pangasius)*	675	1724	1542	1429
Others	1747	2513	2345	2654
Total	**15763**	**26120**	**24889**	**30561**

In the table 44 other species point includes Common carp (*Cyprinus carpio*), Bighead carp (*Aristichthys nobilis*), Air (*Sperata aor*), Kuchia (*Monopterus cuchia*), Ghuso chingri (*Gono linder*), Royna (*Nandus nandus*), Kakila *(Xenentodon cancila)*, Chela *(Salmostoma bacaila)*, Tilapia *(Orechromis mossambica)*, Nilotica *(Oreochromis nilotica)* etc.

It was found that total annual production trend was increasing after the establishment of the sanctuary but in regards to decreasing before the establishment of sanctuary. Maximum fish production obtained in winter and the highest catchable species are rui, katol, mrigal and silver carp. This is due to release of fry of those species. Nevertheless, production of tengra and small chingri were also high and no fry of such species is released. Minimum production obtained in the rainy reason when there is less water in the river. Due to careless fishing and unwanted need fish production were decreasing steadily. Before starting, the project the base line production went down to about 8.5 Ton. However, after the sanctuary production increased du to premeditated activities by the commity and the uppermost production was found in 2006/07, which was 30561 Kg.

Socio-economic status of the fishermen

Economic condition

To economically secure the household or to maintain or increase the goods necessary for the stability of the household economy fishers were involved in the sanctuary. After the sanctuary their desire became true due to incresing fish and non fish production. Therefore, the average income of the fishermen increased after the sanctuary. They earn average 35-40 Tk/day before the sanctuary and 150-200 Tk/day after the sanctuary.

Education status

In this survey area, no one was found above higher secondary level of education. A few respondents stated that they did not appreciate the importance of educating their children because of their proverty. Rather, they try to send them for fishing or engage in other supplementary activities for additional income. But after established the sanctuary they wish to send their children in the school due to increasing their income. Another important reason in them was appeciate during the training on fisheries.

Table 45. Educational Background of Fishermen

Education					Total
Sign only	Up to Primary	Up to secondary	Up to HSC	Above HSC	
55%	27%	13%	4%	1%	100%

Woman participation

Women participation in this area is about 10%. Nearly all cases it was seen that they implicated in the sanctuary for the poverty. In some cases for no substitute works and also to work together with their husbands.

Table 46. Participation of woman

Man	Woman	Total
90%	10%	100%

Occupation of fishermen

Fishing is considered as a low-class profession and fishermen in this area are traditionally poor. They lived from hand to mouth. These fishermen are socially, economically and educationally disadvantaged communities and lack their own financial resources. The professional fisherman in this is about 65%. The overall status of the occupations of the fishermen is given in the below table:

Table 47. Occupation of Fishermen

Occupation			Total
Professional Fisherman	Occasonal Fisherman	Subsistance Fisherman	
65%	14%	21%	100.00%

4.3 SATKHIRA DISTRICT

4.3.1 Betna river sanctuary, Kalaroya

It is an important river which supply fishes to the local market at Kalaroya Upzilla in Satkhhira district. The sanctuary was established with the supervision of both GO and NGO in 2006. The area of the river is 36.83 hac. But in dry season it reduced to 26.0 hac and in the rainy season 52.0 hac. The area of the sanctuary is 1.1 hac and it is established in the deaper part of the river. Average depth of the water is 7-8 feet. The number of beneficiaries of this sanctuary is 186. Both Hindus and Muslims were involved in this sanctuary. The fisherman formed a community for the management of the sanctuary. Porous bamboos and Concrit pillars were used for establishing the sanctuary, which may dish up as secure place to protect the fish beyond catching. Some particular fishing gear is harshly forbidden in this region, which is mosquito net and current jal. About 500 fishermen were dependent on this river to sustain their lives. The farmer managed the

sanctuary by forming community. Training was provided by Thana fisheries officer and NGO (IFID). Financial supports to fishermen is given by NGO.

They use pata, ber jal, khapla jal, polo etc. to catch fish. The farmers continue their fishing all the year round but in some cases, 1-2 months were prohibited to catch fish. Before establishing the sanctuary, all the professional fishers, boatmen and local people living around the river (both side) were contacted and they were made aware about the intention of the project – the proposed sanctuary in a series of meetings and focus group discussion. An informal committee was formed by the representatives from fishers and 2 executive officers were subsequently elected by the group members. A series of meetings were held to discuss and form the management and fishing rules and guidelines that all fishers eventually followed.

Changes in Biodiversity

The production of the sanctuary gradually decreasing due to environmental degradation and lack of awarnees among the fishers to protect the endangered or valuable species. Fishers' catch small sized fry of large fish and by-catch of other species is another inportant reason. But after the samctuary environmental condition of the sanctuary is suitable to regain the endangered and extinct species. Due to suitable environmental condition fry of black carp, rui, katla, mrigal etc. is released into the sanctuary and it was seen that its production is very good. Breeding ground of the sanctuary is not developed enough to breed in natural condition. Along with fish catch, species diversity also increased which is related with age of sanctuary in the habitat. Tengra, puti, baila, guchi baim, chingri, indian nmajor carp, tilapia and nilotica are available in this river. The production of chela, puti, golda chingri and baila was decrased gradually but they were not in severe indangered condition. Different species such as koi, shol, taki, magur, shing, royna, pabda etc. were extinct before few years du to seasonal saline water in the river. Different types of aquatic weeds that are water lily, kalmi, helenca, khudi pana, kacho etc were available in the sanctuary.

Table 48. Species that have appeared or disappeared after the sanctuary

Category type	Appear or increase substantly	Disappear or decrease substantly
Fish	Taki, Shol, Air, Mola	Puti, Chela, Baila (but not severly)
Other species	Crab, Shrimp	Turtle
Aquatic weeds	Kata shela, Nalsa shela	Water lily

Table 49. Change of Production in the sanctuary

Species name	Production (Kg)		
	2005-2006	2006-2007	2007-2008
Rui *(Labeo rohita)*	1894	3274	3317
Mrigal *(Cirrhinus cirrhosus)*	1071	1584	1427
Puti (*Puntius spp.*)	519	456	478
Tengra *(Mystus vittatus)*	1154	1547	1645
Chela *(Salmostoma bacaila)*	514	471	492
Small Chingre *(Palaemon spp.)*	473	596	576
Baila *(Glossogobius giuris)*	210	157	162
Guchi baim *(Mastacembelus panacalus)*	82	97	92
Tilapia *(Oreochromis mossambica)*	845	1274	1345
Nilotica *(Oreochromis nilotica)*	627	1487	1345
Silver carp *(Hypopthalmichthys molitrix)*	549	768	697
Black carp *(Mylpharyngodon pisceus)*	723	854	884
Bata *(Labeo ariza)*	56	187	292
Others	1012	1195	1338
Total	**9829**	**13947**	**14090**

In the table 49 the point other species includes Shol *(Channa striata)*, Taki *(Channa puntata)*, Shrimp *(Penaeus monodon)*, Crab (*Scylla spp.*), Parsea *(Mugil cephalus)*, Vetki *(Lates calcarifer)*, Kakila *(Xenentodon cancila)*, Chanda *(Chanda spp)*, Kholisa *(Colisa fasciatus)*, Air *(Sperata aor)*, Tara baim *(Macrognathus aculeatus)*, Khorsula *(Rhinomugil corsula)* etc.

In this sanctuary, maximum production was found in the rainy season. To increase production fry of rui, mrigal, silver carp and black carp was that is why, supreme production of such species are found in the sanctuary area. Before establishing, the sanctuary the base line production went down to 4.0 Ton. After the sanctuary due to release fry in the river production increased and the highest production obtained in 2007/2008. The supreme production is 14.0 Ton.

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Socio-economic status of the fishermen

Economic condition

The regular income of the fishermen increased after the sanctuary. They earn average 50-70 Tk/day before the sanctuary and 140-190 Tk/day after the sanctuary. So new fishermen wish to involve into the sanctuary committee. There is an alternative livelihood source the dike of the sanctuary. Papao, guard etc were cultivated on the dike of the estuary. This may act as additional income for them.

Woman participation

This area is an important example for the participation of women. After establishing sanctuary, the woman finds a way to help their family. Further more woman wish to join the commity. Number of beneficiaries of this sanctuary are 186 of which female are 27.

Table 50. Participation of woman

Man	Woman	Total
159	27	186

Education status

If fishermen should be properly educated with respect to the importance of management then it helps to improve the efficiency of rural household's in production. Education is also necessary to trained properly about the scientific method of culture technich. But in this survey area no one was found above higher secondary level of education. A few respondents stated that they did not appreciate the importance of educating their children. Due to poverty, they try to send them for fishing, or engage in other supplementary activities for additional income. But after establishing sanctuary their income incraesed, so they were careful about their children education.

Table 51. Educational Background of Fishermen

Education				Total
Sign only	Up to Primary	Up to secondary	Up to HSC	
131	41	10	4	186

Occupation of Fishermen

Most of the fishermen are very poor and depend on fishery, but not completely. The income derived therefore may be insufficient to provide adequate means of livelihood. Here, 70% were professional fishermen, 17% occasional fishermen, 13% subsistence fishermen in Talbaria baor. All respondents stated that their secondary occupation was agriculture, day labor, small business etc.

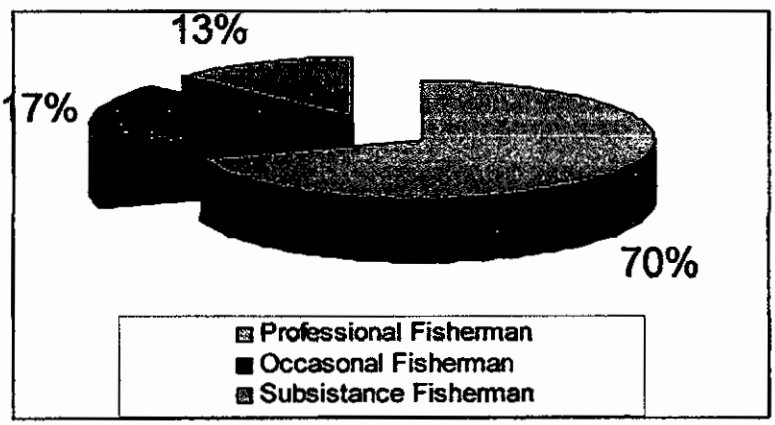

Figure 9: Occupation of Btena River Sanctuary Fishermen

4.4 NARAIL DISTRICT

4.4.1 Chitra River, Narail sadar

The site Chitra River is a very important fishery area to meet the fisheries production. This river was high in biodiversity. Different Government organizations and Non-government organizations are workings for sustainable fisheries development at this region. Installation of fish sanctuary by the department of fisheries (DoF) was one of the approaches to conserve the native species and to conserve the biodiversity as well. In 2003, sanctuary was established at different part in this river. The total area of the sanctuary in this river is 4.04 hac. Committee was formed to manage the sanctuary. Different types of gears such as gill net, seine net, set bag, large lift, small lift, cast net, push net, trap, long line, hook & line, spear, katha, pen/other, hand fishing etc. Current jal, berjal and poison fishing are totaly prohibited in this area.

Change in biodiversity

Species, which are available in the river, are puti, bain, guraichra, baila, tengra, shol, taki etc. However, their production decreases geadually due to over fishing and unsuitable condition of their breeding and feedind graund. After the establishment of sanctuary few species such as chela, boal, chapila, chakka chingri, thai sarputi, poa, koi, kholisha, kalibaus, chital, goinna, darkina, chunna bele etc. which was seriously endangered in condition. The base line production of Sarputi, Silver carp, Koi, Kalibaus, Darkina, Foloi, Chital, Bali Chata, Poa etc. were found in such a low level that indicates the vanishing state of those species. After sanctuary, the impacted production of those species was good enough indicating the reappearing trend of those species. The production of other species as pabda, rayek, batashi, tepa, fesha, black carp etc. '0' both in baseline and influence the production. This production indicates vanishing state of those species in this river. These species still then did not recover even after the sanctuary in the sanctuary. Different types of aquatic weeds such as different types of water hyacinth, kolmi, water lily, helencha, maloncha were available in the area that was almost extinct. The other interesting organisms as turtle, crabs, different types of small shrimp and prawn were found for establishing the sanctuary. Breeding ground of this river is good after the sanctuary but this river still in vulnerable condition for the recruitment of endangered species and sustainable condition of biodiversity

Table 52. Species that have appeared or disappeared after the sanctuary

Category type	Appear or increase substantly	Disappear or decrease substantly
Fish	Chela, Boal, Chapila, Chakka chingri, Thai sarputi, Poa, Koi, Kholisha, Kalibaus, Chital, Goinna, Darkina, Chunna Bele	Ilish, Jat Puti, Taki, Guraicha, Deshi Tengra, Boro Baim, Shing.
Other species	Crab, Shrimp,Toad	Gui shap, Snake
Aquatic weeds	Kata shela, Nalsa shela, Water hycinth	Topa pana

Table 53. Percentage of catch by Species in Chitra River

Species name	Production (Kg)			
	2002-2003	2003-2004	2004-2005	2005-2006
Tit puti *(Puntius ticto)*	7.0	20.8	19.2	23.6
Jat Puti *(Puntius sophore)*	22.1	19.6	15.4	12.9
Guchi baim *(Mastacembelus panacalus)*	10.5	7.5	8.8	10.9
Taki *(Channa punctata)*	15.7	12.2	6.8	5.1
Giura licha*(Nematopalaemon tenuipes)*	10.3	5.9	6.9	0.8
Rui *(Labeo rohita)*	0	1.6	6.2	5.0
Lomba Chanda *(Chanda spp)*	0.0	2.1	6.3	3.8
Tara baim *(Macrognathus aculeatus)*	0.6	5.1	4.2	3.0
Baila *(Glossogobius giuris)*	3.8	2.8	3.1	4.6
Chela *(Salmostoma bacaila)*	0	0	2.3	6.6
Bojuri Tengra *(Mystus vittatus))*	2.3	2.2	2.1	3.3
Shol *(Channa striata)*	0.7	2.1	2.8	2.3
Tengra *(Mystus vittatus)*	15.2	4.1	1.5	1.8
Mola *(Amblypharyngodon mola)*	0	0.2	2.5	2.1
Boal *(Wallago attu)*	0	0	0.7	4.5
Kakila *(Xenentodon cancila)*	1.3	0	2.4	0.6
Mrigal *(Cirrhinus cirrhosus)*	1.2	0.5	2.0	0.9
Tengra *(Mystus vittatus)*	0	0	0.4	3.0
Meni *(Nandus nandus)*	0.4	3.3	0.8	0.3
Shing *(Heteropneustes fossilis)*	1.7	1.8	0.5	0.2
Sarputi *(Puntius sarana)*	0	1.1	0.8	0.1
Boro Baim *(Mastacembelus armatus)*	2.1	1.0	0.4	0.3
Dimua *(Macribrachium villosimanus)*	0.1	0.4	0.1	1.0
Nona Chingri *(Palemon spp.)*	0	0.5	0.4	0.3
Foli *(Notopterus notopterus)*	0	0.6	0.2	0.5
Katla *(Catla catla)*	0	0.6	0.3	0.2
Chhatka Chingri *(Palemon spp.)*	0	0	0.3	0.4
Kali koi *(Badis badis)*	0	0.5	0.3	0.1
Chapila *(Gudusia chapra)*	0	0	0.5	0
Gutum *(Lepidocephalus guntea)*	0.1	0.3	0.1	0.5
Thai sarputi *(Puntius gonionotus)*	0	0	0.4	0
Common carp *(Cyprinus carpio)*	0	0.2	0.2	0.2
Modhu Pabda *(Ompok pabda)*	0	0.1	0.3	0
Poa *(Pama pama)*	0	0	0.3	0
Koi *(Anabas testudineus)*	0	0.8	0	0
Siliver carp *(Hypopthalmichthys molitrix)*	0	0	0.1	0.2
Bali Chata *(Nemacheilus Batia)*	0	0.6	0	0.1
Gozar *(Channa marulius)*	2.6	0.3	0	0
Magur *(Clarias batrachus)*	0.4	0.2	0.1	0.1
Kholisa *(Colisa fasciatus)*	0	0.3	0.1	0
Kalbasu (*Labeo calbasu*)	0	0	0.1	0.1
Kash Khoria*(Chela laubuca)*	1.2	0	0	0.2
Gachua *(Channa gachua)*	0	0.3	0	0

