

**PRESENT STATUS OF CULTURE AND CAPTURE
FISHERY IN BEEL DAKATIA AND THE SOCIO-
ECONOMIC CONDITION OF THE PEOPLE IN THE
REGION**



A Project Work

By

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Examination Roll No: MS-050610

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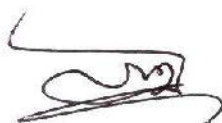
A project work submitted in partial fulfillment of the requirements
For the Degree of Master of Science in Fisheries and Marine Resource Technology

August, 2007

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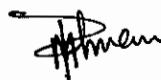
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Declaration

Present Status of Culture and Capture Fishery in Beel Dakatia and the Socio-Economic Condition of the People in the Region

The results presented in the project work with the above mentioned title are entirely of the candidate's own investigations and no part of the results has been accepted for any degree nor is it being concurrently submitted for any degree.

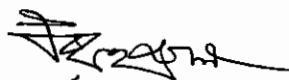


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DEDICATED TO
MY BELOVED PARENTS



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Abstract

A Survey was conducted in Beel Dakatia at Dumuria, Fultala and Daulatpur thana under the district of khulna. A questionnaire was used to collect the information through interview, which included the aquaculture, capture fishery, agriculture and socio-economic related information. Total area of Beel Dakatia is about 28,328 acre and total population is about 1,35,000. About 5365 people directly and 26829 people indirectly involved in aquaculture, about 264 people directly and 1320 people indirectly involved in the capture fishery, about 1014 people directly and 5071 people indirectly involved in the pure agricultural activities. The area distribution was 52% for aquaculture, 31% for housing, 9.83% for agriculture, 2.56% for capture fishery, 0.61% for marshland and 4% for shop, bazaar, mosque, school, college, madrasha and other things. There are found mainly two types of culture system that is integrated culture and poly culture. About 93% farmers practiced integrated culture and only 7% farmers practiced poly culture. Because integrated culture is more beneficial than poly culture. In poly culture, average production of prawn and fish were found to be 225 kg/acre and 95 kg/acre respectively and in integrated culture, average production of prawn and fish were found to be 198 kg/acre and 83 kg/acre respectively. In case of integrated culture, paddy and other vegetable products were also produced along with prawn and fishes. Average production of paddy in integrated culture was found to be 1560 kg/acre. About 22 types of vegetables and fruits were found in the integrated culture on the dyke of the farms. Net profit per acre from integrated culture and poly culture were recorded to be 59,673Tk and 51,022Tk respectively. A total of 41 different species of fish and 3 species of prawn were identified in the capture fishery where as only 8 species of fish and one species of prawn were cultured in the culture fishery. Only three types of craft including Nouka, Donga (Talgas) and Vella (banna tree) were found in capture fishery where as in aquaculture, some farmers only used Nouka. The study also observed that 5 types of gear (Khapla jal, Tana jal, Current jal, Fash jal, Thela jal), 6 types of trap (Ghuni, Vair, Chonga, Polo, Tubo and Bitte) and 5 types of hook and spear (Chip Borshi, Borshi, Fulkuchi, Jhupi and Konch) used in the capture fishery where as only Tana jal and Khapla jal are used in aquaculture for harvesting. Sometimes farmers used fash jal for white fish harvesting in aquaculture. Pure agricultural activities were very limited in the study area. Pure agriculture and capture fishery area is decreasing rapidly with increasing aquaculture activities. People who involved in aquaculture had a better economic condition than that people who engaged in other activities. People suffered many problems in this study area. So there is a necessity of proper organizational involvement to make a proper guideline for the proper use of resources by the community people to ensure their better socio-economic. However, over all livelihood status of the people is developing day by day with increasing aquaculture activities in Beel Dakatia.

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List of Abbreviations and non-English Words

CEP	Coastal Embankment Project
WAPDA	Water and Power Development Authority
BWDB	Bangladesh Water Development Board
BIDS	Bangladesh Institute of Development Studies
GOB	Government of Bangladesh
DoF	Department of Fisheries
CPP	Compartmentalization Pilot Project
SRF	Sundarbans Reserve Forest
BCAS	Bangladesh Centre for Advanced Studies
ADB	Asian Development Bank
FCD	Flood Control and Drainage
FCDI	Flood Control Drainage and Irrigation
SRF	Sundarbans Reserve Forest

Chapter one

Introduction



Introduction

1.1 Background of the study

Beel Dakatia is the second largest Beel in Bangladesh. Its total area is about 28,328 acre. It is located in the northeastern part of khulna district and falls within the Ganges tidal deltaic plain. The area has been experiencing water logging and drainage problems for more than 15 years as a result of creating polders and ignoring morphological, hydrological and tectonic conditions. This has resulted in crop failure and environmental degradation. The balance that existed between sedimentation and subsidence was totally disrupted by polders, causing very rapid sedimentation in the tidal channels, and very limited sedimentation and rapid subsidence of the tidal flats. In the Khulna and Jessore regions, polders 1, 3, 4, 5, 6, 8, 15, 24 and 25 have been experiencing water logging and among these the most serious problem is observed in polder 25, the waterlogged part of which is known as Beel Dakatia. It lies between longitudes 89°20'E and 89°35'E and latitudes 22°45'N and 23°00'N under the administrative boundaries of dumuria, phultala and daulatpur upazilas of Khulna district (Banglapedia, 2004).

The climatological conditions of Beel Dakatia are characterized by sultry summers and moderate winters. The area also suffers heavily from tropical cyclones and heavy rainfall. The maximum and minimum temperatures usually ranges from 40°C to 29°C and 5°C to 25°C respectively. The average annual rainfall during 1965-1990 was about 1,750 mm. The average relative humidity in the dry season ranges from 64 to 75 percent and in the wet season from 75 to 87 percent. The area is drained by the Solmari, Hamkura, Hari, Salta, bhadra and bhairab rivers. Beel Dakatia and its surrounding areas have marsh clay, peat and deltaic silt deposits. Peaty clay, clayey peat and peat constitute the major part of the area. In fact, the organic rich and fine-textured materials are common except in the slightly raised area, where clayey silt, silty clay and clay are common. Different geological deposits of Beel Dakatia are tidal-channel deposit, natural levee (kanda) deposit, intertidal-plain deposit and subtidal-plain deposit.

Water logging has caused serious environmental degradation and suffering to the people of Beel Dakatia. It affects people, agriculture, infrastructures and water resources. Villages, roads, bridges, culverts have either become isolated or gone under water. Six villages are completely isolated from other villages, about ten villages are more or less detached from the

mainland and about 9,000 ha of arable land are now under water together with all the Sweetwater ponds and even some tubewells. Diarrhoeal Disease, dysentery, gastric and skin diseases are common here. Water logging, increased salinity and siltation in and around the area have affected the flora and fauna. Trees, birds and domestic animals like cows and goats are also disturbed due to water logging and salinity.

An agro-based economy and a colourful socio-cultural life have suffered decline. About 55 percent of farming families have turned fishermen. A sizeable number of local people have already migrated to other places. Before polders were created in the area, crop failure due to saline inundation and monsoon flooding occurred every two or three years. To overcome this problem, Zamindars since the 17th century constructed temporary low dikes and wooden sluices around the area to protect the arable land from natural hazards. After the abolition of the Zamindari system, the problems of land management became serious and crop failure occurred frequently due to irregular and inadequate maintenance of the dikes. To overcome the problem, a programme to create permanent polders was undertaken by the government in 1959 (Banglapedia, 2004).

In the early 1960s in order to protect the coastal areas including these beels from intrusion of saline water, the government conceived a Coastal Embankment Project (CEP) as apart of green revolution program. Then Water and Power Development Authority (WAPDA) constructed a network of embankments forming polders mat provided protection from daily tidal inundation by saline water and from peak seasonal or storm flood level. This project allowed the coastal land to be more intensively developed for agriculture purposes and agricultural protection increase significantly for 10 to 15 years. Crops were so plentiful that the area came to be known locally as the "granary of Khulna".