Chuna Bele *(Glossogobius giuris)*	0	0.1	0	0.1
Chitol *(Chital chitala)*	0	0	0	0.1
Darkina *(Esomus danricus)*	0	0	0.1	0
Golda *(Macrobrachium rosenburgii)*	0	0	0.1	0
Grass carp *(Ctenopharyngodon idellus)*	0	0	0.1	0
Goinna *(Labeo gonius)*	0	0.1	0	0

Socio-economic status of the fishermen

Economic condition

Most of the fishermen in this area are poor. All of them have no fishing gears and boats. The average income of the fishermen was increased after the sanctuary. They earn average 65-80 Tk/day before the sanctuary and 145-205 Tk/day after the sanctuary.

Education status

In this survey only 1% fisherman was found above higher secondary level of education. A few respondents stated that they did not appreciate the importance of educating their children. Due to proverty they ingage their children in fishing, agriculture or other livelihood occupation.

Table 54. Educational Background of Fishermen

Education					Total
Sign only	Up to Primary	Up to secondary	Up to HSC	Above HSC	
62%	20%	11%	6%	1%	100%

Women participation:

In most cases, it was seen that they involved in the sanctuary for the poverty. These women were completely the community member.

Table 55 . Participation of woman

Man	Woman	Total
82%	18%	100%

Occupation of the fishermen

The professional fishermen around the sanctuary area is 80%, most of them are depend only fishing rest of the fishermen have alternative livelihood. The ovarall status of the the occupition of the fishermen is given in below table:

Table 56: Occupation of Fishermen

Occupation			Total
Professional Fisherman	Occasonal Fisherman	Subsistance Fisherman	
80%	8%	12%	100.00%

4.4.2 Shatra khal fish sanctuary, Lohagara

In 2003, three sanctuaries were established in shatrakhal by the direct supervision of Fisheries Management Committee (FMC) of this locality. Thana Fisheries Office (Lohagara) and BRAC also helped to manage this sanctuary. It is a community based fish sanctuary. People of about seven villages were directly involved in these sanctuary. Total area of the water body is near about 45 ha and the sanctuary area is near about 5.0 ha. By the proper management of the sanctuary fish production and biodiversity has increased. The amounts of total catch of fish were increased after the establishment of the sanctuary. In this sanctuary about 287 fishermen were directly involved of them 83% were Hindus and rest 17% were Muslims. Training was provided by Fourth Fisheries Extension officer. Credit program were run through by various NGO such as gramen bank, BRAC. These sanctuaries closed in 2004 but is still running by the supervision of community people. Participation of woman in various activities is seen in here. Porous bamboos were used for establishing the sanctuary which may serve as safe guard of fish from predator. The average depth is near about 2.0 m in rainy season and 0.75 m in dry season. About 12 boats were engaged in this area and mainly vesal jal, casal jal, behundi jal, jakhi jal, coach, cast net etc. are used for fishing. Fishing gears such as current jal, fash jal, moshari jal etc. are prohibited in this sanctuary.

Changes in biodiversity

Environmental condition of the sanctuary was average; it should be increase to regain the endangered and extinct species. Breeding ground of the sanctuary was properly developed enough to breed in natural condition. Along with fish catch, species diversity also increased which is related with age of sanctuary in the habitat. Comparatively less pollution factors are found here. Only jute retting create severe problem.

Species which are available in the sanctuary are puti, baim, shol, gozar, taki, shing, magur, tengra, rui, catla, roina, kolisa, kakila etc. After the establishment of sanctuary, few species are regained such as chital, foli, calbasu, sarputi, tatkini etc. Different types of aquatic weeds such as water hyacinth, kolmi, santi, shapla, shela were available in this area. Some time small chingri, mollusks are found in this area.

Table 57. Species that have appeared or disappeared after the sanctuary

Category type	Appear or increase substantly	Disappear or decrease substantly
Fish	Air, Chapila, Foli, Tatkini, Koi	Kamini, Batashi (but not severly)
Other species	Snail, Mussel, Crab, Shrimp	Turtle
Aquatic weeds	Water hycinth, Nalsa shela	-

Table 58. Production of the sanctuary

Species name	Production (Kg)				
	2003-2004	2004-2005	2005-2006	2006-2007	2007-2008
Rui (*Labeo rohita*)	25041	30216	27541	34260	33184
Tara baim *(Macrognathus aculeatus)*	425	546	513	684	689
Boro baim (*Mastacembelus armatus*)	401	497	451	512	579
Sar Puti (*Puntius sophore)*	1478	1754	1701	1785	1848
Tengra (*Mystus tengra)*	1057	1457	1784	1798	1947
Small Chingree (*Palaemon spp)*	2785	3015	3412	3309	3471
Bele (*Glossogobius guris)*	4068	4479	4357	4572	4681
Deshi sar puti *(Puntius sarana)*	2658	2784	3102	3456	3741
Taki (*Channa punctata)*	1524	1745	1794	2143	1894
Koi (*Anabas testudineus*)	349	412	478	503	549
Kholisha (*Colisha fasciatus*)	248	345	375	412	475
Royna (*Nandus nandus*)	2715	2845	3074	3426	3379
Others	21549	24457	28496	34794	34457
Total	**64298**	**74552**	**77078**	**91654**	**90894**

In the table 58 the point others include Kakila *(Xenentodon cancila)*, Chela *(Salmostoma bacaila)* ,Rani *(Batia dario)*, Mola *(Amblypharyngodon mola)*, Magur *(Clarias batrachus)*, Shing *(Heteropneustes fossilis)*, Silver carp *(Hypopthalmichthys molitrix)*,Katla *(Catla catla)*, Guchi baim *(Mastacembelus pancalus)*, Shol *(Channa striata)*, Gozar *(Channa marulius)*,Gutum *(Lepidocephalus guenta)*, Jat puti *(Puntius sophore)*, Tit puti *(Puntius ticto)*, Pabda *(Ompok pabda)*, Chanda *(Chanda spp.)*, Chitol *(Notopterus chitala)*, Foli *(Notopterus notopterus)*, Kalibaus *(Labeo calbasu)*.

Day by day production decreased due to the unsuitable condition of environment and aslo for the human careless fishing. The base line production was gone down to 3.0-3.5 MT in this area. But after the sanctuary the production seemed to increase. Fry of different species was released to increase production. Rui is specially one of them. In 2006/2007 the highest production was found which 9.0 MT.

Socio-economic condition

Economic condition

Most of the fishermen in this area are poor. Some of them have no land for cultivation, so they completely have to depend on the sanctuary to maintain their family. Due to poverty they have to ingage their women and children in fish catching, harvesting and marketing. Before the sanctuary they earned about 45-50 Tk per day but after the sanctuary about 175-225 Tk.

Occupation of the fishermen

The professional fishermen around the sanctuary area is 60%, most of them are depend only fishing rest of the fishermen have alternative livelihood. The ovarall status of the the occupition of the fishermen is given in table 59.

Table 59. Occupation of Fishermen

Occupation			Total
Professional Fisherman	*Occasonal Fisherman*	*Subsistance Fisherman*	
60%	29%	11%	100.00%

Woman participation

About 12% women involvement was found in this sanctuary. This less amount is because they have alternative livelihood. Another important reason is there is no more chance of intering themselves into the sanctuary commitee.

Table 60. Participation of woman

Man	Woman	Total
88%	12%	100%

Education status

in this survey it was seen that most of the fishermen are illiterate or got sign only, 26% of them were completed primary education but forgotten all, 10% of them were in upto secondary level and rest 4% were in upto HSC, which were shown by the below figure:

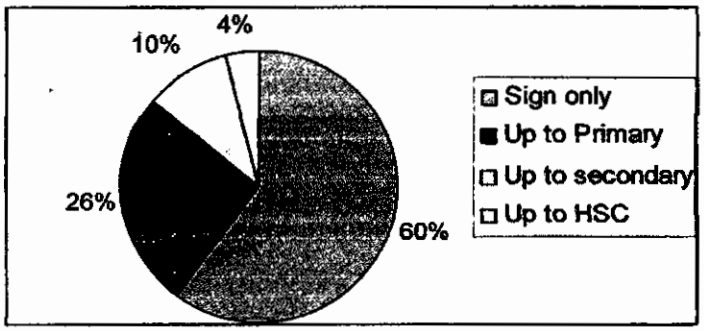

Figure 10: Educational Background of Fishermen

4.5 MAGURA DISTRICT

4.5.1 Serijdia Baor, Magura sadar

Serijdia Baor is an important fishery area at in the district of Magura. About five villages fishermen are directly or indirectly related on this Baor. Therefore, its management is very necessary. In 2003, a sanctuary is established by IFAD and the Thana Fisheries Office. The total area of the baor is 37.0 hac but the areas, which are under sanctuary, are about 2.05 hac. 71 persons are directly related in the sanctuary but the numbers of beneficiaries are about 416. It is an on going sanctuary. The average depth of this baor is about 5.0 m in rainy season and 1.5-2.0 m in dry season. Total management is supervised by both NGO and GO. The people who are directly related on the sanctuary about 80% of them are Hindus rest of them are Muslims. Fishing is done 4 times in a year by using traditional nets and boats. Six small boats and seine net, lift net, coach, cast net etc. are used for fishing. Fishing gears such as current jal, fash jal, moshari jal etc. are totally proscribed in this sanctuary. Training was provided by Thana Fisheries Officer and NGO (IFID). Financial supports to fishermen are given by NGO.

Change in boidiversity

Environmental state of the sanctuary is suitable to regain the endangered and extinct species after the sanctuary. Breeding ground of the sanctuary is developed enough to breed in natural condition. Comparatively less pollution factors are found here. Only jute retting create severe problem. Species, which are available in the sanctuary, are silver carp, rui, katol, baila, boal, shol, air, tengra etc. After the establishment of sanctuary, few species are regained such as chapila, chanda and foli etc. Different types of aquatic weeds such as pata shela, kolmi, sapla, nalsha shela were available in this area. Some time small chingri, shellfish are found in this area.

Table 61. Species that have appeared or disappeared after the sanctuary

Category type	Appear or increase substantly	Disappear or decrease substantly
Fish	Chapila, Chanda, Foli	Kamini, Batashi (but not severly)
Other species	Snail, Mussel, Crab, Shrimp	Turtle
Aquatic weeds	Water hycinth, Nalsa shela	-

Table 62. Production of the sanctuary

Species name	Production (Kg)					
	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007	2007-2008
Rui *(Labeo rohita)*	2410	3325	3057	4198	4071	4029
Catla *(Catla catla)*	2124	3058	2316	3889	3971	3302
Mrigel *(Cirrhinus cirrhosus)*	1964	2510	1845	3227	3201	2813
Silver carp *(Hypopthalmichthys molitrix)*	1715	2361	1503	2639	2190	1894
Grass *ciarp (Ctenopharyngodon idellus)*	1636	2519	1905	2384	1927	1695
Mirror carp (*Cyprinus carpio*)	1482	2394	1642	2138	2018	1677
Small Chingri *(Palemon spp.)*	1055	1743	1559	2257	2345	2193
Chanda *(Chanda spp)*	561	957	901	1203	1189	1074
Shol *(Channa striata)*	741	1289	1103	1553	1598	1654
Taki *(Channa punctata)*	719	1432	1265	1549	1552	1397
Baila *(Glossogobius giuris)*	523	951	836	1295	1327	1274
Gozar *(Channa marulius)*	294	531	545	621	609	589
Chapila *(Gudusia chapra)*	11	12	15	13	13	15
Tengra *(Mystus vittatus)*	569	1571	1412	1667	1698	1574
Deshi sar puti *(Puntius sarana)*	139	364	462	751	705	692
Chela *(Salmostoma bacaila)*	75	59	61	102	97	105
Foloi *(Notopterus notopterus)*	49	148	118	179	165	141
Others	711	1119	1002	1454	1346	1254
Total	**16778**	**26343**	**21547**	**31119**	**30022**	**27372**

In the table 62 the point other species includes Shing *(Heteropneustes fossilis)*, Magur (*Clarius batrachus*), Koi (*Anabas testudineus*), Kholisha (*Colisha fasciatus*), Telapia (*Oreochromis mossambicus*), Rani *(Batia dario)*, Puti (*Puntius spp*), Crab (*Scylla spp*), Kakila *(Xenentodon cancila)*, Chanda (*Chanda spp)* etc.

Fish production being increased day-by-day due to establishing sanctuary, which was shown in the table. Fry of rui, mrigal, silver carp, grass carp, mirror carp and black carp to increase production. Before establishing the sanctuary the base line production went down to 14.0 Ton. After the sanctuary due to release fry in the river production increased and the peak production obtained in 2005/2006. The supreme production is 31119 Kg.

Socio-economic status of the fishermen

Economic condition

New fishermen wish to involve into the sanctuary committee because the expected income of the fishermen increased after the sanctuary. They earn average 50-70 Tk/day before the sanctuary and 240-350 Tk/day after the sanctuary.

Woman participation

Only 1% women involvement was found in this sanctuary. However, seasonal participation of woman also found in this area.

Table 63. Participation of woman

Man	Woman	Total
99%	1%	100%

Education status

This survey described that most of the fishermen were illiterate or got sign only, 8% of them was completed primary education but forgotten all, 4% of them were in up to secondary level and no were in up to HSC, which were shown in table

Table 64. Educational Background of Fishermen

Education				Total
Sign only	Up to Primary	Up to secondary	Up to HSC	
88%	8%	4%	0%	100%

4.5.2 Naba Ganga River (Bhangura to Chandpur), Magura sadar

In Naba Ganga River, the sanctuary was established in 2001 from Bhangura to Chandpur. It is a community based fish sanctuary. Fishermen of about 8 villages around the river directly or indirectly depend on the river. For increasing fish production and conservation, Fourth Fisheries Project established a sanctuary in this water body. Total area of the water body is near about 638.72 acres in it the sanctuary area is near about 183 hac. This river plays a vital role to satisfy the market demand of fish in Magura sadar. 408 fishermen were directly involved in sanctuary but the overall beneficiaries were more than thousands, of them 60% were Muslim and rest were Hindus. Fourth Fisheries closed their management in 2005 but this sanctuary is still running by the supervision of community people. Participation of woman in various activities is seen in here. Porous bamboos were used for establishing the sanctuary that may serve as safe guard of fish from predator. The average depth of the river is near about 4.0 m in rainy season and 1.0 m in dry season. Total management was supervised by Fourth Fisheries Project. Fishing is done through out the year. About 100-150 boats were engaged in this area and mainly gill net, net jal, puti jal, koi jal, khepla jal, charpata jal, veshal jal, barshi, traps, katha, ber jal (large mesh) etc. are used for fishing. Fishing gears such as current jal, fash jal, moshari jal etc. are prohibited in this sanctuary. Comparatively less pollution factors are found here. Only jute retting create severe problem. Training was provided by Fourth Fisheries Extension officer. Credit program were run through by various NGO.

Change in biodiversity

Species that are available in the sanctuary are rui, katol, puti, chapila, sarputi, rayek, baim etc. After the establishment of sanctuary, few species such as batashi. koi shol, taki, chela, mola were endangered in condition whose production increases after the sanctuary. Different types of aquatic weeds such as water hyacinth, kolmi, santi, shapla, shela were available in this area. Some time snail, crabs, mollusks are found in this sanctuary. Breeding ground, spawning ground of the sanctuary area is not proper to spawn and breed of native species. Environment condition of the sanctuary area is average. Pollution factor is not so available only problem is created during the jute retting and water hyacinth rotten.

Table 65. Species that have appeared or disappeared after the sanctuary

Category type	Appear or increase substantly	Disappear or decrease substantly
Fish	Batashi, Rani	Illish, Rui, Kamini, Aleng, Kalibaus, Molongi, Boal
Other species	Snail, Mussel, Crab,	-
Aquatic weeds	Water hycinth, Topa pana	-

Table 66. Production of the sanctuary

Species name	Production (Kg)			
	2002-2003	2003-2004	2004-2005	2005-2006
Rui *(Labeo rohita)*	3041	2924	2412	2041
Mrigel *(Cirrhinus cirrhosus)*	1361	1408	1712	1523
Catla *(Catla catla)*	2404	2142	2293	2549
Tit Puti *(Puntius ticto)*	8054	9102	10945	10524
Chapila *(Gudusia chapra)*	7154	6578	7594	8145
Rayna (*Nandus nandus*)	1387	1548	1894	2012
Rayek *(Chrrhinus reba)*	6945	7181	8954	8484
Baila *(Glossogobius giuris)*	2451	3245	3104	3874
Taki *(Channa punctata)*	1032	1749	1625	1702
Shol *(Channa striata)*	954	1542	1023	1792
Baim *(Mastacembelus spp)*	633	1421	942	1425
Small Chingri *(Palemon spp.)*	4025	6113	5751	6345
Tengra *(Mystus spp)*	3125	4102	5124	5079
Koi *(Anabas testudineus)*	329	426	403	845
Kholisa *(Colisa fasciatus)*	269	457	304	397
Bata *(Labeo ariza)*	451	784	620	841
Sarputi *(Puntius sarana)*	4823	5845	5901	6513
Others	4265	10204	5203	11540
Total	**52703**	**66771**	**65804**	**75631**

In the table 66 the point other species includes Boal (*Wallago attu*), Silver carp (*Ctenopharyngodon idellus*), Kalibaush (*Labeo calbasu*), Common carp (*Cyprinus carpio*), Molongi, Ilish (*Tenualosa ilisha*), Kamini, Aleng, Air (*Sperata* aeor), Shrimp (*Pelaemon spp*), Crab (*Scylla spp*), Shing *(Heteropneustes*

fossilis), Kholisha (*Colisha fasciatus*), Telapia (*Oreochromis mossambicus*), Rani *(Batia dario),* Puti (*Puntius spp*), Kakila *(Xenentodon cancila)*, Chanda (*Chanda spp)* etc.

Impact of sanctuary is assessed by its production. Before stablishing sanctuary, production of these baor was not so high. Gradually the production was decreased to 35.0 Ton. Nevertheless, after sanctuary production increased as the indigenous species breed in natural condition. The uppermost production was found in 35631 Kg in 2005/06.

Socio-economic status of the fishermen

Economic condition

After the sanctuary, their average income was increased. That is a great benefit to them to educate their children. Some fishermen responded that due to committee member and increasing income their dignity developed in the society. Therefore, new fishermen wish to involve into the sanctuary committee. They earn average 50-60 Tk/day before the sanctuary and 200-300 Tk/day after the sanctuary.

Educational condition of the fishermen

Educational condition of this area was not good. Most of them were generally know how to sign. In this area, no one was found above the HSC level of education.

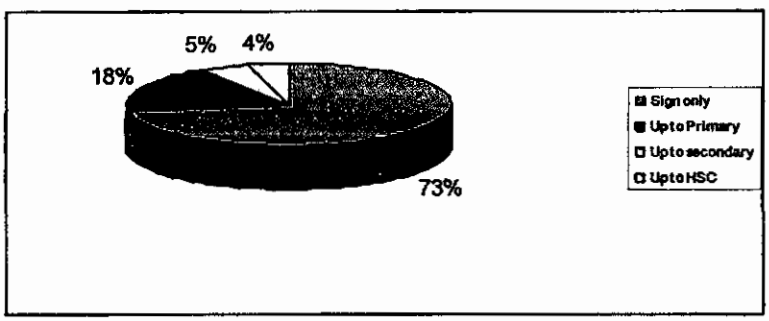

Figure 11. Educational Background of Fishermen

Woman participation

Women are greatly involved in this area. About 27% women involvement was found in this sanctuary. This may increase due to seasonal participation.

Table 67. Participation of woman

Man	Woman	Total
83%	27%	100%

Occupation of the fishermen

408 fishermen were directly involved in sanctuary but the overall beneficiaries were more than thousands, of them 60% were Muslim and rest were Hindus. The professional fishemen are about 75% from which 80% are Muslim. The overall status of the occupation of the fishermen is given in table 68.

Table 68. Occupation of Fishermen

Occupation			Total
Professional Fisherman	Occasonal Fisherman	Subsistance Fisherman	
75%	11%	14%	100.00%

4.5.3 Fotki river, Shalikha

Shalikha is one of the biggest Thana in Magura district. Fishery activities are directed with the Fotki River, part of Chitra River and Afra khal mainly. All native species were very much available in this region. But day by day a great number of native fish species extinct and some are in endangered condition. Different Government organizations and Non-government organizations are workings for sustainable fisheries development at this region.

Majority of the people of this region is Hindu. At the adjacent region of Fotki river, most of the family solely dependent on the river. Fishing activity was done all the season. There were no rules and regulations to catch fish at this region before October 2002. CNRS (Center for Natural Resource Studies) one of the promising NGOs working for the sustainable development of fisheries resources. They divided the Fotki River in 15 sections in their CBFM-2 (Community Based Fisheries Management-II Phase).

1. Mashakhali
2. Chaniapara
3. Dhaneshargati
4. Khilagati to Shangda Laksmipur
5. Darilakshmipur
6. Vateail
7. Kapasati
8. Chukinogor
9. Arpara
10. Alokdia to Darishaloi
11. Barasholoi

12. Boroichar
13. Kullia to Beel Boroil
14. Kuchiamora to Dakshin Shimnulia
15. Kuwatpur

In every river section, they made a fish sanctuary. Each of the sanctuary was closed in different months of 2007. These sanctuaries are now managed by the local authority. In this study, Vateail and Chukinogor sanctuary were studied. Fish condition is considerable but bad in dry season as water availability and flow is limited. Fishes are harvested continually all the year round around the sanctuary. But in some cases it was seen that fishers used to catch fish from the sanctuary.

4.5.3.1 Vateail, Shalikha

The area of the Vateail fish sanctuary is 50 decimal, the depth reaches its highest point 30 feet at the rainy season, and it reaches its lowest point 5-6 feet at the winter season. Bamboo leafs and branches of trees, kolmi, water hyacinth and red flag are usually used for making the sanctuary. Some particular fishing gear is strictly prohibited in the region that is fash jal, mosquito net and current jal. Different types training were given to the fishermen by the DOF and CNRS and by the present project. Some training programs are given below:

- Basic concept about the fish sanctuary
- Preparation of the fish sanctuary
- Fish sanctuary and its impact on fish production
- Management of fish sanctuary

Change in biodiversity

Breeding ground of Fotki River is good after establishing the sanctuary but this river still in vulnerable condition for the recruitment of endangered species and sustainable condition of biodiversity. Chela, boal, chapila, koi, rayek, kalibaus, chital, darkina, goinna etc. were extremely endangered in condition. Goinna, chapila, gang magur, poa and thai-sarputi were extinct in this river few years ago, but after establishing sanctuary they were found in some times. Different types of aquatic weeds such as different types of water hyacinth, pata shela, kolmi, water lily, helencha, maloncha were available in this area which was almost extinct. The other interesting organisms as Turtle, Guishap, Crabs and different types of small shrimp were found for establishing the sanctuary.

Jute retting is one of the major problems in this *Fotki River*. During the month of June, July and August jute retting is very much common in this region. As jute retting is a long time process, ponds, ditches are not usually used for jute retting. Therefore, the farmers are solely dependent on the rivers for jute retting. Chemicals from the jute retting pollute the whole water body and destroy the habitat of different aquatic organisms.

Table 69. Species that have appeared or disappeared after the sanctuary

Category type	Appear or increase substantly	Disappear or decrease substantly
Fish	Goinna, Chapila, Gang magur, Poa and Thai sarputi	Jat puti, Illish, Taki, Guraicha, Tara baim
Other species	Snail, Crab, Snake	Guishap
Aquatic weeds	Water lily, Pata sela, Maloncha	-

Table 70. Production of the sanctuary

Species name	Production (Kg)				
	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007
Tit puti *(Puntius ticto)*	543	1074	1013	1098	981
Jat Puti *(Puntius sophore)*	921	945	841	742	639
Sar Puti *(Puntius sarana)*	13	109	168	175	209
Rui *(Labeo rohita)*	257	486	457	512	589
Guraicha *(Nematopalaemon tenuipes)*	470	425	401	342	305
Katla *(Catla catla)*	165	243	203	241	209
Mrigal *(Cirrhinus cirrhosus)*	123	241	196	187	210
Kalbasu (*Labeo calbasu*)	84	156	102	142	189
Taki *(Channa punctata)*	175	161	95	104	71
Tara Baim *(Macrognathus aculeatus)*	394	624	725	795	765
Tengra *(Mystus vittatus)*	1054	1845	1954	2130	2016
Kakila *(Xenentodon cancila)*	105	245	204	251	239
Gozar *(Channa marulius)*	49	97	92	103	145
Shol *(Channa striata)*	59	156	142	164	161
Foli *(Notopterus notopterus)*	42	45	78	81	71
Pabda *(Ompok pabda)*	32	49	54	62	63
Chingri *(Palemon spp.)*	597	843	958	1124	1164
Chela *(Salmostoma bacaila)*	24	196	258	351	342
Mola *(Amblypharyngodon mola)*	34	159	185	214	297
Others	1291	1524	1459	1742	1851
Total	**6432**	**9623**	**9585**	**10560**	**10316**

In the table 70 the point **others** includes Silver carp (*Ctenopharyngodon idellus*), Common carp (*Cyprinus carpio*), Ilish (*Tenualosa ilisha*), Air (*Sperata aor*), Shrimp (*Pelaemon spp*), Crab (*Scylla spp*), Shing (*Heteropneustes fossilis*), Kholisha (*Colisha fasciatus*), Telapia (*Oreochromis mossambicus*), Kakila (*Xenentodon cancila*), Ek thota (*Hyporhamphus limbatus*), Kanpona (*Aplocheilus panchax*), Gulsha (*Mystus cavasius*), Goinna (*Labeo gonius*), Chanda (*Chanda spp*) etc.

Day by day as different species were demolishing, after sanctuary their production increasing in a little bit too. The base line production in this area is about 4.0 MT but after sanctuary it increases and the highest production found in 2005/2006, which is 10560 Kg.

Socio-economic status of the fishermen

Economic condition

The expected income of the fishermen increased after the sanctuary. They earn average 45-90 Tk/day before the sanctuary and 110-200 Tk/day after the sanctuary. So they are able to remove their poverty in a great part.

Woman participation

Only 3% women involvement was found in this sanctuary. However, seasonally this number increased those are completely relatives of the related fishermen. Woman in this area have alternative livelihood profession.

Table 71. Participation of woman

Man	Woman	Total
97%	3%	100%

Education status

This survey described that most of the fishermen are illiterate or sign only, 14% of them were completed primary education but forgotten all, 7% of them were in up to secondary level and 3% were in up to HSC, which were shown in table 72.

Table 72. Educational Background of Fishermen

Education				Total
Sign only	Up to Primary	Up to secondary	Up to HSC	
76%	14%	7%	3%	100%

4.5.3.2 Chukinogor, Shalikha

This sanctuary is now managed by the local authority. The area of the Chukinogor fish sanctuary is 70 decimal and the depth reaches its highest point 30 feet at the rainy season and it reaches its lowest point 5.5-6.5 feet at the winter season. Some farmer has gears. Only two boats and different types of gears as doar, borshi, fash jal, berjal, kochal etc were used for fishing. Some particular fishing gear is strictly prohibited in the region that is mosquito net and current jal. Fish condition is considerable but bad in dry season as water availability and flow is limited. Fishes are harvested continually all the year round around the sanctuary. But in some cases it was seen that fisher used to catch fish from the sanctuary. Different types training were given to the fishermen by the DOF and CNRS and by the present project

Change in biodiversity

Production of jat puti, baim, tengra, kakila, chingri, guraicha, rui, tit puti etc. species are good in this region. Different species were losing its survibability du to environmental degradation in this area. For this region goinna, darkina, gang magur, rayek, telapia, bata, batashi, piali, dhela, khosula etc. species were extinct and chital, foloi, sarputi, jatputi, guraicha etc were in endangered condition. Breeding ground of Fotki River is good after establishing the sanctuary but this river still in vulnerable condition for the recruitment of endangered species and sustainable condition of biodiversity. After the sanctuary goinna, gang magur, thai- sarputi and chital regained. Only a few numbers of them are seen at some time.