Beel Dakatia, one of the beels of the coastal area was empoldered by the polder no. 25 under CEP to save it from both sweet and saline water. This polder was given three regulators, two were discharging into the Hamkura and one into Upper Solmali rivers. The project was very successful in the first decade i.e. up to the end of the 1970s and cropping intensity increased remarkably.

But after the drainage became a problem because of elevation of the river gradient due to heavy siltation on the downstream. The drainage outlets as well as the sluice gates have

gradually blocked by siltation due to reduce volume of upstream water and decrease the speed of water flow in the adjacent rivers as the constructed embankment obstructed the tidal volume flowing in and out of the polder areas.

The accumulated rainwater of the catchments area of the Beel Dakatia could not get the outlet. On the other hand, the early monsoon rain aided in increasing the extent of inundation. As a result water-logging spreader gradually, the area under permanent flooding has been increasing remarkably since early 1980s. Local people suffered for a decade and waited for the government to find some solutions for them. The prolonged flooding and the continued deterioration in the quality of the stagnant water trapped in the polder particularly frustrated them (Razi and Hossain, 1992).

Although water congestion started from 1982 Government remained apathetic to the sufferings of the people of Beel Dakatia for long two years. In 1984 GOB requested the ADB to investigate the possibility of investment of rehabilitation of 400,006 ha of land originally enclosed by the coastal embankment project in Khulna region. As part of its regional study on drainage congestion the ADB approved a project preparatory TA to first assess the situation of a smaller area (31,900 ha) in January 1985. On the basis of this study ADB approved the Khulna Coastal Embankment Rehabilitation project (CERP-II). A second Coastal Embankment Rehabilitation project (CERP -II) was approved by the ADB in September 1989 to covet another 6000 ha of land to address the immediate congestion problems.

In the wake of there losing morale and frustration with the outcome the Government's rehabilitation program people started agitation against the project (CERP -II). Consequently, Government suspended the project in 1990. However, they did not limit themselves in agitation only; they organized themselves to affect several cuts on the embankment in 1990 to restore natural flow of water in and out of the Beel. Cutting the embankment to allow tidal circulation was perceived by the general local population as a way to improve water quality. For the group, interested in shrimp culture it was an opportunity for promoting brackish water shrimp culture. Furthermore, for the owners of low lying lands near where the cuts were made it was an opportunity to encourage sediment deposition on their low lying lands there by raising the land elevation. The cuts in the embankment have, however, further aggravated flooding and salinity intrusion within the polder, expanding the inundated area from 7000 to 9000 ha. Overtime, the stagnation of water in Beel Dakatia has caused serious damages to

agriculture, forestry, fisheries, livestock and social infrastructure. An unwise development intervention, instead of improving the lot of the local people beneficiaries, has actually lowered their standards of living.

In the previous time, flood tide water entered into vast beel and at the time to ebb tide, that water passed away from river to the sea. There was no scope to drain out the sediment. As a result, day by day, the rivers were converted into plain land. It is seen that 8 to 10 kilometers of Bhadra, Hari, Hunkura, Shalmad, Jhinadha and Shalta rivers were silted around the sluice gates and somewhere the depth of the river is only 1 to 3 meters. The water during the rainy season was stored in beels of those areas and the water could not be drained out as a result vast area has been suffering from permanent water logging. Besides, the land reformation of the beel was stopped because of non-occurrence of flood tide water. As a result, this land was very lower than river plain. Water logging existed from July to March and April of the following year (Khan and Ranju, 1993)

The siltation rate was very much high in the rivers adjoining the beels. After polder construction in Hamkura river, Siltation rate was 5 cm per day. 0.9 meter siltation rate was recorded in 19 days in Hari River. Maximum 50 cm of siltation rate was recorded for rivers. Some areas of the world where water logging is controlled by provision of polder and dredging, they still have more or less water logging. But those areas are maintained properly by dredging to reduce the water logging problem. Bangladesh is a poor country. So it is not so easy to continue dredging in the river to reduce the water logging problem.

In a fresh initiative GOB conducted a Technical and Social Design Studies to accentuate the plan of action to mitigate the sufferings of the people of Beel Dakatia. Instead of top-down 'expert solution' to the problem the SDS study conducted by BIDS recommended ways and means to mobilize beneficiary participation in the project area. As follow up actions to the Technical and Social Design Studies Bangladesh Water Development Board (BWDB) has undertaken an Early Action Plan in 1994 viz. pumping out water from the Beel; rehabilitation of the three existing sluice gates; re-excavation of Shalua river of 12 kilometers out of 20 kilometers; cutting at least 15 new canals within the Beel area; building a new and automatic sluice gate at the connection point of Kajibatcha and Shalua river, and cutting a new canal to connect Sandhya Khal to Shalua river etc. As a result, a part of the Beel has already dried up (Rahman, 1995).

Now, Water logging problem is solved by the cutting a new canal to connect Sandhya Khal to Shulua river. These areas are used as aquaculture, housing, agriculture and capture fishery. This area is very potential for aquaculture as well as agriculture. After connection to the river, the vast area of Beel Dakatia was raised by siltation. As a result, from 1995, the aquaculture farming area is gradually increasing up to now. About 52% area of Beel Dakatia is used as aquaculture. So this area is very potential as aquaculture farming. Socio-economic condition is gradually developing with increasing aquaculture activities in the study area of Beel Dakatia.

1.2 Problem statement

During water logging, the fishery, agriculture and socio-economic structure of the area began to collapse. People lost their land under water. And in the true sense, the whole agro-based community becomes land less and financially shattered. But now, several aquaculture practices like poly culture and integrated culture are available seen in this area. Agricultural, capture fishery and socioeconomic status are quit different from the water logging period.

The fish farmers of Beel Dakatia do not earn expected amount due to lack of technology. The resources of Beel Dakatia would be the tremendous wheel of improving the socio-economic status of the farmer. With considering the community development, it needs to assess the resource profile of Beel Dakatia. Evaluating the fishery status would be the key factors of designing the development strategy. Subsequently, fish culture system, fish diversity, fishing method, marketing system is mandatory issues. Encouraging the local people to use the resource at sustainable level in compliance with assessing the present fishery condition and problems existed is also effective strategy for the development of community livelihood and consequently the resource would be the road to national economic upliftment.

There is no proper management scheme for capture fishery of Beel Dakatia. So many native species are drastically reducing day by day. Government and non-government organization are not found to take sufficient measures to overcome this problem. That's why proper rules and regulation should be applied in a planned way to increase the production as to save the threatened species as well as to improve the livelihood status of the people in the region.

1.3 Hypothesis setting

Relatively in any practical field, socio-economic condition illustrates the present status, standard of living and economic condition of the people. For the overall planning, and development and implementation in fisheries sector, it is necessary to have the sound knowledge about the livelihood pattern of the related people.

Many studies have been conducted about Beel Dakatia. Most of these studies were "water logging" related. In fact income earning activities as an outcome of socio-economic pattern which are affected by the community environment, is one of the most obvious issue that had not been conducted in the Beel Dakatia. So in this respect, this study is very much important.

On the other hand, there are two phases in income earning activities of the people in Beel Dakatia, one before 1980s when people based on the cultivation of agricultural product and another is after 1980s when people switchover their income earning activities in fishing. This study mainly focuses specifically on the present condition of aquaculture, capture fishery and socio-economic condition of the people in Beel Dakatia.

This area is very potential for aquaculture like integrated culture. There were found two types of culture like poly culture and integrated culture. Just a few farmers practiced poly culture but most of the farmers practiced integrated culture in this area, because integrated culture is more benefited than poly culture. The average production of fish and prawn was found to be 225kg/acre and 95kg/acre in integrated culture but in poly culture this production was found to be 198kg/acre and 83kg/acre respectively. This production is possible to rise through proper management. Capture fishery management is most essential to protect the native species. The livelihood status is also possible to increase rapidly through adequate practiced aquaculture and proper management of capture fishery area.