Different types of aquatic weeds such as different types of water hyacinth, pata shela, kolmi, water lily, helencha, maloncha were available in this area which was almost extinct. The other interesting organisms as turtle, guishap, different types of small shrimp and prawn were found for establishing the sanctuary. Jute retting is one of the major problems in this Fotki River. During the month of June, July, August, jute retting is very much common in this region. Chemicals from the jute retting pollute the whole water body and destroy the habitat of different aquatic organisms.

Table 73. Production of the sanctuary

Species name	Production (Kg)				
	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007
Tit puti *(Puntius ticto)*	814	1074	1313	1797	1902
Jat Puti *(Puntius sophore)*	1020	1230	1524	1452	1621
Sar Puti *(Puntius sarana)*	14	21	26	39	34
Rui *(Labeo rohita)*	385	762	789	951	821
Guraicha *(Nematopalaemon tenuipes)*	541	513	402	431	394
Katla *(Catla catla)*	254	485	426	521	510
Mrigal *(Cirrhinus cirrhosus)*	53	84	106	94	105
Kalbasu (*Labeo calbasu*)	186	368	312	394	402
Taki *(Channa punctata)*	61	52	69	75	93
Baim *(Mastacembellus spp.)*	521	503	651	624	694
Tengra *(Mystus vittatus)*	1248	1942	2145	2130	2359
Kakila *(Xenentodon cancila)*	127	120	143	157	196
Gozar *(Channa marulius)*	84	153	121	110	146
Shol *(Channa striata)*	102	157	103	115	121
Foli *(Notopterus notopterus)*	16	24	31	25	32
Pabda *(Ompok pabda)*	42	76	81	103	109
Chingri *(Palemon spp.)*	1023	1421	1861	1684	1794
Chela *(Salmostoma bacaila)*	24	196	258	351	342
Mola *(Amblypharyngodon mola)*	53	159	189	281	309
Others	1137	1440	1794	2045	2013
Total	**7705**	**10780**	**12344**	**13379**	**13997**

In the table 73 the point **others** includes Common carp (*Cyprinus carpio*), Ilish (*Tenualosa Ilisha*), Air (*Sperata aor*), Shrimp (*Pelaemon spp*), Shing (*Heteropneustes fossilis*), Kholisha (*Colisha fasciatus*), Telapia (*Oreochromis mossambicus*), Crab (*Scylla spp*), Kakila (*Xenentodon cancila*), Ek thota (*Hyporhamphus limbatus*), Kanpona (*Aplocheilus panchax*), Gulsha (*Mystus cavasius*), Goinna (*Labeo gonius*) etc.

Table 74. Species that have appeared or disappeared after the sanctuary

Category type	Appear or increase substantly	Disappear or decrease substantly
Fish	Chital, Goinna, Gang magur, Thai sarputi	Telapia, Kash Khoyra, Jat puti, Illish, Taki, Guraicha,
Other species	Mussel, Snake	Crab
Aquatic weeds	Water lily, Pata sela, Maloncha	-

In this sanctuary, maximum production was found in the rainy season. Before establishing, the sanctuary the base line production went down to 4.0 Ton. After the sanctuary due to developing the biodiversity and careful fishing of farmers production increased and the highest production obtained in 2006/2007. The supreme production is 14.0 Ton. Therefore, it may say that naturally increase the production.

Socio-economic status of the fishermen

Economic condition

The income of the fishermen increased after the sanctuary. They earn average 55-70 Tk/day before the sanctuary and 110-180 Tk/day after the sanctuary.

Woman participation

After establishing sanctuary, the woman finds a way to help their family. Further more woman wish to join the committee. Only 19% are directly involved in this sanctuary. Besides this seasonal participation of women are also noted.

Table 75. Participation of woman

Man	Woman	Total
83%	17%	100%

Occupation of the fishermen

From the beneficiaries 65% was Muslim and rest was Hindus. The professional fishemen are about 60% from which 45% are Muslim. The overall status of the occupations of the fishermen is given in table 76.

Table 76. Occupation of Fishermen

Occupation			Total
Professional Fisherman	Occasonal Fisherman	Subsistance Fisherman	
60%	21%	19%	100.00%

Education status

In this survey area, no one was found above higher secondary level of education. A few respondents stated that they did not appreciate the importance of educating their children. The educational status is given in the table 77.

Table 77. Educational Background of Fishermen

Education				Total
Sign only	Up to Primary	Up to secondary	Up to HSC	
57%	22%	9%	2%	100%

4.6 KUSHTIA DISTRICT

4.6.1 Jaggonathpur kole, Kumarkhali

Kumarkhali, one of the thanas in Khustia district situated beside the Gorai River, tributaries of Padma River. Gorai River is the main source of fishery activities in this Thana. This river was high in biodiversity. Different Government organizations and Non-government organizations are workings for sustainable fisheries development at this region. Installation of fish sanctuary by the department of fisheries (DoF) was one of the approaches to conserve the native species and to conserve the biodiversity as well.

Jaggonathpur Kole fish sanctuary was established in 2002. The area of this fish sanctuary is 10 ha, the depth reaches its highest point 20-25 feet at the rainy season, and it reaches its lowest point 5-6 feet at the winter season. Bamboo leafs and branches of trees, red flag are usually used to install a sanctuary. Some particular fishing gear is strictly prohibited in this region, which is mosquito net and current jal.

Change in biodiversity

There were over 140 fish species, the richest freshwater fish fauna in Bangladesh. Nevertheless, the fish production and the biodiversity have been affected over the years in the area due to change in water unavailability, unstable condition of the water level and the increasing pressure of fishing activity. The established pattern of water flow, velocity, water turbidity, total dissolved solids (TDS), and salinity, on which fisheries of the region flourished, has undergone changes affecting all the native species along with 12 species of prawn inhabiting in this river. Hilsa was affected the most and its catch dwindled

alarmingly over the years in the post Farakka era. The reduced flows in the rivers have also affected the spawning activities of major species like rui, katla and mrigel etc

This area is an excellent example of recruit of extinct species. After sanctuary shol, taki, deshi puti, air, foli, and pabda are newly recruited species that were previously extinct or severly endangered. Different types of aquatic weeds such as different types of water hyacinth, pata shela, kolmi, water lily, helencha, maloncha were available in this area which was almost extinct. The other interesting organisms as turtle, guishap, crabs, different types of small shrimp and prawn were found for establishing the sanctuary. Breeding ground of this river is good after establishing the sanctuary but this river still in vulnerable condition for the recruitment of endangered species and sustainable condition of biodiversity. Six numbers of fish species are newly recruited which were almost extinct but all the other native species still not found and their habitat should be reconstructed.

Production trend of the sanctuary:

In regards to total annual catch, the normal production trend was decreasing before the establishment of sanctuary. Nevertheless, it was found increasing after the establishment of the sanctuary. Decade wise annual catches were collected by PRA (up to 2000) and the annual catches during study period were taken by sampling method (2001- 04). It was found that the average yearly fish production of the Kole in the decade of 70 was 3,52,225 kg. But it began to decrease gradually and in the decades of 80, it was found 148555 kg. An abrupt fall of production found in the decade of ninety, it was 9535 kg. In 2001 and 2002, it was found 69732 kg and 64811 kg. After the establishment of sanctuary in the Kole in 2002, the production of Kole was found 94562 kg and 148920 kg in the year of 2003 and 2004 respectively. Again, the increasing trend was found.

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Table-78: Year wise production of Kole

Year	Production (kg)
1960-70	3,52,225
1971-80	3,42,326
1981-90	1,48,555
1991-2000	94,535
2001	69,732
2002	64,811
2003	94,562
2004	1,48,920

Table 79. Production of the kole

Species name	Production (kg)			
	2001	2002	2003	2004
Chanda *(Chanda spp)*	12984	13050	9234	7105
Puti *(Puntius spp)*	5204	5114	5700	5138
Taki *(Channa punctata)*	3126	2142	2427	2877
Baim *(Mastacembelus spp)*	3016	2272	2325	2325
Tengra *(Mystus vittatus)*	3917	3792	3714	7024
Beley *(Glossogobius giuris)*	3376	1198	1715	2470
Air *(Sperata aor)*	1977	1484	2371	4347
Boal *(Wallago attu)*	1138	1181	2282	3747
Chital *(Notopterus chitala)*	770	458	1534	3122
Chingri *(Palemon spp.)*	11213	9253	7292	5928
Bata *(Labeo ariza)*	517	372	1715	2778
Chapila *(Gudusia chapra)*	1964	1744	2381	3254
Piali *(Aspidoparia morar)*	698	524	1113	2501
Pabda *(Ompok pabda)*	18	13	44	74
Kajali *(Ailichthys punctata)*	50	50	114	178
Rui *(Labeo rohita)*	2393	2140	17227	16441
Catla *(Catla catla)*	2843	2813	13726	17315
Mrigel *(Cirrhinus cirrhosus)*	1928	3666	9671	13283
Shol *(Channa striata)*	993	1141	1872	2399
Others	11658	12404	8105	46614
Total	69732	64811	94562	148920

In the table 79 the point others include Kakila *(Xenentodon cancila)*, fulchela *(Salmostoma bacaila)*, Teltupri, Kakchi, Raich Bata *(Labeo ariza)*, Bajar Dhela *(Rohtee cotio)*, Meni *(Nandus nandus)*, Rani *(Batia dario)*, Mola *(Amblypharyngodon mola)*, Darkina (*Rasbora danconius*), Khorsula *(Rhinomugil corsula)*, Silanda *(Silonia silondia)*, Koi *(Anabas testudineus)*, Magur *(Clarias batrachus)*, Shing *(Heteropneustes fossilis)*, Ilish *(Tenualosa ilisha)*, Pungus *(Pangasius pangasius)*, Silver carp *(Hypopthalmichthys molitrix)*, Grass carp *(Ctenopharyngodon idellus)*, Common carp *(Cyprinus carpio)* etc.

Beneficiaries and their livelihood approach

The number of total beneficiaries of this sanctuary is 1536 of 300 families. The number of men beneficiaries is 1082 and the women beneficiaries are 454. The number of Hindus is 216 of 36 families. In the study area, most fishermen are quite young (21-30 yrs). According to the interviewee, almost all males over 15 yrs are directly engaged in fishing, while women help in weaving and repairing of nets, making fish traps, and are also engaged in maintaining the house, collecting firewood and livestock rearing to supplement the household income.

Woman participation

This area is an excellent example of woman participation. 454 women was found from the 1536 farmers.

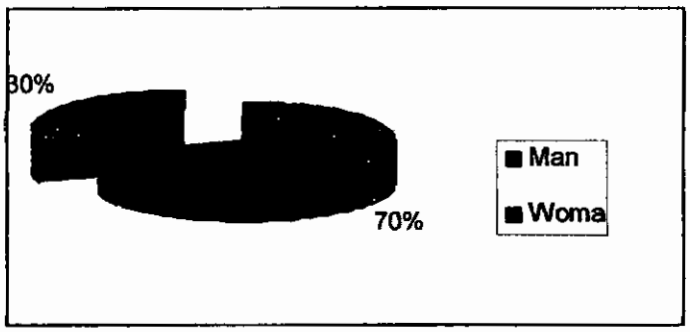

Figure 12: Participation of woman

Education status

Most of the fishermen are young. Due to poverty, they did not get scope of education. But being poverty they try to educate themselves. In this study, no one was found above HSC level of education.

Table 80. Educational Background of Fishermen

Education				Total
Sign only	Up to Primary	Up to secondary	Up to HSC	
50%	43%	5%	2%	100.00%

Occupation of Kole Fishermen

Fishing cannot provide full time employment, and the income derived therefore may be insufficient to provide adequate means of livelihood. As such, secondary occupations are involved. Here, 66% professional fishermen, 13% occasional fishermen, 21% subsistence fishermen in Kole. All respondents stated that their secondary occupation was agriculture, day labor, small business etc.

Table 81. Occupation of Kole Fishermen

Occupation			Total
Professional Fisherman	Occasonal Fisherman	Subsistance Fisherman	
66%	13%	21%	100.00%

4.6.2 Talbaria baor, Daulatpur

Daulatpur, one of the thanas in Khustia district situated beside the Padma River. Talbaria baor is the main source of fishery activities in this Thana. This baor was high in biodiversity. But the fish production and the biodiversity have been affected over the years in the area due to change in water unavailability, unstable condition of the water level and the increasing pressure of fishing activity. Different Government organizations and Non-government organizations are workings for sustainable fisheries development at this region. Talbaria baor fish sanctuary was established in 2002. The area of this fish sanctuary is 0.83 ha, the depth reaches its highest point 20-25 feet at the rainy season, and it reaches its lowest point 5-6 feet at the winter season. Bamboo leafs and branches of trees, kolmi, water hyacinth, red flag are usually used for making the sanctuary. Some particular fishing gear is strictly prohibited in the region that is mosquito net and current jal. Different types training were given to the fishermen by the DoF for developing their Knowledge about fishing, managing of the sanctuary etc.

Change in biodiversity

Chanda, puti, taki, baila, tengra, boal, baim etc species are available in this area. But their production decrease gradually due to over fishing and unsuitable condition of their breeding and feeding ground. After sanctuary shol, deshi puti, air, foli and pabda are newly recruited that were previously extinct or severely endangered. The base line production of kajali, pabda and chital were found in such a low level that indicates the vanishing state of those species. After sanctuary, the impacted production of those species was good enough indicating the reappearing trend of those species. The production of other two species rita and kawnia found '0' both in baseline and impact production. This production indicates vanishing state of those species in that kole. This two species still then did not recovered even after the sanctuary in the sanctuary. Different types of aquatic weeds such as different types of water hyacinth, kolmi, Water lily, Helencha, Maloncha were available in this area, which was almost extinct. The other interesting organisms as Turtle, Guishap, Crabs, different types of small Shrimp and Prawn were found for establishing the sanctuary. Breeding ground of this river is good after establishing the sanctuary but this river still in vulnerable condition for the recruitment of endangered species and sustainable condition of biodiversity.

Table 82. Species that have appeared or disappeared after the sanctuary

Category type	Appear or increase substantly	Disappear or decrease substantly
Fish	Kajoli, Pabda, Chital	Illish, Taki, Chingri, Puti
Other species	Mussel, Snake	Crab
Aquatic weeds	Water lily, Pata sela, Maloncha	-

Table 83.Change of fish production

Species name	Production (Kg)				
	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007
Chanda *(Chanda spp)*	4086	4594	5024	529	6023
Puti *(Puntius spp)*	1997	1810	1636	1556	1459
Taki *(Channa punctata)*	2254	1830	1701	1642	1548
Tara Bain *(Macrognathus aculestus)*	1341	1548	1297	1576	1779
Tengra *(Mystus vittatus)*	2513	2841	3096	2986	3271
Baila *(Glossogobius giuris)*	1102	1537	1594	1692	1687
Guchibaim *(Mastacembelus pancalus)*	326	421	456	642	751
Air *(Sperata aor)*	362	529	521	654	694
Boal*(Wallago attu)*	857	1129	1123	1257	1296
Chital *(Chital chitala)*	213	254	362	394	418
Chingri *(Palemon spp.)*	795	1025	1012	1123	1092
Bata *(Labeo ariza)*	325	785	854	1024	1194
Chapila *(Gudusia chapra)*	264	489	472	510	587
Piali *(Aspidoparia morar)*	213	198	205	184	197
Rui *(Labeo rohita)*	1024	1542	1720	1954	2134
Catla *(Catla catla)*	1103	1025	1423	1527	1591
Mrigel *(Cirrhinus cirrhosus)*	842	937	1324	1231	1294
Shol *(Channa striata)*	141	421	597	624	658
Others	1512	2498	3119	3492	3673
Total	**21270**	**25413**	**27536**	**24597**	**31346**

In the table 83 the point **others** include Kakila *(Xenentodon cancila)*, Raich Bata *(Labeo ariza)*, Bajar Dhela *(Rohtee cotio)*, Meni *(Nandus nandus)*, Rani *(Batia dario)*, Mola *(Amblypharyngodon mola)*, Darkina *(Rasbora danconius)*, Khorsula *(Rhinomugil corsula)*, Silanda *(Silonia silondia)*, Koi *(Anabas testudineus)*, Magur *(Clarias batrachus)*, Shing *(Heteropneustes fossilis)*, Ilish *(Tenualosa ilisha)*, Pungus *(Pangasius pangasius)*, Silver carp *(Hypopthalmichthys molitrix)*, Grass carp *(Ctenopharyngodon idellus)*, Common carp *(Cyprimus carpio)* etc

In this study, the production of air, boal, chital, tengra, piali and bata etc. increased amazingly. Such notable increasing might occur due to impact of sanctuary in the baor. All respondent including fishers said that the species mentioned above were true indicator for that sanctuary. The baor sanctuary provided a safe zone for escaping small, medium and above all parent fish. It also provided a safe environment for breeding, nursing, feeding, escaping and growing of those fishes. That is why increased production obtained year to year and the production found 31346 Kg in 2006/07. Study also show that the production of chanda, puti, taki and chingri reduced gradually. These decreasing

continued even in the impact period. This badly decreasing might occur due to amazing increase of predatory species like beley, boal, chital, aeor, shoal etc.

Beneficiaries and their livlihood approach

Woman participation

The number of total beneficiaries of this sanctuary is 83 of 14 families. The number of men beneficiaries is 70 and the women beneficiaries' are 13. The number of Hindus is 12 of 3 families. In this area women are involved mainly help in weaving and repairing of nets, making fish traps, and are also engaged in maintaining the house, collecting firewood and livestock rearing to supplement the household income.

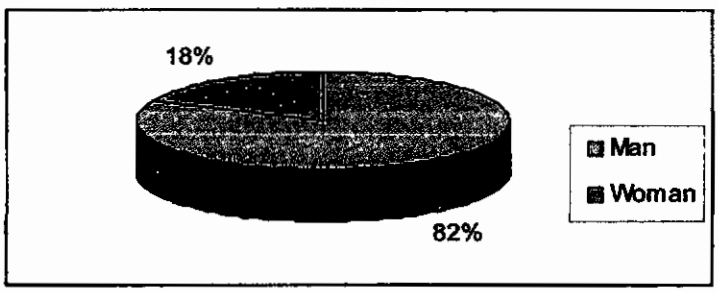

Figure 13: Woman participation in talbaria baor

Educational Background

Educational background in this area is very poor. Most of the fishermen are illiterate and no one was found above higher secondary level of education. But government and other organization try to educate with knowledge how to sign. The fishermen were influenced to this by representing before them about the importance of education.

Table 84. Educational background of fishermen

Education				Total
Sign only	Up to Primary	Up to secondary	Up to HSC	
55%	40%	4%	1%	100.00%

Occupation of Fishermen

Most of the fishermen are poor and depend on fishery, but not completely. The income derived therefore may be insufficient to provide adequate means of livelihood. So,

secondary occupations are involved. Here, 45% professional fishermen, 30% occasional fishermen, 25% subsistence fishermen in Talbaria baor. All respondents stated that their secondary occupation was agriculture, day labor, small business etc.

Table 85. Occupation of Talbaria baor Fishermen

Occupation			Total
Professional Fisherman	Occasonal Fisherman	Subsistance Fisherman	
45%	30%	25%	100%

4.7 CHUADANGA DISTRICT

4.7.1 Banipur baor, Jibon nagor

Banipur baor is one of the important fishery areas for supplying fishes in the local market of Jibon nagor Thana. For establishing a sanctuary, site has been selected in the deeper part of the baor with easy access so that it retains sufficient water in dry season. The area of the baor is 25.37 ha of which the sanctuary site is 0.404 ha. The number of beneficiaries of this sanctuary is 62. Both Hindus and Muslims were involved in the comity of this sanctuary. There is no way of woman participation in this sanctuary. However, fishing is prohibited up to 200 meter from the sanctuary boundary at both ends. Bamboo poles, branches of tree, red flags were used for establishing the sanctuary. During rainy season when water level and current velocity are very high the bamboos and branches have been taken out from the river and kept on riverbank. Sufficient awareness has been made among the local people/fishers about the need and importance of fish sanctuary so that no unauthorized/illegal fishing is done. Both in Bangla and in English signboards have been fixed. Sanctuary area has been demarcated with red flags at four corners of the sanctuary and in between.

A flap-type sluice gate controls the flow of water of this baor. There is a tidal range in the river, and the sluice gate is supposed to automatically close during rising water period to keep out saline water. Then if the water level inside the khal is higher than in the river the gate automatically opens during the low tide period.

Changes in biodiversity

In the conservation of sanctuary area during dry season (November to February) Chingree, Puti were more. Among non-fish organisms mussel, snail and algae were also present Loitya fish were more outside the sanctuary. Again, in far distance a number of species was less compared to nearer area. This was scenario at the end of dry season. However, in early dry season numbers of fish species in sanctuary and nearby area were nearly same. Compared to this site number of species were less than half in control site. Similarly numbers of small snails were more at nearby and very less in far distance.

In the conservation site, major species were reported as bighead carp, black carp, common carp, grass carp, silver carp and some exotic species. there were also bata, baila, boal, catla, chanda, chapila, chela, foli, gauchi baim and many other indigenous species available. However, existence of these fishes were observed and reported by the people, as experimental netting was not done within the conservation. Practically, as there was no fishing, the number of species and population were more near to the site, as fishing tendency near to conservation site is usually high. The base line production of puti, pabda, koi, chinda chingri, and maya were found in such a low level that indicates the vanishing state of those species. After sanctuary, the impacted production of those species was good enough indicating the reappearing trend of those species. The production of rita, rani and kajoli was found '0' both in baseline and impact production. This production indicates vanishing state of those species in the baor. These species still then did not recover even after the sanctuary in the sanctuary.

Fishing intensity was more in post monsoon followed by monsoon and dry season. As premonsoon period was short and fish started to move for breeding (small fish) fishing for longer duration was not possible. In control site, same trend was observed. However, in sanctuary area or its vicinity fishing intensity was less. Major species composition pattern in the sanctuary site is that annually rui, katla, mrigel, shol and boal dominate in the study river.

There is an alternative livelihood source the dike of the estuary. Papao, guard etc were cultivated on the dike of the estuary. Lily, kalmi, helenca, khudi pana, kacho etc were available in the sanctuary.

Table 86. Species that have appeared or disappeared after the sanctuary

Category type	Appear or increase substantly	Disappear or decrease substantly
Fish	Maya, Tit puti,Chanda, Shing	Pabda
Other species	Gui shap, Crabs, Golda	-
Aquatic weeds	Water lily, Nalsa shela, Pata sela.	Helancha

Table 87. Present condition of fish Species of Banipur baor Sanctuary

Fish species	Production (kg)		
	2005-2006	2006-2007	2007-2008
Rui *(Labeo rohita)*	1235	1589	1624
Mrigal *(Cirrhinus cirrhosus)*	578	897	851
Boal *(Wallago attu)*	254	215	197
Kātla *(Cātlā cātla)*	841	1002	1103
Pabda *(Ompok pabda)*	12	8	10
Tit puti *(Puntius ticto)*	9	17	13
Tengra *(Mystus Vittatus)*	84	105	117
Small Chingree *(Palaemon spp.)*	12	15	23
Baila *(Glossogobius giuris)*	37	54	62
Mola *(Amblypharyngodon mola)*	128	189	217
Shol *(Channa striata)*	354	480	524
Deshi sar puti *(Puntius sarana)*	365	614	751
Taki *(Channa punctata)*	104	215	208
Chanda *(Chanda spp)*	13	21	23
Koi *(Anabas testudineus)*	45	61	48
Titputi *(Puntius ticto)*	58	71	85
Shing *(Heteropneustes fossilis)*	11	21	14
Maya *(Amblypharyngodon mola)*	05	07	11
Magur *(Clarias batrachus)*	20	23	23
Others	184	261	295
Total	**4349**	**5865**	**6199**

In the table 87 the point, others include Bata *(Labeo ariza)*, Dhela *(Rohtee cotio)*, Pungus *(Pangasius pangasius)*, Baim (*Mastacembleus spp.*), Air *(Sperata aor)*, Golda *(Macrobrachium rosenburgii)*, Kholisa *(Colisa fasciatus)*, *Crab* (*Scylla spp.*) etc.

In this study, the production of rui, katla, mrigal, shol, taki, deshi sarputi etc. increased remarkably. Such notable increasing might occur due to release fry of such species and impact of sanctuary in the baor. The baor sanctuary provided a safe zone for escaping small, medium and above all parent fish. It also provided a safe environment for breeding, nursing, feeding, escaping and growing of those fishes. That is why increased production obtained year to year and the highest production found 6199 Kg in 2007/08. Before establishing sanctuary the baseline production was found about 1.5-2.5 MT. Study also show that the production of chanda, puti, taki, tengra, maya and chingri are not increased remarkably due to predatory species like baila, boal, air, shol etc.

Socio-economic status of the fishermen

Economic condition

In this study, it was seen that economic condition was developed after the sanctuary. They earn average 45-75 Tk/day before the sanctuary and 100-150 Tk/day after the sanctuary.

There is an alternative income source through the dike of the estuary. Papao, guard etc were cultivated on the dike of the estuary

Women participation:

The number of beneficiaries of this sanctuary is 62. Both Hindus and Muslims were involved in the community of this sanctuary. There is no way of Woman participation in this sanctuary.

Education

No one was found above higher secondary level of education. These findings concur with the results that most of the fishermen were illiterate and few had primary level education. A few respondents staled that they did not appreciate the importance of educating their children.

Table 88. Educational Background of Fishermen

Education				Total
Sign only	Up to Primary	Up to secondary	Up to HSC	
14	37	8	3	62

Occupation of fishermen

Fishing is considered as a low-class profession and fishermen are traditionally poor. They lived from hand to mouth. These fishermen are socially, economically and educationally disadvantaged communities and lack their own financial resources. The professional fisherman in this is about 67%. The overall status of the occupations of the fishermen is given in the below figure:

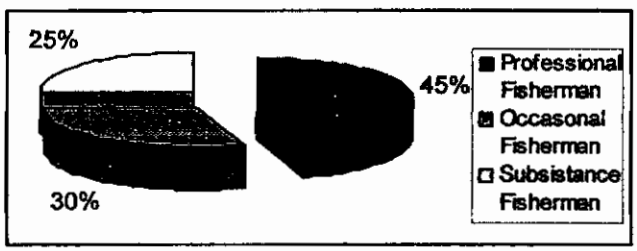

Figure 14: Occupation of fishermen in Banipur baor

Table 89. Overall changes of the FMP (Fishery Monitoring Plan) rules in the different sanctuaries with its objective and implementation status

SL	Issues	Description	Objective of the plan (FMC & Fisher)	Implementation status
1	Access right	Fishers of beneficiary villages	To benefit the traditional users of the site by paying gear fee (as needed for management and organization running)	100%
		Outside fisher paying gear fee	Keep going with the tradition	100%
2	Gear ban	Beundi jal	To save the hatchling &fry to increase production	100%
		Char pata jal	To save the hatchling &fry to increase production	100%
		Current jal (Mesh size below 45 mm)	• To follow the fish act • Save brood fish • Reduce individual high catch	75%
		Net jal (mosquito net)	To save the hatchling &fry to increase production	60%
		Konch/Juti	Reduce non-fishers benefit	25%
3	Seasonal gear ban	Katchal jal	To save the hatchling &fry to increase production	
4	Private Katha	Remove the private katha	To reduce the non-fishers benefit and personal high gains	80%
5	Night fishing	Banned in some area	To reduce fishing (stealing) and stop some fishers extra income.	
6	Fishing in the sanctuary	Year round ban. Ban extended 100m to 200m both sides of the brush piles	➢ Save brood fish and increase breeding to increase population and production ➢ Scare species increase ➢ Species reappear	70-80%
7	Water hyacinth	Would be removed	• Increase fishing ground • Increase production • Reduce pollution	16-33%
8	Controls of sluice gate	To control for fish friendly opening and closing	Increase fish migration and therefore production	In some area being implemented
9	Water pollution mitigation	To mitigate effect of jute retting and others pollution	➢ Save fish from going out of the site ➢ Save fish from death	Completely impossible by the CBO with out any outside support
10	Fingerling stocking	Stocked in some area	Increase production	20-25% of the visited area
11	Fishing ban after stocking	2 months	Allow to grow stocked species	75%
12	Fishing by poisoning	Ban	• Save water pollution • Save the fishes	100%. No practice in the past
13	Catching of Rui, Catla, Mrigel Below 9"	Ban	✓ To increase production ✓ To get large sized species	80%
14	Catching size of indian major carp species	Not less than 1 Kg	Not stated	Plnning mistake, Not followed and also dropped in some area
15	Brood fish catching	Ban. Would be release if caught	Increase population and production	No monitoring method inplace