1.2 Objectives of the study

The principal objectives of the present study are as following:

- To observe the present condition of culture and capture fishery
- To observe the status of agricultural activities other than fishery
- To find out present status of socio-economic condition of the involved people in fishery and other non-fishery agricultural activities.
- To identify the problems and to suggest possible measures for overcoming the existing barriers.



Chapter two

Literature review



Literature Review

Amin (1997) reported that before the Coastal Embankment Project (CEP) was launched in the 1960s, the rural people of the area used to practice sustainable agriculture land management in tune with the environment. They had their own style of cultivation. Some unique occupations evolved according to the availability and use of natural resources in the region. Brackish water and others temporarily submerged some portions of land by fresh water. Local people in the past used to make with their own initiative temporary embankments for eight months of the year for crop cultivation. These embankments were removed after each harvest allowing plot-use by browsing river species of fishes and crustaceans. Only local varieties of crops were chosen for cultivation but yearly harvest was not certain as the land was often flooded by tidal surges. Indigenous paddy cultivation and fishing were the people's prime occupations.

Nandy (1996) quoted that the water-logging problem is causing a huge national loss of almost \$12,000,00 per year. Nandy (1995a) expressed in his study that long 10 years of inhuman suffering and struggle has changed the total mode of life Beel Dakatia's people who had never thought of leaving their lush green villages are now crowding the streets and industry premises of the town for work. Nandy (1995b) quoted that land less people was benefited during the water-logging period in the perspective of the source of income only. Nandy (1994) explained that Beel Dakatia sometimes become dry. But again she backed to her own pavilion. Now Beel Dakatia is full of water. According to the villagers Beel Dakatia was free from water only for one and a half months. Again the same scenery has come but there is no fish that was the only source of income of the affected people. At present, people are completely hopeless. Before 80s they were farmers, after 80s due to water logging they become fishermen, but now they are surrounded by water without fish.

Khan and Ranju (1993) reported that the embankment system was fruitful and produced bumper crops in this area from the beginning of 1960 to the middle of 1980. It is noteworthy that the curse Beel Dakatia produced crops of 12-core taka every year during that period. And after making embankment only the rivers remain open and the effect of death trap Farrakkha Barrage makes a dangerous situation. In 1960, the width and depth of these rivers (Solmari and Homkura) were 500 ft. to 600 ft. and 30 ft. at lowest flood level respectively. But now those of the rivers are 150 ft. to 200 ft. and 20 ft. at lowest flood level respectively. Before

1960, water from this region would drain out through natural process (i.e. through existing river). After Construction of coastal embankment protect in this region this natural drainage system hampered seriously. Most of the out falls river silted up tremendously. As a result the outfall riverbed raised over the formation level of the cultivated land. So the whole drainage system became hampered. The area covered by polder 25 is 17400 hacter out of which 10,100 hectare of land is now suffering from acute drainage congestion. The depth of water in some area is 5-6 ft. (approx.). No crop is growing in polder 25. Even the people in this area are now forced to migrate other place to save their lives.

DoF (1990) conducted a survey on the socio-economic conditions of the fishermen in eleven Upazillas of the district of Patuakhail and Barguna under fisheries extension development project and reported that rate of literacy among fishing communities is far less than others areas, their economic condition was so bad that they often could not afford educational expenses for their children. Many fishing households had no latrines of any type. Most of the fishermen were landless; about 70-80% fishermen were labours (work in another gears and boats). About 70% of the fishermen had an average daily income of TK 20-25 and the rest 30% had TK 25-40.

Bhaumik and Saha (1994) carried out a study to assess the socio-economic conditions of the fishermen engaged in fishing in some estuaries of Sundarbans. The age group of the sample varied between 20 years and 70 years. Most of them belonged to scheduled caste community; 36.6 % had have 21- 30 years of experience in fishing. They operated dinghy types of boats, size range of which varied between 7.92 and 9.14m. Majority of them (41.5%) operated bag net. About 24 % of them undertook fishing operation for 241-260 days and 39.9 % spend 12 hours per day for fishing. On an average 29 % of them caught 131- 150 kg. fish per month. During off-season 23.4 % of them undertook the job of net making or mending or repairing and 50.4 % earned about Tk 501 to 600 per man whereas during season income 36.4 % of them varied between Tk 801- 900.

A survey on the professional fishermen was done in the Project area in Tangail district under the Compartmentalization Pilot Project (CPP, 1996) and reported that highest (42%) family size of the fishermen community was between 3-4. The community had 53% literacy rate, about 95% functionally were landless, 89% used tin as a roof material and 79% used stalk as a well material for construction of living house, 52% were owner of Jhaki jal (Cast net), 54%

earned taka 50. Daily, 70% taking loan from money tender, 69% fish individually, 35% had no any disease and 41 % did not use any latrine.

Chantarasri (1994) presented socio-economic data on Sundarbans Reserve Forest (SRF) fishermen. The majority of fishermen were found to be poorly educated, married men aged 20-40 years. Significant numbers to both younger (less than 15 years) and older males (greater than 60 years) also operate in the SRF. These age groups are associated with the prawn seed and crab fisheries. Most fishermen are Muslim, though substantial minorities are Hindu. Fishing trips to the SRF typically last 10-12 days each month. Fishing was usually carried out in-group, though a few fishermen belong to the cooperatives. Most fishermen own their fishing gears with which they catch less than 40 kg of fish each month. Typically monthly earning was between 2000-3000 TK. Over half of all fishermen owned a small amount of land and half owned cattle. The majority of fishermen were in debt for money borrowed to buy fishing gear and food. Fishing usually takes place from partially covered wooden boats between 5-7 m long.

Ahamed (1996) studied the socio-economic conditions of the fisherman of Tangail district and obtained data on various aspects of fishermen's living conditions. He obtained that the full time fishermen in the area were at 84%. The fishermen population consisted 66% people who were under 40 years of age. He said, as usual as elsewhere, majority of the population was Hindu (57%). The population was having 94% married and 41% illiterate person. There were 94% fishermen who had their own house; the household size was 5.8 person per house, there were 1.17 children attending school per house. In the community 12% had electricity connection in their house, 24% had subsidiary occupation, 81 % were found fishing throughout the year, 50% sold their catch in the market directly, per house hold had ownership of 22 decimal of land, 98% used tube-well water for drinking, 6% used sanitary latrines for defecation, 42% borrowed food and 92% were member of some associations, clubs and co-operatives.

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, modal age group of the fishermen was 35-39, sex ratio was 100:10 (male : female), household size 6.4, 64% were Hindus, 45% literate, 85% individually fishing, 5% members of co-operative, 34% being aware of NGO's programs, 891% was land owner, 48% cattle owner, 2% pond

owner, 51 % ditch owner 49% living in katcha house, 100% use tube-well water, 2% use electricity, 98% did not lend money and average household income was 15000 TK/ year.

Mannu (1999) studied the socio-economic conditions of the sea going fishermen at Kuakata and reported that 92% of the fishermen were married, 96% belonging to 18-40 age group, 72% were full time fishermen, 20% had subsidiary occupation, 36% had their own living house, 16% possessed crop land including house, ranging between 30 decimal to 5 acre, 28% live in Khas land out side the dam, 12% live jointly with their father, 89% earn on average 25 thousand taka per year, 14% earn from other sector too, 88% saying fishing as beneficial, 8% saying living from hand to mouth, only 2% owning of a trawler, 4% fishing during winter and rainy season and 3% claiming becoming debtor instead surplus earner.

Ahamed (1999) studied the socio-economic conditions of coastal fishermen and reported that 73.33% fishermen mentioning their daily income above TK.50 and for rest of the fishermen 26.67% daily income were less than TK.50 during the fry catching season. Most of their housing condition was poor, their houses were made of mud and one kind of weed leaves (Locally called Golpata), 68.33% Muslims and 31.67% Hindus, 70% fishermen belonging to age group below 40 years, family size 6.4, 75% of the fishermen were illiterate, less than 5% fishermen went to village doctors. Most fishermen used pond water because lack of tube-well.

Al-Muhit (2000) carried out a study on Impact of Bangabandhu Bridge Construction on Fish Production and Socio-economic Conditions of the Fishermen Communities of the Dhaleswari River. He conducted his study considering some important aspects of the fishermen community such as economic status, social status, and the fishermen activities. The result of the study indicated that the socio-economic parameters of the fishermen such as occupation, daily income, credit availability, assets, fishing period, daily fish consumption, food intake, health and sanitation. The study revealed that total capture fisheries production of the study area was estimated at only 2494 metric tons. This study reported that the majority, 90% and 91.66% fishermen engaged in full time fishing during before and after closure respectively. Among the full time and part time fishermen, 12.22% and 20.56% had subsidiary occupation during before and after closure respectively. This study also resulted that maximum fishermen caught fish individually; more than 97% fishermen were members of different associations during after closure and 47% before closure.

Rahman and Hassan (1992) established some basic information on socio-economics characters of Kaptai lake fishermen. It was found that about four hundred to five hundred fishing units are engaged each year in the lake area. Chakraborty et al. (1995) described the fishing methods used in inland waters of Bangladesh along with the structural design of various types of fishing gears. These gears have been classified into nine major categories according to their mode of operation and the capabilities of these gears have been reviewed in terms of harvesting fish from inland water bodies of Bangladesh.

The fishing techniques that are currently in use amongst the fishermen of Bangladesh have been broadly categorized into netting, angling, trapping, spearing, dewatering and hand picking by Dewan and Mazid (1994). They also reported that at present a total of 91 gears under broad categories have been found to be in use amongst the fishermen in different types of water bodies of the country. Among the gears, they found 28 gill nets, 21 seine nets, 8 drag and bag nets, 8 lift, 5 clasp, cast and push nets, 6 hooks and lines, 5 traps and 5 spears/harpoons. They also recorded 7 new gears during their study, which are phoot jal, paia jal, patpati jal, dool-chot jal, sruti jal, bhurdi jal, goria jal. Among the newly recorded jals, 3 are being used in beels and other 4 jals in rivers. They also indicated that phoot jal, patpati jal, paia jal as gill net; dool-chot (seine net), sruti jal (bag net), bhuri jal (clasp net) and guria jal (dragged net).

According to BCAS (1991), approximately 30 different types of fishing gears have been identified to be in use in Haldi beel. The major species of fish caught in this beel are koi, shing, magur, raikh, boal, aire, punti, baim, tengra, gazar, taki and various species of prawn. During the water recession period a number of "fixed engine" (locally known as shuti jai) are operated in the old Atrai River and Panullal khal. Similarly, in their study at Chanda beel, they reported fishing gears used in that beel include fishing nets made of nylon or cotton twine, bamboo traps, hook and line and spears, while the fish species caught include major carps as well as others such as, koi, punti, etc.

BCAS (1991) also observed the most commonly occurring species in the annual catches of the different beels viz Kanglar haor, Karchanadi, Roail beel and Arial Khan produced by the combined fishing efforts are punti, mola, chanda, chapila, tengra, carps, pabda, taki, and bujuri. Their respective contribution, however, differ from fishery to fishery. Catch composition of Road fishery also recorded by them. The total annual catch of the Roail beel

fishery produced by the comb lined fishing effort composed of chapila (13.690%), batashi (13.54%), bujuri (8.92%), pabda (5.0%), mola (4.46%), tengra (2.3%), chanda (2.23%), bele (0.461%), carps (0.92%), chona (0.92%), shoal (0.92%), and others (32.030%). But in the monsoon, bujuri, chanda, and tengra were the dominant species for the combined fishing efforts at Arial Khan beel a counting to 24.87%, 23.64%, and 14.97% respectively. The rest are mola (5.55%), carps (0.35%), catfish (0.23%), pabda (2.450%),foli (0.62%) and others (12.300/o).They also recorded the contribution on dominant species in the catches of cast net in the beel of Arial Khan fishery were punti (30%), pabda (50%), taki (5%), baila(10%), baim (10%) and others (30%).

BCAS (1989) investigated the gear used by fishermen for fishing in the beels of Netrokona and Sunamgoaj district. The gears recorded were jhaki jal, uthar jal, veshal jal, dal jal, kona ber jal, ber jal, tona jal, goar jai, pine/pice jal, sarda jal, current jal, ram jal and chouhunda jal and in haor areas gears recorded were kochal jal, katha jal , tonti jal, punti jal, chak jal and fash jal.

Paul et al. (1993) recorded 7 species in the catches of large mesh size (10-15cm) gill net (fish jal) in Chanda Beel and 9 spp. of fish in the catches of fash jal (9-12cm, mesh) in Halti Beel. The dominant species recorded by them in the catches of this gear (large mesh size gill net) were common carp (55.1 %), catla (17.1%), rui (12.7%), and mrigal 7.7%) in Chanda beel and common carp (35.6%), catla (25.8%), kalibaush (16.5%),thai punti (7.4%) and rui (4.1 %) in Halti beel. However, this catch composition was the result of mass scale stocking of water bodies under the third fisheries project. Rahman et al. (1992) recorded 20 species of fish in the catches of punti jal (2.5-3.18 cm, mesh) in Chanda beel. The composition 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%) kholisha (17.42%), and koi (15.46%).

Rashid (1991) stated that probably over a thousand beel exist in Bangladesh. The beels are suitable in the floodplains and the delta basin. The habitat of the inland fishes are the major rivers, tributaries, distributaries, haors, baors and beels which found the floodplain of Bangladesh and cover an area of 54,86,609 ha. These water ways are the breeding and raring grounds for the fish.

Tsai and Ali (1997) reported that the supply of fish depends upon the season, a number of fishermen engaged in fishing and their fishing method. The fishermen during fishing use various types of fishing gears and crafts. The types of fishing gear that are used changes with seasons, according to flooding condition, target species and sizes of species. Except a few types of fishing gear which has a specific target species, most of them are for the multiple species purpose. Generally the fishermen use all conceivable types of fishing gear, ranging from bare hand to sophisticated seine and gill nets to catch fish. A type of fishing gear may have different names in different regions. Some are after the names of target species of fish. Moreover, the fishermen use the fishing crafts considering the availability and their capability.

Asain Development Bank (1996) reported the percentage of the total households around Beel Dakatia which are considered to be subsistence fishermen in 1996 is 58.5 and in Beel Dakatia alone 503 ha of aquaculture ponds (Ghers) were constructed and put into operation within the last 10 months. Brackish water fish are found in Beel Dakatia only and comprises approximately 15 percent of the total catch. The limited catch, the low standing stocks in Beel Dakatia and the fact these species are abundant throughout the coastal area, justifies that no special measures are to be taken for this group of fishes.