Table 90. Overall checklist of fishes that were found in this survey

Sl no	Local name	Scientific name
1	Tit puti	*Puntius ticto*
2	Jat Puti	*Puntius sophore*
3	Sarputi	*Puntius sarana*
4	Rayek	*Chrrhinus reba*
5	Thai sarputi	*Barbanymus gonionotus*
6	Guchi baim	*Mastacembelus panacalus*
7	Taki	*Channa punctata*
8	Guraicha	*Nematopalaemon tenuipes*
9	Rui	*Labeo rohita*
10	Lomba chanda	*Chanda nama*
11	Tara baim	*Macrognathus aculeatus*
12	Baila	*Glossogobius giuris*
13	Chela	*Salmostoma bacaila*
14	Air	*Sperata aor*
15	Bata	*Labeo ariza*
16	Chanda	*Chanda spp.*
17	Ranga chanda	*Chanda ranga*
18	Boal	*Wallago attu*
19	Catla	*Catla catla*
20	Common carp	*Cyprinus carpio*
21	Chapila	*Gudusia chapra*
22	Shing	*Heteropneustes fossilis*
23	Magur	*Clarias batrachus*
24	Gozar	*Channa marulius*
25	Chital	*Chital chitala*
26	Foli	*Notopterus notopterus*
27	Gutum	*Lepiodocephalus guntea*
28	Kachki	*Corica soborna*
29	Kaspona/Dankona	*Aplocheilus panchax*
30	Lal kholisa	*Colisa lalius*
31	Kholisa	*Colisa fasciatus*
32	Kali baus	*Labeo calbasu*
33	Khorsula	*Rhinomugil corsula*
34	Silver carp	*Hypopthalmichthys molitrix*
35	Grass carp	*Ctenopharyngodon idellus*
36	Mohashol	*Tor tor*
37	Mrigal	*Cirrhinus cirrhosus*
38	Mola/Maya	*Amblypharyngodon mola*
39	Pabda	*Ompok pabda*
40	Modhu pabda	*Ompak pabo*
41	Piali	*Aspidoparia morar*
42	Kazoli	*Ailichthys punctata*
43	Shoal	*Channa striata*
44	Pungus	*Pangasius pangasius*
45	Bojuti Tengra	*Mystus tengra*
46	Tengra	*Mystus vittatus*
47	Small chingri	*Palaemon spp.*
48	Golda chingri	*Macrobrachium rosenbergii*
49	Lotia chingri	*Macrobrachium mirabilie*
50	Koi	*Anabas testudineus*
51	Kali koi	*Badis badis*
52	Poa	*Pama pama*
53	Parsia	*Mugil cephalus and Liza parsia*

54	Vetki	*Lates calcarifer*
55	Dimua	*Macoibrachium villosimanus*
56	Kuchea	*Monoptrus cuchea*
57	Royna/ Meni	*Nandus nandus*
58	Rani	*Batia dario*
59	Dhela	*Rohtee cotio*
60	Tilapia	*Oreochromis mossambica*
61	Nilotica	*Oreochromis nilotica*
62	Kakila	*Xenentodon cancila*
63	Goinna	*Labeo gonius*
64	Ilish	*Tenualosa ilisha*
65	Silanda	*Silonia silondia*
66	Taposhi	*Polynemus paradiseus*
68	Fesha	*Satipinna fasha*
69	Kanpona	*Aplocheilus panchax*
70	Gulsha	*Mystus cavasius*
71	Ek thota	*Hyporhamphus limbatus*
72	Kash Khaira	*Chela laubaca*
73	Black carp	*Mylopharyngodon piceus*
74	Mirror carp	*Cyprinus carpio*
75	Big head carp	*Aristichthys nobolis*

Table 91. Summary Finding of case studies of Sanctuary's

Sl. No	Name of Jalmohal/ Sanctuary	Management by CBO/ NGO/ GOB	Impact on				
			Productivity	Biodiversity	Environment	Socio-economic of fishers	Others
1	Sirijdia Baor, Magura Sadar,	GO/NGO	Increased	Improved	Positive impact on environment.	Improved	Conflicts with agriculture
2	Nobo ganga rtiver, Magura Sadar	CBO	Increased	Not improved	No adverse impact	improved	Conflict with agriculture
3	Nobo ganga river, mohammedpur (nohahati part)	GO	Increased	Improved	No adverse impact	Improved	do
4	Teka-Mukteshshari, monirampur	GO	Increased	Not improved	Conflict with resources user	Improved	do
5	Lokhi danga bridge, Monirampur	GO	Increased	Not improved	Creating water logging	Slightly improved	Conflict with WAPDA
6	Beal Kadaria, Monirampur	GO	Increased	Improved	Creating logging of water	Positive impact for the member	Conflict with indirect resources user
7	Dohakhola, Bagharpara	NGO	Increased	Improved	No adverse impact, average	Positively improved	Conflict with agriculture
8	Sathara khal, Lohaghora	GO, NGO	Increased	Biodiversity increased	Sanctuary has no negative impact on ecology and fish	Properly improved	Recently water pollution has affected the Biodiversity
9	Bill Khukshia , Keshobpur,Jessore	GO and NGO	Increased	Same	No adverse impact	Improved	
10	Baor morshina, Keshobpur,Jessore	GO/NG0	Do	Developed	Better	Community in adjacent area is benefited.	Jute retting is a great problem

Sl. No	Name of Jalmohal/ Sanctuary	Management by CBO/ NGO/ GOB	Impact on				
			Productivity	Biodiversity	Environment	Socio-economic of fishers	Others
11	Nurpur, Jessore Sodor	GO	Increased	Improved	Average	Changed	Problem for managements
12	Pagladah, Jessore Sadar	GO	Increased	Changed	Good	Changed	Problem for managements
13	Vatioel, Shalikha	GO, NGO, CB	Increased	Improved	Average	Changed	Jute rottening
14	Chukinagor, Shalikha	GO, NGO, CB	Increased	Improved	Average	Changed	Jute rottening
15	Purakhali baor, Avoynagar	GO, NGO	Increased	Changed	Good	Improved	Embankment is needed
16	Mishtrydiara, Jhikargasha	GO	Increased	Changed	Average	Moderately changed	Full of aquatic weed
17	Panchanagor, Jhikargasha	GO, NGO	Increased	Changed	Low	Moderately changed	Full of aquatic weed
18	Purakhali baor,Avoynagor	GO, NGO	Increased	Improved	Good	Changed	Problem in embankment
19	Basuakhali, Terokhada	GO	Slightly increased	No change	Low	Moderately improved	Deterioration of water du to stagnant condition
20	Baoisona, Kalia	GO	Slightly increased		Low	Moderately improved	Lack of water in dry season
21	Betna river, Kalaroa	GO, NGO	Increased	Improved	Average	Improved	Jute rottening
22	Jaggonathpur kole, Kumerkhali	GO	Increased	Improved	Average	Have positively changed	Fluctuation of water level
23	Talbaria baor, Daulatpur	GO	Increased	Improved	Average	Have positively changed	Lack of water in dry season
24	Banipur baor, Jibonnagar	GO, CBO	Increased	Slightly change	Average	Moderately improved	Deterioration of water du to stagnant condition

CHAPTER 5

Discussion

CHAPTER 5

Discussion

5.1 Overall changes of fish production

It is evident from the review of literature and existing sanctuary impact that sanctuary/reserve as means of protection and conservation of living aquatic resources is an important and efficient tool for management provided it is properly planned and executed/implemented. Where resource is under pressure of heavy exploitation by poor group of people as means of their livelihoods in developing/ poor countries like Bangladesh and where the people are illiterate, it is difficult to manage a sanctuary only through Govt. intervention. People's awareness and participation /cooperation are essential for management and sustainability of the sanctuary. In the past, the sanctuaries could not be sustainable mainly due to lack in proper planning including lack of cooperation among different Govt. organizations. The benefit of sanctuary could not be fully achieved due to non-involvement of the community. However, it appears that the communities are not properly organized and capacity built up in most of the cases to run the sanctuaries after the project support (NGO) is withdrawn. The community needs support for longer period to develop their attitude skill, management capability to run the sanctuaries on sustainable basis.

In the post project period the supervision and monitoring of the Jalmohal and sanctuary management by the Govt have relaxed or lately stopped in many sanctuary sites due to lack of manpower and funds. NGO support has also been withdrawn after the project is over. The community organizations have been involved in local conflicts and the community organizations have collapsed leading to closure of the sanctuary particularly in large water bodies like reverine Jalmohals. In large Jalmohal like rivers, community organizations have been reported to be non-functional because of large area with many community members. Some sanctuaries have become non-functional due to external influences of local power groups.

53 sanctuaries were established under 45 water body (rivers and beals) by the Department of Fisheries through their 4th Fisheries Project from 2001 to 2003 (DoF 2005). Because of establishment of sanctuary, the production of fish increased at the rate of 15% to 200%.

However in this study it was seen that the earlier fish production in all the sanctuary was diminishing. The base line production went down 60-100 kg/ha, consequently, this production came up to 600 kg/ha in case of some water body (Table 36) might impacted from the establishment of sanctuary including other management taken in the rivers or canals or haors or beels.

The diminishing fish production trend of the sanctuary area was found during the period of establishing the sanctuary. In baseline period, total and individual production also decreased badly. It might occur due to change of the habitat, loss of connectivity with the main channel and lack of proper management and many other causes. When the first time organized management practices began in the sanctuary site, there were a lower productions, might occur due to lack of effective management as because of the fact that the beginning year was the preparatory phase for effective management process. Then the main activities were limited to the community institutional arrangement, preparation of fisheries management plan (FMP) and awareness building. Therefore, the management effects were not reflects properly on the production. Hence, a decreasing trend was found at that period.

When, as per plan developed and approved by the community, effective management measures were taken and at the same time, some area was protected as sanctuary, fish production were found increasing after establishing the sanctuary. In this period, the baseline production increased more than double and in some cases eight times of the baseline. That increasing trend can be considered as the outcome of the sanctuary including other managements taken in the sanctuary site. One thing should be kept in mind that impacts of a sanctuary depend on the other managements taken in the whole water body. Its success depends on how effectively protect the fish ban area along with the other restrictions incorporated in the over all water body management.

We can explain this increased production in an alternative way. In this regards, over all, we can consider the hypothesis - (1) Fish production increased due to the other management operated in the sanctuary area. (2) Fish production increased because of more favorable

climatic and other geophysical conditions prevailed in the impact period. (3) Fish production increased due to sanctuary management in the sanctuary.

Almost similar increasing production trend was found in other sanctuary sites in Bangladesh. In different water bodies many sanctuaries were established, under the GO or NGO which were managed by CBO. Impacts on fish production and biodiversity conservation were found to increase in varying degrees. The results show that in the study site the number of fish species increased within a few years of sanctuary establishment.

From this survey, it was seen that production of different species were increased. In Jessore districts, production increased about 150-200%. But in Naril districts production increased about 200-350% and in Magura 220-270%. Where as in CBFM project fish production increased by 81.42%.On the other hand, in MACH (Management of Aquatic Resource through Community Husbandry, a project operated by Ministry of Fisheries & Livestock.) project fish production increased 110- 163% (DoF, 2005). A big success were found in Haile Haor, Srimongal, under Habiganj district where 27 sanctuary were established 1998- 2003. Fish production found increase from 171.08 kg/ha. to 316.0 kg./ha. (CNRS, DoF). In the same period in Turag- Bangshi river of kaliakair, Tangail & Gajipur districts where fish production increased from 59.57 kg/ha to 321.0 kg./ha. While in Kangsho Malighi River, Sherpur district where 23 sanctuaries were established. The fish production were increased in this river from 150kg/ha to 316 kg/ha with in 3-5 years. In these sites, in some cases the production was higher than the production of the study site. This variation might come from the effective support activities and management taken for those sites. In those sites, a lot of connecting channels were made. Beside these, a strong institutional arrangement was provided for effective management of the sanctuary site. Where as in case of study site, there were some laps and gaps such as connectivity with the main channel, Proper sluice gate management, environmental pollution, public awareness were not improved and also using prohibited fishing gears and fishing in blocked season.

In this study it was seen that fish catching rate in dry season is higher than rainy season. According to (Baird *et al.,* 2001b; Baird & Flaherty, 2005) fishers realize that when water

levels are high, fish are much less vulnerable than during the low water dry season, and concentrate their protection efforts in the latter period.

In this study, the production of air, boal, chital, tengra, piali, bata, shing, magur, koi, chital, baim, baila etc. and also the Indian major carps production increased amazingly. Such notable increasing might occur due to impact of sanctuary in the rivers or canals or haors or beels. All respondent including fishers said that the species mentioned above were true indicator for that sanctuary. The sanctuary in the water body provided a safe zone for escaping small, medium and above all parent fish. It also provided a safe environment for breeding, nursing, feeding, escaping and growing of those fishes. That is why increased production obtained.

The base line productions of the extinct species chala, tengra, pabda, sarputi were incresed in chatra khal, narial. in the jessor region chital, sarputi, magur, boal, air, batasi, tengra, della etc. were regained. From the captured fisheries, it was seen that about 0.72-1.20% is extinct species.

The base line production of other indicator species (endangered and threatened, discuss it individually mentioning) were found in such a low level that indicated the vanishing state of those species. After sanctuary, the impacted production of those species was good enough indicating the reappearing trend of those species. It can be compared with the other CBFM (Community based Fisheries Management, a project implemented World Fish and DoF.) sanctuary sites of the country, where the species number increased by 31.24%, In 54 FFP (Fourth Fisheries Project, DoF) sanctuary sites 23 species recovered from the endanger level. In this study site, it was found the recovery trend of at least 5-15 species.

Study also shows that the production of chanda, puti, taki, bain and chingri in kustia and magura are reduced gradually. These decreasing continued even in the impact period. This badly decreasing might occur due to amazing increase of predatory species like baila, boal, chital, air, shol etc.

5.2 Socio-Economic Profiles of the Fishermen Community

5.2.1. Woman participation

Fishing is considered as a low-class profession and fishermen are traditionally poor. They lived from hand to mouth (Hannan, 1994). These fishermen are socially, economically and educationally disadvantaged communities and lack their own financial resources (Rahman, 1994b). Fishermen and their families in the South and South East Asia often are considered to be among the poorest of the poor (Bailey, 1994).

Due to poverty and employment problem woman takes part in fishing and agricultural activities. However, in case of direct involvement their participation is a case of great repent. The highest participation was found at the Jaggonnathpur Kole in Kustia district that is 454 within 1536, the percentage is about 30% (Figure 12). According to the interviewee, almost all males over 15 yrs are directly engaged in fishing, while women help in weaving and repairing of nets, making fish traps, and are also engaged in maintaining the house, collecting firewood and livestock rearing to supplement the household income.

5.2.2 Educational Background

There is a strong relationship between society and education (Veerina *et al.,* 1999). Human resource development is largely a function of literacy and educational attainment. Amongst fishermen, literacy and education attainments help to develop conceptual skill and also facilitate the acquisition of technical skill, which can have direct bearing on income generation, expenditure and saving activities. Atapattu (1994) stated that fishermen should be properly educated with respect to the importance of management. Education of fishermen was also reported to help improve the efficiency of rural household's in production (Wang *et al.,* 1996).