Razi and Hossain (1992) pointed out that the dissolved oxygen (D.O) present in Beel Dakatia varies from 6.47 to 7.13 mg/l which is in favor of cultivating fisheries. Now the fishing has become the main alternative to crops as a means of surviving life to the millions of people living around Beel Dakatia. Many plants and trees have been damaged. Many have got rotten. And logs of trees are found below 2 to 3 ft. from the ground. Even logs of large size are found below 10 to 15 ft. from ground during the construction of embankment in that area. These logs are used for making furniture. From the case study it is heard, there was a violent windstorm in 1600AC, which broke down many trees and plants in course of time these trees were buried beneath the earth. However considerable reduction of trees and plants surrounding Beel Dakatia due to atmospheric change and ecological imbalance is gradually increasing a bad weather contrary to all living creatures. People have been involved in different occupations. Some work in the mills and factories. Some are day labors, some are rickshaw and van drivers. Some are fishermen and a very few are cultivating lands in some dry part of the area. Women have also come out of their homes and are working as day labors in the mills and factories. It is the stagnancy of water of Beel Dakatia that has made birds

such as dove, crow, drake, heron, sparrow, cuckoo, kite, houseboat, wafer-hen, kingfishers were seen who made the environment rack and ruin by their honey tunes. But today it is nearly out of sight. Different kinds of animal like fox, jackal, squirrel, mongoose etc were available in the beel. But they have migrated to some other place due to shortage of food. Among domestic animals the cows are hardly seen in individual houses, as there is water all round not a piece of land to cultivate inside Beel Dakatia with the cows. Beel water is unhygienic and harmful to health. It spreads many contagious or says water-born diseases. Once the people played football and other country games like Ha-du-du etc. in beel after reaping crops. At present they have no pleasure in life due to this catastrophic problems. People have to depend on boat to maintain their communication through different parts of the beel area. The boat, they use, is not used for passenger's boat. Once it was used for carrying crops and paddy.

Rahman (1995) reported in his study that while developing physical infrastructures in the near future, the policy makers ought to be careful about the natural flow of water, socio-cultural sensitivity and environmental prudence of the local people. It should be remembered that the elderly people of the area have already started believing that Beel Dakatia became a curse, as people in power wanted to violate the rule of nature and neglected people's prudence.

Chapter three

Materials and methods

Materials and Methods

3.1 Selection of the Study Area

Beel Dakatia is the second largest beel of Bangladesh. It is located in the southwestern region of the country covering a gross area of 28,328 acre. Figure-1 and Figure-2 represent the study area in context of Bangladesh and in context of Khulna city respectively. This area was chosen to carry out the study of present status of aquaculture and capture fishery and the socio- economic condition of concern people in Beel Dakatia. Ten villages were randomly selected from the study area.

3.2 Sample Design

Sampling means collecting data from a selected part of the total population. The total population is the total number of households for this survey. Those means households are the units. The sample consists of those units from the total population, which are selected for data collection. At first, it was decided that stratified random sampling method would be followed on the basis of different villages. Then it was decided that "A sample random sample" would be applied to each villages. The next step was to select the sample size. Ten villages were randomly selected from the study area. At least 10 households were selected randomly from each village of the selected area as a sample.

3.3 Indicator Used

Some indicators have been selected to collect relevant data from the study area. These are as follows;

- | | |
|---------------------------------|-------------------------|
| • Area of beel | • Feed used in the gher |
| • People involvement | • Harvesting |
| • Area of the agricultural land | • Religious status |
| • Area of the aquaculture | • Marital status |
| • Control of the predator | • Education status |
| • Liming of the gher | • Household asset |
| • Fertilizer used in the gher | • Occupation |
| • Source of fry | • Health and sanitation |
| • Stocking density | • Electricity supply |
| • Problems of culture | • Diseases suffering |

3.4 Preparation of questionnaire

The survey was conducted to collect the baseline information from the selected farmers. Before preparing the final interview questionnaire, a draft interview questionnaire was developed keeping it in line with the objectives of the study. The draft questionnaire was pre-tested in the selected area by direct interviewing with some selected farmers by the researcher himself. The questionnaire form was then changed, modified and rearranged according to the experience obtained during pre-testing. A final questionnaire was then developed in logical sequence, so that farmers could provide information chronologically in comfortable manner.

3.5 Data collection

In order to fulfill the objectives set out for this study relevant information and literature were collected mainly from two sources such as:

3.5.1 Primary sources

At first, preliminary survey was done in the study areas. Secondly on the basis of preliminary survey, a questionnaire was prepared. Thirdly, households' survey was conducted based on pre-tested questionnaire. In total one hundred households were interviewed chronologically in the study area. Households were selected randomly according to the enlistment of the village.

3.5.2 Secondary sources

Secondary information was collected from the following sources:

- Upazila fisheries office
- Upazila agriculture office
- Upazila land, youth development and statistical office
- District fisheries office
- Seminar Library, URP Discipline, Khulna University
- Seminar Library, FMRT Discipline, Khulna University
- Central library, Khulna University, Khulna

3.6 Data processing and analysis

The data from questionnaires were grouped, categorized and interpreted according to the objectives as well as the indicators. Some data had numeric and some contained narrative facts. For measurable and indicative answer data have been grouped in the tabular forms. Data analysis had been done by using prominent programs (MS EXCEL).