Four categories were used to define education level: 1) Sign only, 2) Up to primary, 3) Up to secondary, 4) Up to HSC. From the total interviewed highest 5 fishetmen was found above higher secondary level of education that was shown in the figure 7. These findings concur with the results of Rahman (1994a), who noted that in Bangladesh, most of the fishermen were illiterate and few had primary level education. A few respondents stated that they did

not appreciate the importance of educating their children. Rather, they try to send them for fishing, or engage in other supplementary activities for additional income. Fishermen educational background represent in the result section. So in this study average result was shown below the table:

Table 92. Educational background of fishermen

Education				Total
Sign only	Up to Primary	Up to secondary	Up to HSC	
50-65%	27-35%	7-12%	1-2.5%	100.00%

5.2.3 Occupation

Fishing cannot provide full time employment, and the income derived therefore may be insufficient to provide adequate means of livelihood. As such, secondary occupations are involved. Here, average 60-70% professional fishermen were found. All respondents stated that their secondary occupation was agriculture, day labor, small business etc. Ahmed (1996) found that the full time fishermen in Tangail district area were 84%; 24% had subsidiary occupation, 81% were found fishing throughout the year and 92% were member of some associations, clubs and co-operatives. DOF (1993) on fishermen community of the chanda beel and revealed that there were 22% professional and 74% non-professional fishermen

Hannan (1994) said fishing is considered as a low-class profession and fishermen are traditionally poor. They lived from hand to mouth. These fishermen are socially, economically and educationally disadvantaged communities and lack their own financial resources (Rahman, 1994 b). Fishermen and their families in the South and South East Asia often are considered to be among the poorest of the poor (Bailey, 1994). A vast majority (90% and 91.66%) fisherman of the Dhaleswari River is engaged in full time fishing. This study also revealed that maximum fishermen caught fish individually, and more than 97% fishermen were members of different associations (Al-Muhit, 2000).

Table 93. Occupation of fishermen

Occupation			Total
Professional Fisherman	Occasonal Fisherman	Subsistance Fisherman	
60-70%	13-18%	15-20%	100.00%

5.2.4 Gross Annual Income

Farmer's income is a key measure reflecting economic security, to the extent of adequacy in income to meet basic needs of the household. A household is economically secure when it has the capacity to generate sufficient income to satisfy the basic needs of the family and to maintain or increase the goods necessary for the stability of the household economy. Increasing population pressures may aggravate the problem of major incomes of fishermen. According to the survey, the average yearly income of a fisherman is increased after the sanctuary. Each earned about 50-70 Tk/day before the sanctuary but 110-150 Tk/day after the sanctuary. This was the average income of farmers of all the sanctuary. After sanctuary there is a great scope for them to buy fishing gears and also to educate their children.

Chantarasri (1994) reported about the Sunderbans Reserve Forest (SRF) fishermen community. Fishing was carried out in-groups. Most fishermen own their fishing gears with which they caught less than 40-kg fish per month. Typically, monthly earning was between 2000 and 3000 taka. DOF (1993) on fishermen community of the chanda beel and revealed that average household income was 15000 taka per year.

CHAPTER 6

Problems and Constraints, Suggestions and Recommendation

CHAPTER 6

Problems and Constraints, Suggestions and Recommendation

6.1 Problems and constraints

A major problem in management of fisheries in public water bodies is the policy conflict between the government ministries. The Ministry of Land (MOL) is the custodian of the water bodies and is responsible for collecting the maximum revenue by leasing those water bodies, on the other hand the Ministry of Fisheries and Livestock MOFL)'s mandate is to ensure that all of the country's fisheries including jalmohals are managed to ensure the maximum sustainable yield of fish, while the Ministry of Environment and Forests (MOEF) aims to protect natural habitats maintain biodiversity and ensure an acceptable quality of water. Most of the sanctuaries have been established under development projects. The procedure of transferring jalmohals from MOL to MOFL for biological management or establishment of sanctuary is a lengthy and difficult task. After long negotiation and struggle, water bodies could be physically transferred to the projects and community management, maybe only in the middle of the project life and after the project paid the full revenue due from the project start. However, when the project period is over, lease fees cannot be paid from the normal budget of DOF for shortage of fund, and if the community organization does not continue to do this or there is no community organization, then the water bodies are taken back by MOL and are leased to others for fishing. When this happens all the effort of establishing the sanctuary along with its achievements will have gone in vain.

Poaching (illegal fishing) is the major problem for sanctuaries. As fish become more abundant in a sanctuary, it becomes attractive for poaching. Now a day, by setting a gill net (current jal) one can catch a lot of fish easily. Using brush piles or other structures in the sanctuary helps reduce this risk, but negligence or dishonesty by guards is a big risk. Water pollution is also a threat to sanctuaries. It may kill fish directly, or due to an unfavorable environment and loss of food, fish may move away to pollution free areas where they can be caught by the fishers. Agro-chemical pollution is affecting fish and other aquatic organisms everywhere, but rules in the areas immediately surrounding a sanctuary may be needed. Pumping out of water from a beel sanctuary for agriculture or extreme drought may reduce

the water area and depth in a sanctuary, resulting in heavy natural mortality, degradation of water quality, and possibly disease outbreak. In the long-term, there is a risk that sanctuaries (and water bodies) will silt up unless more actions are taken to control soil erosion and maintain the banks of channels.

In community-based management, a local committee is responsible for management including fish sanctuaries. Lack of coordination among the committee members, and with government and/or concerned NGOs may also lead to failure of a sanctuary. Lastly proper site selection considering physical, hydrological, biological, environmental and social factors is very important in establishing a sanctuary, and this is addressed in the recommendations.

6.2 Suggestions and recommendation

The findings and recommendations have been made based on the research/study will be useful for the planner/policy makers, managers and primary stake holders for proper planning and management of fish sanctuary for enhancing efficiency and ensure sustainability of fish sanctuary in Bangladesh. The results/findings of the study may be disseminated to the policy makers/managers for planning implementation and management through

General

1. Strong management and institutional support is required for successful operation of a sanctuary. So it needs to organize local community before establishment of a sanctuary.
2. Sanctuary type and site selection should be based on local communities Knowledge and experiences, so, active participation of the community in planning and implementation is truly expected.
3. Need to develop management plan for controlled fishing and effective implement of it in the sanctuary water body.
4. Massive awareness on positive impact of the sanctuary in the locality is essential for its success.
5. Alternative livelihood program is needed to reduce the negative impact of the sanctuary on local fishers.

Specific to the site

1. Need to connect the sanctuary with the main channel supported by required fish friendly structures.

2. Need to excavate the existing connecting canals of the sanctuary to make it more deep and wide.
3. Fish friendly operation of sluice gate is needed to connect the sanctuary with the adjacent flood plains.
4. Need to set up more brush files with branched bamboo poles in the existing sanctuary.
5. Need to stock endangered species in the sanctuary.
6. Need to make liaison with the local farmers to control surface water pump and insecticides used in the adjacent agriculture farms.

6.3 Sanctuary Management

The most important part of a sanctuary is its management mainly the protection against poaching/ illegal fishing. Public management of sanctuary has proved to be inadequate and poor, often allowing illegal fishing by the guards of the sanctuary in absence of community participation. On the other hand, community participation and co-management have in many cases proved more effective with higher compliance with rules, if the community is properly organized and motivated.

Specific management activities should include:

(1) Placing brush piles /concrete structure

If there is no siltration problem, brush shelters may be placed for protection against poaching and to provide substrata for fish to feed on. Concrete structures (hexapods) have been adopted by MACH in some situations, they are not recommended in rivers or khals, but in the deeper spots in beels, they have the advantage of durability – reducing pressure on cutting down trees and the recurrent cost that community organisations and/or government would face for new brush piles each year. The comparative impacts of these structures have not yet been studied.

(2) Guarding the sanctuary

Proper steps are to be taken for guarding the sanctuary against poaching. Community management of a sanctuary can reduce poaching significantly. Larger sanctuary areas tend to

need full time guards, especially when they are distant from the communities that have established them or that are in support of the sanctuaries.

(3) Improvement/restoration of sanctuary

If the sanctuary area or the connecting canals are silted up, they should be excavated. If there is suitable higher land (normal monsoon inundation not more than about a meter), native trees adapted to swamp conditions (Hijal and Koroch) can be planted to restore "swamp forest" an important component of the wetland ecosystem that once existed in much of the central and north-east regions of the country and which is a valuable nursing ground for fish.

(4) Community awareness and organization

The community should be organized properly for longer period to develop their skill and management capability. The community involved in the fishery / sanctuary management should be made aware of the sanctuary benefits and importance, in terms of not only fishery benefits to them but also the wider ecological importance of sanctuaries and their wildlife. They should be advised on best practices, helped to plan for management including their own local knowledge and experience as well as "expert" advice, and be organized and trained in appropriate skills.

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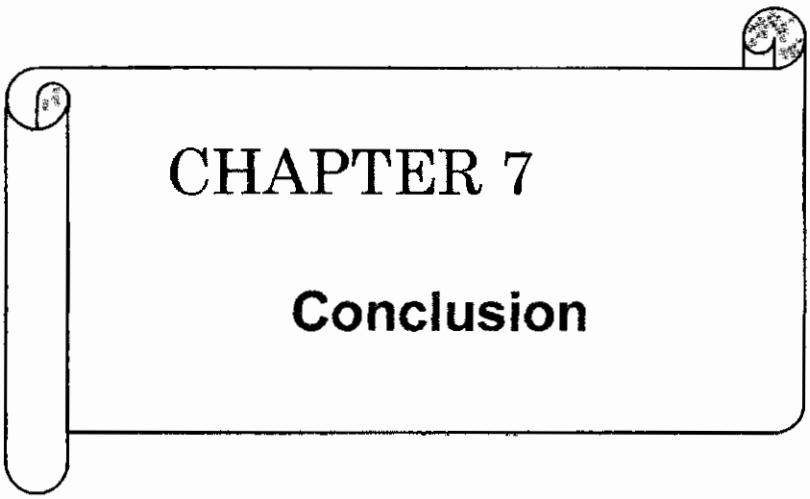
(5) Monitoring and impact assessment

The managers – fishers/community and government - need to see whether a sanctuary is effective. For a sanctuary that is part of a fishery managed by a community for its livelihood security this means generating a benefit in terms of fish stock and fish catches (quantity, value and diversity of species) from the rest of the fishery, and therefore an income benefit for fishers as a whole Simple techniques need to be developed with the user community for assessing impacts and refining their management plans (including sanctuaries). The concerned authorities need to know what change in biodiversity occurs with the sanctuary, and to see that the environment is restored or remains as intended – data on siltation rate, water quality, wintering water bird counts, as well as information on fish catches in

neighboring areas (fish moving out of the sanctuary) will all be valuable, along with records of poaching incidents and other management problems.

6.4 Further study is needed on

1. Identification of stock abundance of the sanctuary by length frequency and catch composition.
2. Find out the recruitment patterns of the selected fishes of the sanctuary.
3. Identification of breeding ground of selected fishes in the sanctuary and adjacent river, canals and flood plains.
4. Find out the gear efficiency of the gears used in the sanctuary for future effective management plan.
5. Find out the suitable management options/tools for enhancement of immigration from the river in to the sanctuary.
6. Impacts of the shape, Size and duration of the sanctuary to measure its effectiveness.
7. To identify the effectiveness of different sanctuary materials for successful sanctuary operation
8. There should be strong management community
9. Sanctuary should be free from fishing.
10. Operational fund should be ensured.
11. There should have awareness raising program for the local communities of sanctuary.
12. Sanctuary should be established permanently in the water body to enhance fish catch, species diversity and conservation.
13. Sanctuary should not be too large or too small in a water body.
14. Holding workshop/seminar and circulating policy breaf/leaflets.
15. Guideline for sanctuary planning establishing, protecting, managing and monitoring may be prepared as extension material for all stakeholders.



CHAPTER 7

Conclusion

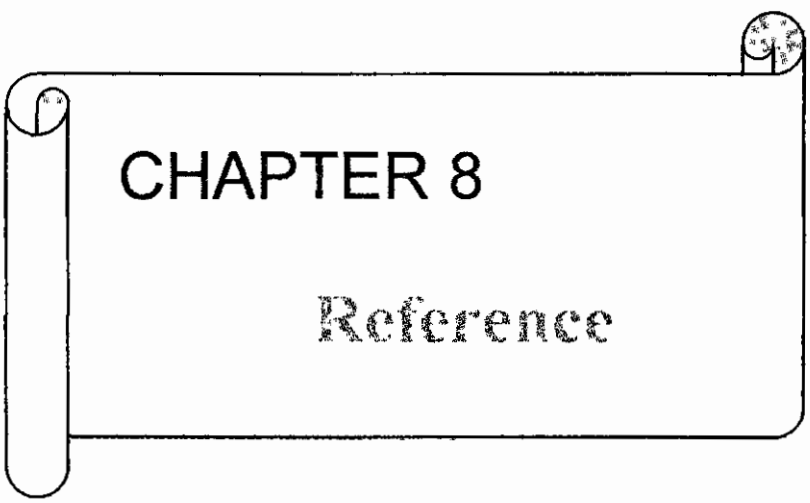
CHAPTER 7

Conclusion

Inland open water fisheries resource of Bangladesh is one of the richest in the world just after China and India. It would in the past contribute more than 90% of the country's fish production. However, it has experienced a significant decline during last four decades due to manmade and natural causes such as over fishing, destructive fishing, loss and destruction of fish habitats, poor policy, planning and management etc. Fish stock, particularly the brood stock has depleted to below replaceable level. As a result, fish production, biodiversity and fishing community have been affected. Govt. has taken different measures for protection, conservation and management of the fisheries resources for sustainable production. Of the measures taken fish sanctuary has been considered as an important tool for protection and conservation of fisheries resources.

In many countries, both home and abroad, Fish Sanctuary has been practicing as one of the effective open water management tool for booting up natural production and biodiversity conservation. In the recent past, a lot sanctuary of different categories has been set up in different water bodies. But a little has been known about actual impact on fish production and biodiversity conservation. In fact enough and credible catch, data on various aspects of the sanctuary are not available in our country that can assist the development planners, workers and fishers in setting up an effective sanctuary. With a view to fulfill this, need a little study steps were taken in different water body in the Greater Khulna region where sanctuary under Government, Non Government and community based management were going on. The study has focused mainly on fish production trend – to see the change before and after the sanctuary in the kole. In this study it was seen that the over all production of the sanctuary area have been increased significantly and the production of some species increased amazing. Some disappearing species were showing reappearing trend. Although, many other factors may influence this increased production. Superficially, we can conclude that this increased production is the outcome of sanctuary management in the hoar, baor, beel, canal, river etc. Further studies on many aspects are needed to make a concrete conclusion.