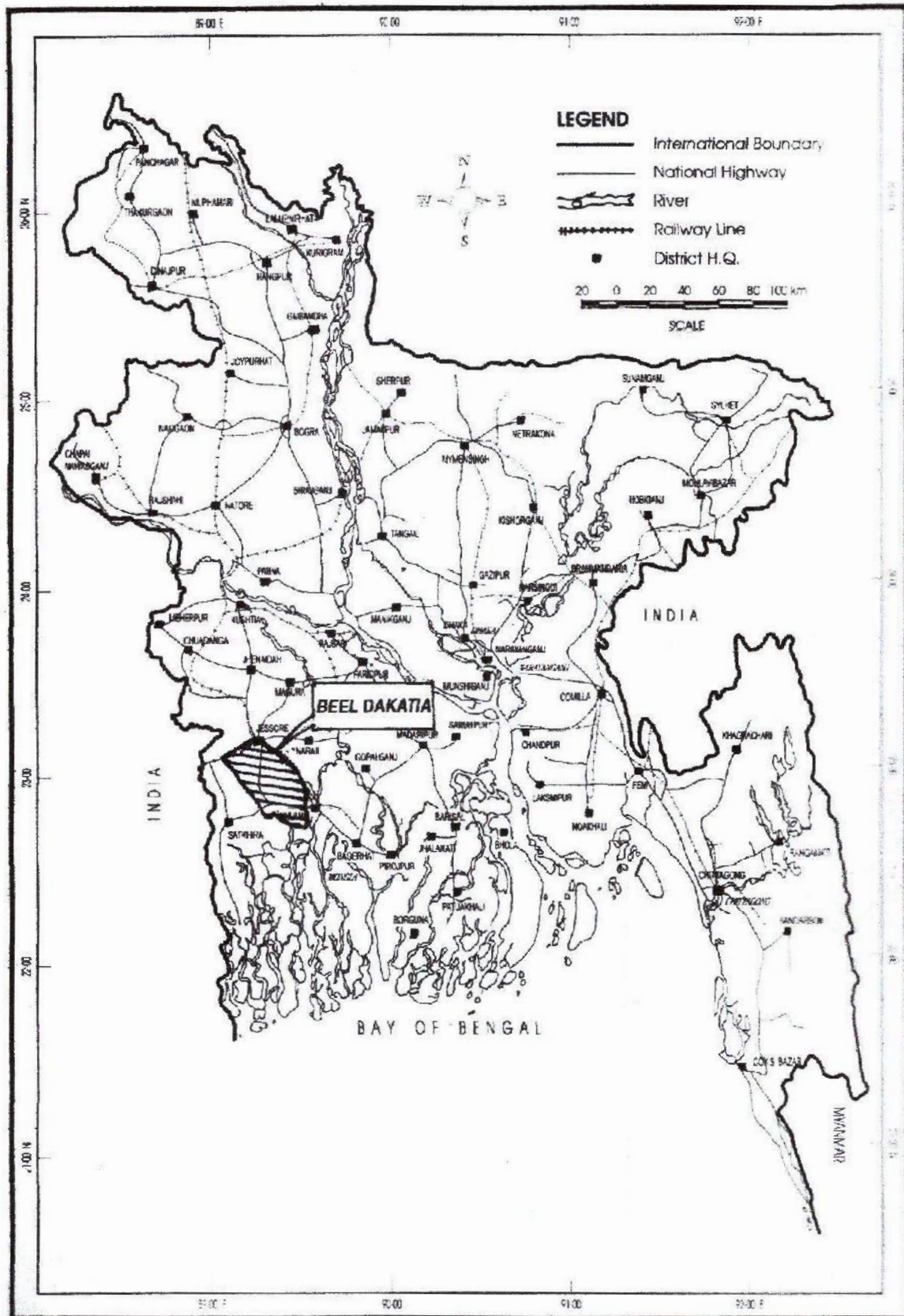


Fig.1. Map of Bangladesh and location of Beel Dakatia

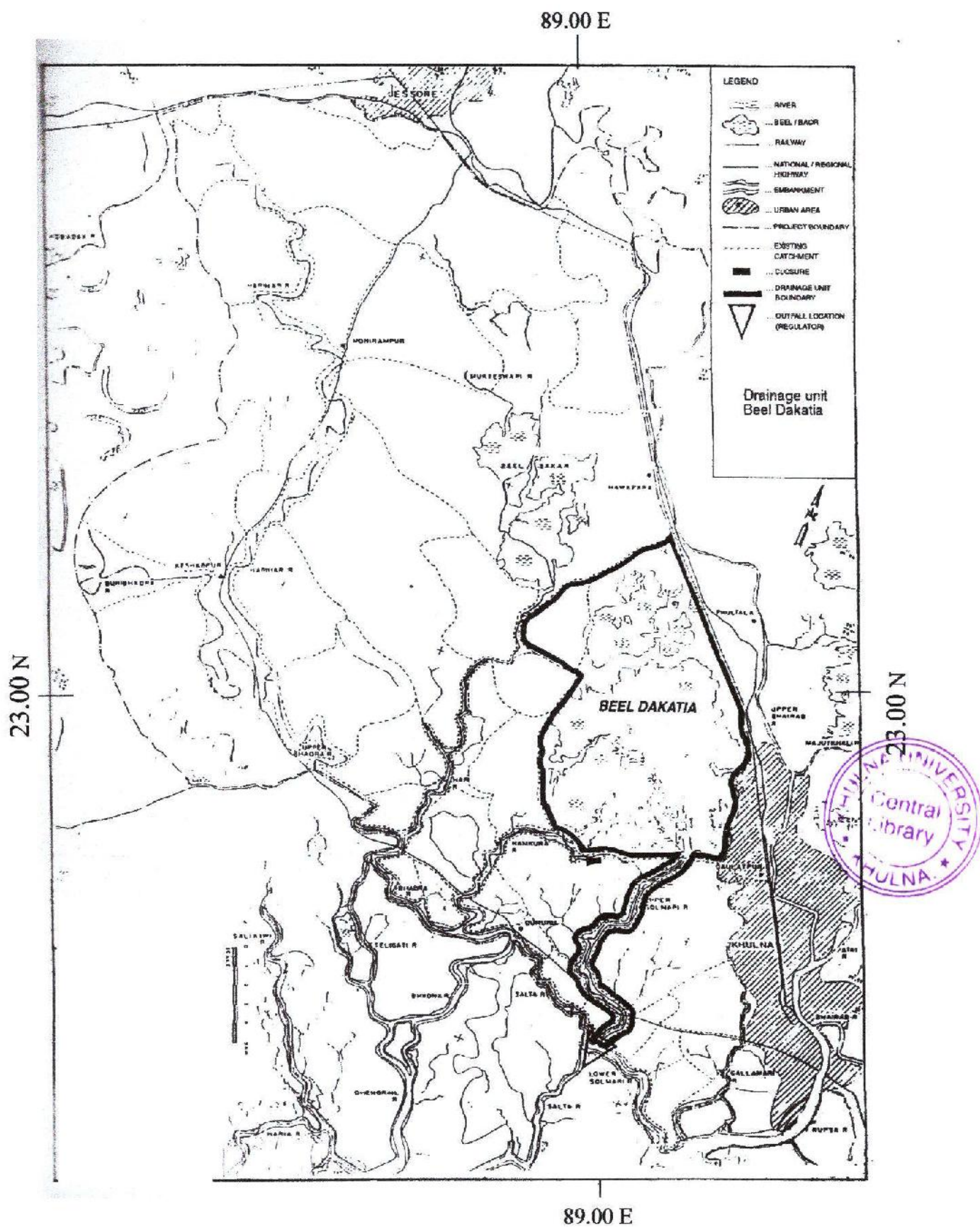


Fig.2. Map of Khulna city and location of Beel Dakatia

Chapter four

Results

Results

4. Present situation of Beel Dakatia

Total area of Beel Dakatia is about 28678.36 acre. About 1,35,000 people live in Beel Dakatia region. Among them about 5365 people directly and 26829 people indirectly involved in aquaculture, about 264 people directly and 1320 people indirectly involved in the capture fishery, about 1014 people directly and 5071 people indirectly involved in the pure agricultural activities and the rest of them are not depend on Beel Dakatia. Before 1980 when people based on the cultivation of agricultural product and another is after 1980 when people switchover their income earning activities in fishing as a result of water logging problem. After connection to the river, the vast area of Beel Dakatia was raised by siltation. As a result, from 1995, the aquaculture farming area is gradually increasing up to now. This area is used as aquaculture, agriculture, capture fishery as well as housing. Now this area is very potential as aquaculture farming and the socio economic condition of the people in Beel Dakatia area is developing day by day. The total area distribution is given in the table-1.

Table-1. Area distribution of Beel Dakatia

Consideration	Area (acre)	Percentage (%)
Housing	8890.29	31
Aquaculture	14912.75	52
Only agriculture	2819.07	9.83
Capture fishery	734.16	2.56
Marshland	174.93	0.61
Others (Mosque, Shop, Bazar, School, College, Madrasha etc.)	1147.13	4.0

The above area distribution is gradually changing in past ten years as a result of aquaculture area increasing. This chapter describes the present condition of aquaculture, capture fishery as well as agriculture and the socio economic condition of the people in the Beel Dakatia region.

4.1 Aquaculture

According to the survey, major portion about 52% areas of Beel Dakatia was used for aquaculture. The total aquaculture demonstration area was found to be 14912.75acre. This area is a very potential zone for the production of fish and prawn. There were found two types culture like poly culture and integrated culture. Just a few farmers practiced poly culture but most of the farmers practiced integrated culture in this area, because integrated culture is more benefited than poly culture. In poly culture and integrated culture system, farmers cultured prawn with white fish species like Silver carp (*Hypophthalmichthys molitrix*), Grass carp (*Ctenopharyngodon idellus*), Common carp (*Cyprinus carpio*), Indian major carps (*Catla catla*, *Labeo rohita*, *Cirrhinus mrigala*, *Labeo calbasu*) and Thai puti (*Puntius gonionotus*). But in case of integrated culture, paddy and vegetable production was excess product over poly culture. In poly culture, the average production of prawn and fish were found to be 225kg/acre and 95kg/acre respectively and in integrated culture, the average production of prawn and fish were found to be 198kg/acre and 83kg/acre respectively. The average production of paddy was found to be 1560kg/acre. The area of aquaculture will be increasing day by day in this area because it is more benefited than other professions. The socio-economic condition is developed day by day in this study area of Beel Dakatia.

4.1.1 Gher size and involvement in aquaculture

In the study area, it observed that most of the gher size was found an average .75-1.5 acre. The highest and the lowest gher size were found to be 6.5 acre and .50 acre in the study area. According to the survey, among the 100 farmers, 12% farmers' gher size was found to be .5-.75acre, 26%, 40% and 22% farmers' gher size were also found to be .75-1acre, 1-1.5 acre and above 1.5 acre.

The average duration of time involvement of the respondents in aquaculture was found about 5.75 years, the maximum and the minimum involvement were found before 14 years and 3 years respectively in the study area. Most of the farmers started aquaculture from 1999-2001 in this region. Gher size and involvement in aquaculture are shown in the table-2.