To make a sanctuary successful, a strong management and other supports are needed. This management shall be supported by a strong community organization. Avoiding some limitation of the study, it can be concluded that the sanctuary is one of the more easy and effective tool for capture fishery management to boost up production & biodiversity conservation.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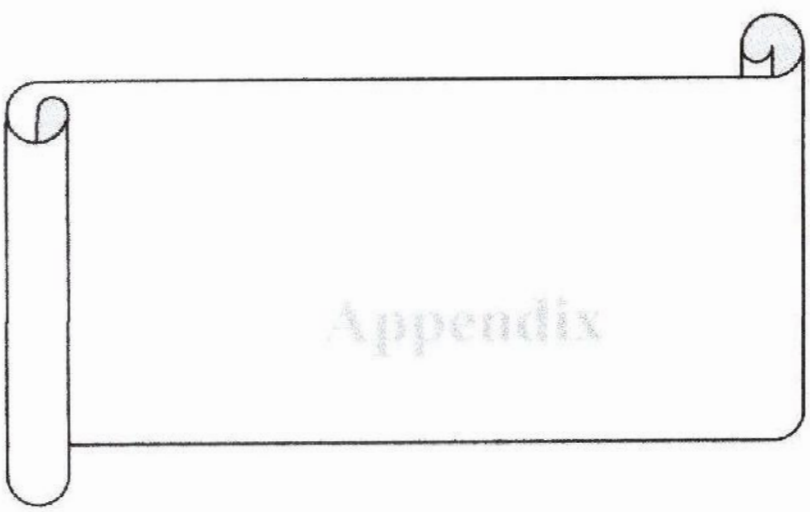

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The information was colleted from the fishermen by using the below questionear during the field visit.

Name:
Cantact no:

Date: **Data sheet No:**

1.	Location:	District:	Thana:	Village:
2.	Name of the Sanctuary:		Area:	Depth:
3.	Sanctuary type:	Perennial/seasonal:	Permanent:	
4.	Sanctuary type:	Open:	Closed:	
5.	Habitat type:	River/canal	Baor/Beel	Others
6.	Type of water body:	Fresh	Brackish	Marine
7.	Management type:	GO	NGO	CB
8.	Duration:	Starting Yr.:	Closing Yr.:	Ongoing
10.	Number of fishermen engaged:	Before:	During:	After:
11.	Number of fishermen of different religion:	Muslims:	Hindus:	Others:
12.	Number of people dependent on sanctuary:	Before:	During:	After:
13.	Total Fish production from sanctuary:	Before:	During:	After:
14.	Season wise fish exploitation: (Monthly or yearly exploitation of diff. sp.)	Maximum:	Minimum:	Average:
15.	Extinct/endangered species before sanctuary:	Extinct:	Threatened:	Endangered:
16.	Extinct/endangered species after sanctuary:	Extinct:	Threatened:	Endangered:
17.	Species available before establishing sanctuary:	Exotic:	Indigenous:	
18.	Species available during sanctuary P.:	Exotic:	Indigenous:	
19.	Species available after sanctuary P.:	Exotic:	Indigenous:	

20.	Status of species other than fin fish: (Crustacean/mollusk/reptiles/amphibians/others)	Before:	During:	After:
21.	Status of breeding ground:	Newly Developed:	Not developed:	
22.	Status of nursery ground:	Newly Developed:	Not developed:	
23.	No. new species recruited after sanctuary:	Exotic:	Indigenous:	Others:
24.	Status of overall biodiversity after sanctuary :	Improved:	Unchanged:	Degraded:
25.	Existence of shelter provided in the sanctuary:	Yes:	No:	If yes, then Material:
26.	Fishing period:	Throughout the year:	Seasonal:	Closing period:
27.	Types of fish harvesting:			
28.	No./type of fishing boat used before sanctuary	Types:	No:	Person/boat:
29.	No./type of fishing boat used during sanctuary	Types:	No:	Person/boat:
30.	Fishing gears used before sanctuary:	Types:	No:	Person/gear:
31.	Fishing gears used during sanctuary:	Types:	No:	Person/gear:
32.	Prohibited fishing gears:	Types:		
33.	Environmental condition of the sanctuary:	Good:	Average:	Low:
34.	Environmental condition around the sanctuary:	Good:	Average:	Low:
35.	Pollution factors available:			
36.	Income of the fishermen/month/year:	Before:	During:	After:
37.	Training provided for fishermen:	Yes:	No:	
38.	If yes, Training provided by:	GO:	NGO:	Others:

39.	Status of awareness of fishermen:	Before:	During:	After:	
40.	Credit facility for the fishermen:	Yes:	No:	If yes, then source:	
41.	Socio-economic condition of fishermen before:	Standard:	Average:	Fall:	
42.	Socio-economic condition of fishermen during:	Standard:	Average:	Fall:	
43.	Socio-economic condition of fishermen after:	Improved:	Unchanged:	Fall:	
44.	Women participation	Yes	No.	If yes, then %:	
45.	The way of women contribution in sanctuary:	Activities:			
46	Status of education in fishermen family:	Improved:	Unchanged:		
47	Alternative livelihood option, if any:				
48.	Proposed alternative livelihood option:				
49	Harvested agricultural crops from sanctu. area:				
50.	Aquatic vegetable/weeds available in sanctuary:				
51.	Suggestion of fishermen and other stakeholders for the improvement of the sanctuary:				
52.	Effect of sanctuary on the local fish market:	High:	Mild:	Low:	No:
53	Other necessary information (Tourism, Problems, effect of amphibians):				

PHOTO GALLERY

Fig: Study site covered with aquatic weeds

Fig : Sanctuary established in Jaggonnathpur Kole

Fig :A wide range of PRA tools have been used to collect required information for this study.

Some of the fish species found in this study are given bellow. (Photo was taken during the data collection)

Fig : Kajali *(Ailia coila)*, Chital (*Notopterus chitala*), Pabda (*Ompok pabda*).These species show reappearing trend in the study.

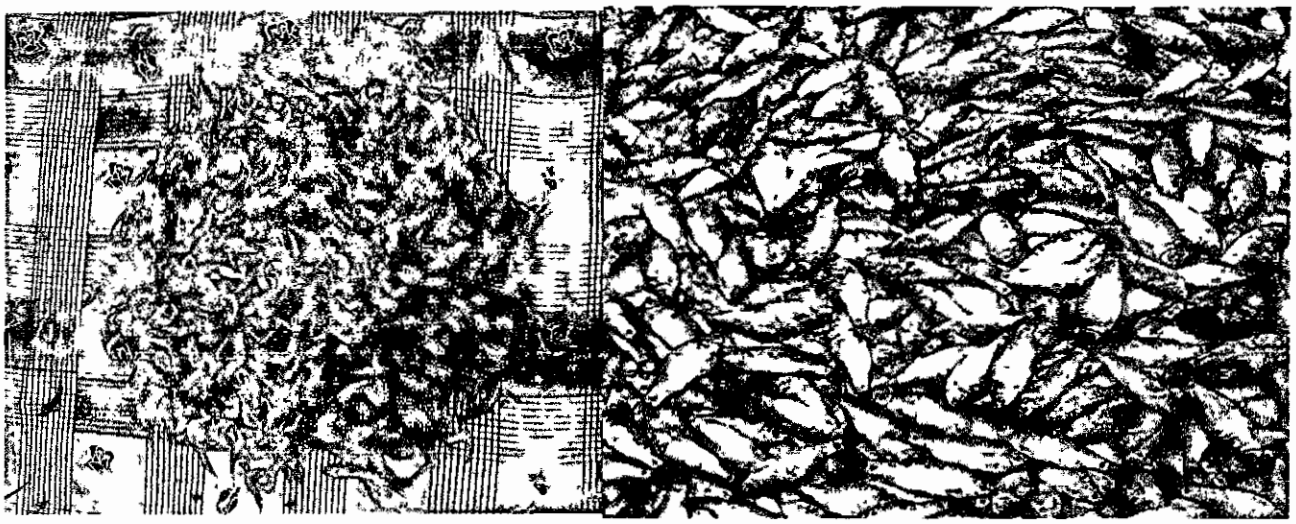

Fig: Small chingri (*Pelaemon spp.*)

Fig: Puti (*puntius spp.*)

Fig: Different types of Bata found in the kole)

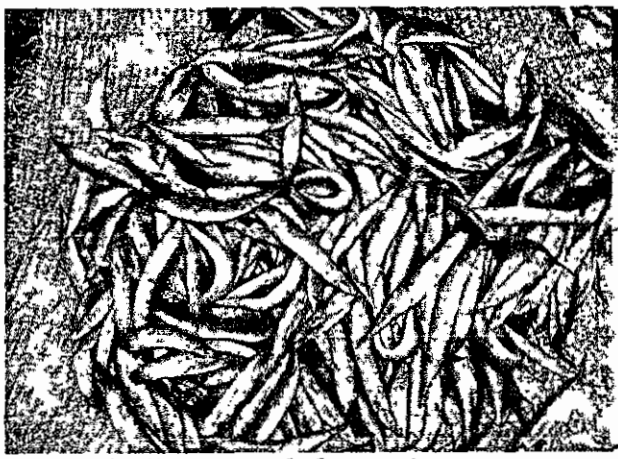

Fig: Bain (*Mastacembelus spp.*)

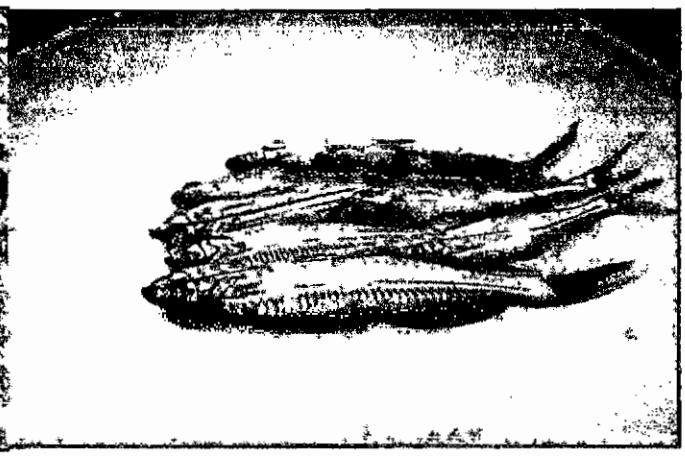

Fig : Tengra (*Mystus tengra*)

Fig: Beley (*Glossogobias giuris*),

Fig: Chapila (*Gudusia chapra*)

Fig: Air.(*Mystus aeor*)

Fig: Boal *(Wallago attu)*).

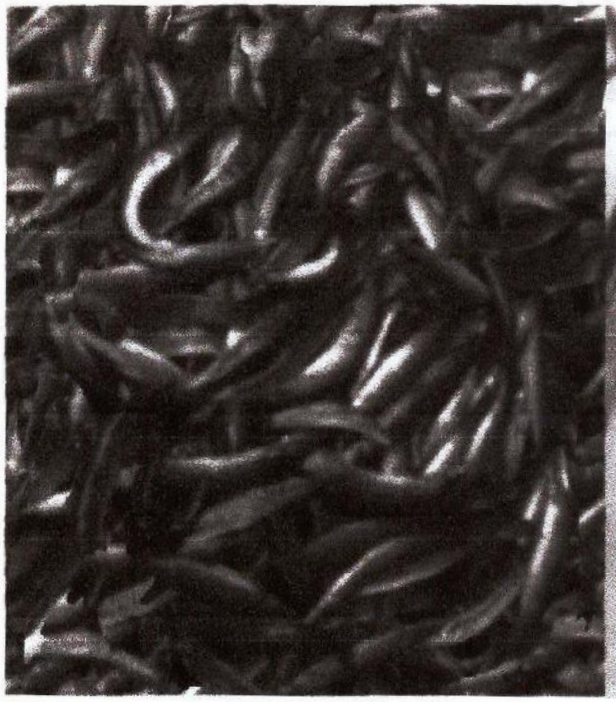

Fig: Kucho Bain. (*Mastacembellus pancalus*).

Fig: Shoal (*Channa striaitus*).

Fig: Shing (*Heteropneustes fossilis*)

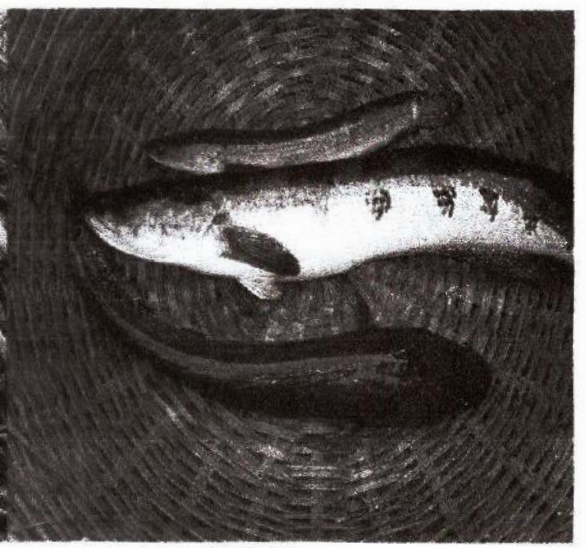

Fig: Gozar (*Channa marulius*)

Fig: kholisa (*Colisa fasciatus)*

Fig: Telapia (*Oreochromis mossambica*)

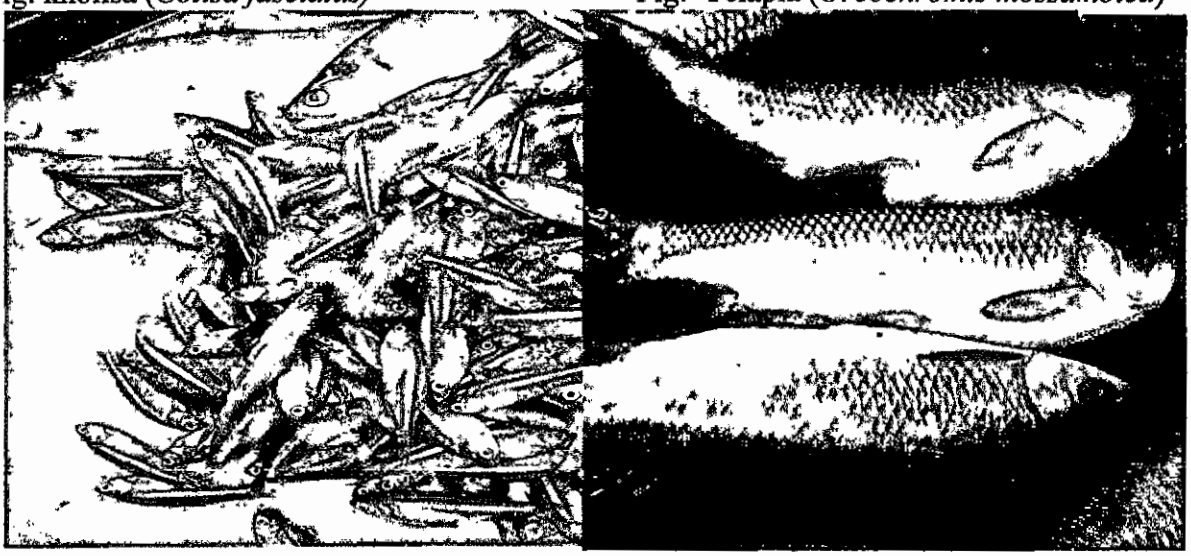

Fig: Mola (*Amblypharyngodon mola*)

Fig: Rui *(Labeo rohita*)

Fig: Mixed Species. Some of the other fishes found in this study,