Table-2. Gher size and involvement in aquaculture

Consideration		Amount (acres/years)
Gher size	Highest size	6.5
	Average size	0.75-1.5
	Lowest size	0.50
Involvement in aquaculture (in years)	First involvement	14
	Last involvement	3.0
	Average	5.75

4.1.2 Ownership and lease value in the region

According to survey, about half of the farmers had their own land for aquaculture, 38% and 8% respondents of the study area had leased land and both (own and leased land) respectively. The average lease value was found at 7750Tk. The highest and the lowest lease value were found at 10500Tk and 6000Tk respectively in the study area. The condition of ownership and lease value is given in the table-3.

Table-3. Ownership and lease value in the study area

Consideration		Percentage/Value in Tk
Gher ownership (% of the respondent)	Own	54
	Leased	38
	Both own and leased	8.0
Lease value per acre in Tk	Average	7750
	Highest	10500
	Lowest	6000

4.1.3 Gher preparation

Gher preparation includes gher drying, gher ploughing, liming, fertilizing etc. In the study of Beel Dakatia, it has been found from the survey that about 74% farmers properly followed gher preparation practice and 22% farmers partially followed it and 4% farmers did not follow it. Gher preparation scenery is graphically shown in the figure-3.

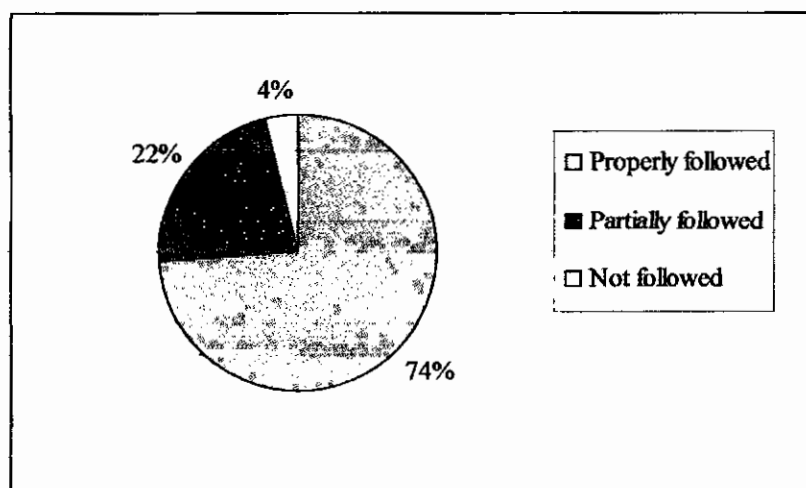


Fig.3: Percentages of the respondents of gher preparation

4.1.4 Uses of pesticides

In the study area, it was found that about 83% farmers did not use pesticide in their gher where as 17% farmers used pesticide. The farmers used various types of pesticides such as Pottash, Rotenon, Aqua, Urea, Sumithion, Dipterex etc.

4.1.5 Culture pattern

According to the present study, two types of culture system were identified in the study area such as poly culture and integrated culture. Only 7% respondents practiced poly culture and 93% respondent practiced integrated culture in the study area.

4.1.6 Seasonal distribution of different crops

The survey observed that most of the farmers used their land for various purposes throughout the year as Golda culture, Whitefish culture, Rice culture, Vegetables and fruits culture. The duration of this culture is given in the table 4.

Table-4. Duration of different product at the same gher

Crop	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Golda												
White fish												
Rice												
Vegetable												
Fruits												

4.1.7 Fry sources

It has been found from the present survey that in poly culture 100% farmers collected prawn fry from wild sources by different collectors but in integrated culture 94.63% farmers collected prawn fry from the wild source and 5.37% farmers collected prawn fry from both wild and hatchery. The causes of highly preference of wild prawn fry over the hatchery fry were found as given below:

- Survivability of the fry is high
- Mortality of the fry is low
- Availability of source
- Growth rate of the fry is higher
- Low rate of suffering of disease
- Less virus
- Low risk.

But all of the farmers collected the fish fry from hatchery in both poly culture and integrated culture in the Beel Dakatia region. The source of prawn and fish fry is shown in the table-5.

Table-5. Different source of prawn and fish fry

Species	Source	Poly culture (% of the farmers)	Integrated culture (% of the farmers)
Prawn	Wild	100	89.26
	Hatchery and wild	0	5.37
White fish	Wild	0	0
	Hatchery	100	100

4.1.8 Stocking density and survivability

Production performance completely depends on the stocking density as well as survivability of the fry. In the study area, it observed that in the poly culture the average prawn fry stocking density was found at 7000PL/acre, the maximum and the minimum stocking densities were found at 10500PL/acre and 4000PL/acre respectively. In the integrated culture, the average prawn fry stocking density was found at 6200PL/acre, the maximum and the minimum stocking densities were found at 9500PL/acre and 3500PL/acre respectively. The average stocking density of white fish was found at 500nos/acre in the poly culture and 400nos/acre in integrated culture respectively.

In the poly culture and the integrated culture, the average survival rate of prawn fry was found at 66% and 62% respectively. The highest and the lowest survival rate of prawn fry were found in poly culture at 79% and 41% respectively. The highest and the lowest survival rate of prawn fry were found in integrated culture at 77% and 44% respectively. The average survival rate of white fish in poly culture and in integrated culture was identified at 75% and 71% respectively. The stocking time and the culture period of prawn and white fish in poly culture and the integrated were found to be same in the study area of Beel Dakatia. All of the farmers practiced as traditional culture in the study area of Beel Dakatia, so the stocking density and survivability were found to be more or less standard. Stocking density and survivability of prawn fry and white fish are shown in the table-6.

Table-6. Stocking density and survivability of prawn fry and white fish in the study area

Consideration			Poly culture	Integrated culture
Stocking density (PL/acre)	Prawn	Average	7000	6200
		Highest	10500	9500
		Lowest	4000	3500
	White fish (no/acre)	Average	500	400
Survival rate (%)	Prawn	Average	66	62
		Highest	79	77
		Lowest	41	44
	White fish	Average	75	71
Stocking time (in month)	Prawn		March – July	April – July
	White fish		June - August	June – August
Culture period (in month)	Prawn		6 -10	6 -10
	White fish		5 - 8	5 - 8

4.1.9 Liming and fertilization

It was found from the survey that most of the fish farmers about 96% followed liming in the gher and 4% farmers did not follow it.

The survey reported that among the farmers in poly culture, the average use of lime was found at .75kg/dec where as in integrated culture, the average use of lime was found at

.50kg/dec. The highest and the lowest use of liming rate in poly culture and integrated culture were found to be same using 1.5kg/dec and .25kg/dec respectively. Liming condition is shown in the table-7.

Table-7. Liming rate in the study area

Consideration		Poly culture	Integrated culture
Liming rate kg per decimal	Average	0.75	0.50
	Highest	1.5	1.5
	Lowest	0.25	0.25

Most of the farmers applied fertilizer (cow dung and urea) in their gher that enhanced the natural productivity by promoting the growth of phytoplankton and zooplankton that served as a feed for fish and prawn.

According to the survey, it was observed that out of interviewed farmers 71% farmers used organic fertilizer, 6% farmers used inorganic fertilizer and 23% used both organic and inorganic fertilizer. Fertilizing condition are shown graphically in the figure-4.

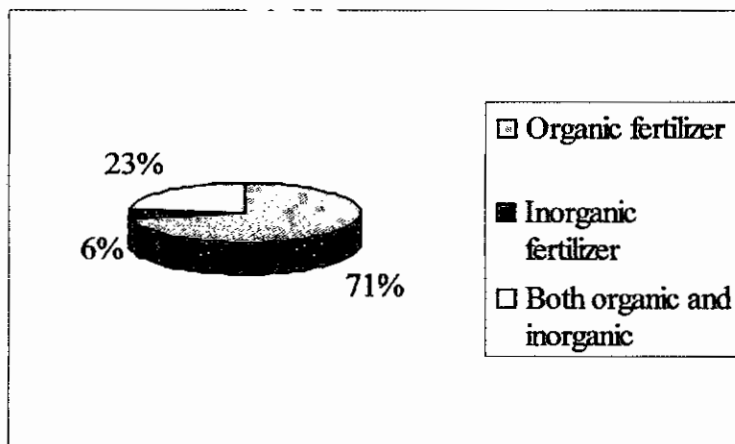


Fig.4: Application of fertilizers in gher by fish farmers

It also observed from the study area that the average use of organic fertilizer in poly culture and integrated culture were found at 1.8kg/dec and 1.5kg/dec respectively. The highest and the lowest use of organic fertilizer in both poly culture and integrated culture were found to be same using 6kg/dec and .5dec/kg respectively. Fertilizing condition is given in the table-8.

Table-8. Use of organic fertilizer in the region

Features		Poly culture	Integrated culture
Organic fertilizing rate kg/dec	Average	1.8	1.5
	Highest	6.0	6.0
	Lowest	0.5	0.5

4.1.10 Types of feed

It observed from the study that most of the farmers used both type of feeds including commercial and prepared for better production in poly culture and integrated culture system. Different feeds brand named Abtab fish feed, Niribili fish feed, Saudi Bangla fish feed and CP fish feed were found to be used as commercial feed. The major ingredients of prepared feed were found as flat rice, crashed snail, boiled rice, wheat flour, rice and wheat bran, mustard oil cake and soyabin oil cake. Feeds were not regularly used in the study area, sometime they used twice in a day, once in the morning and once in the evening, sometime they used once in a day and sometime they did not show it. According to the farmers, use of both commercial and home-made feeds, especially snail meat yield higher production than others.

Farmers also produced by themselves one kind of prepared feed, which was made of locally available raw materials. The ingredients of the prepared feed are given in table-9.

Table-9: Ingredients of prepared feed

Ingredients	Weight (gm)	Percentage (%)
Fine rice bran	100	10
Fish meal	200	20
Wheat bran	150	15
Wheat flour	200	20
Mustard oil cake	200	20
Snail shell grain	50	5
Molasses	100	10
Total	1000	100

4.1.11 Diseases

It observed from the survey that about 92 % gher were attacked by different diseases including antenna cutting of prawn, sudden death during over wintering of prawn during culturing period. These types of diseases occurred in the study area of Beel Dakatia before last three or four years. The main causes for attacking these diseases were identified in the study area such as

- Lack of appropriate use of pesticide.
- Excess fry released in the gher.
- Lack of checking of water and soil quality parameters.
- Lack of available facilities for water exchange.
- Lack of proper uses of lime and fertilizer.
- Lack of proper management.
- Lack of technical support.

4.1.12 Prevention taken in case of disease attack

The preventions that had been taken by farmers in both poly culture and integrated culture during attacking period were given below:

- Harvesting of prawn and sold to the market.
- Sometimes uses of lime in gher.
- Some of farmers used antibiotic like Methylene blue.
- Sometimes uses of different types vitamin tablets.
- Medicine was used with feed.
- Some farmers used $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ and $\text{K}_2\text{SO}_4 \text{ Al}_2\text{SO}_4 \cdot 24\text{H}_2\text{O}$.
- Some farmers transfer water in their gher.

4.1.13 Harvesting pattern

According to the survey, it was found about 94% of the all farmers started harvesting after 5-6 month from the stocking as partial harvesting while the rest of 6 % farmers harvested prawn fully at a time. Most of the farmers harvested two-third of the product from November to December. The farmers used thana jal or khapla jal for their gradual harvesting and Sometimes farmers used fash jal for white fish harvesting in aquaculture. At the end of culture period farmers carried out complete harvest by draining out of the gher and then hand picking the prawn and fish. They did not use any preservatives immediately after harvesting.

These result also indicated that they sold their prawn to the market several times according to their necessity of money.

4.1.14 Labor involvement in harvesting

It was identified from the survey in the study area of Beel Dakatia that the highest 52% of the gher required 4 to 5 labor for harvesting of prawn and fish and the lowest 8% of the gher required above 8 labor for harvesting. Labor involvement in harvesting which depends on the basis of size of the gher. People involved in harvesting are shown in the table-10.

Table-10. People involved in harvesting

People involvement	Percentage of the gher (%)
2-3	19
4-5	52
6-7	21
Above 8	8.0

4.1.15 Marketing

According to the survey, it was observed that about 96 % farmers sold their product several times to the market whereas the rest of 4% sold it wholly once. This point was relevant to the point of pattern of harvesting. Some farmers sold their products to the depot, some sold these to the chatal auctioneer. Some farmers sold their product to the local market and dadonder. This result also indicated the marketing channel of product. The owners of depot and arotder sold their product to the factory. If any farmer would take loan from dadonder, they would give prawn and fish to the dadonder instead of return their loan. It was the system of taken dadon/loan from dadonder. In this system the farmers would not get their appropriate price of prawn and fish. The highest 58% farmers sold their product to the Dipot and only a few about 2% farmers sold their product to the local market in the study area of Beel Dakatia. The Poor farmer taken loan from the dadonder by some conditions. The place of fish and prawn marketing are shown in the table-11.



Table-I1. Prawn and fish marketing condition

Place of sell	Percentage (%)
Dipot	58
Chatal	25
Local market	2.0
Dadonder	15

4.1.16 Production performance

4.1.16.1 Prawn

According to the survey in the study area of Beel Dakatia, the average prawn production was found to be 225kg/acre in poly culture and 198kg/acre in integrated culture. In poly culture, the highest and the lowest prawn production was found to be 300kg/acre and 130kg/acre respectively. In integrated culture, the highest and the lowest prawn production was found to be 285kg/acre and 90kg/acre respectively. Prawn production in the study area is shown graphically in the figure-5.

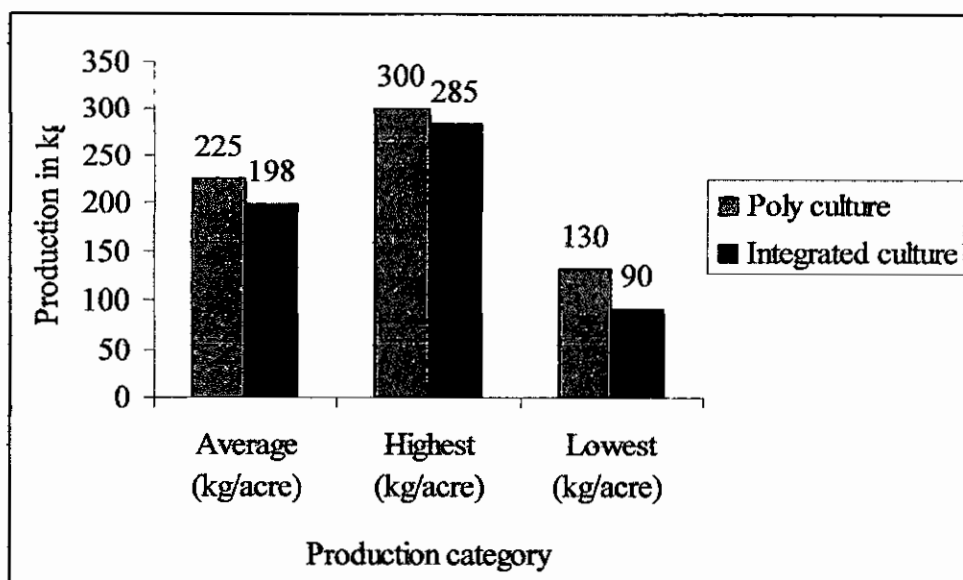


Fig.5: Prawn production in the study area

4.1.16.2 White fish

It was found from the survey that the average white fish production in poly culture and integrated culture were found to be 95kg/acre and 83kg/acre respectively. The highest and the lowest fish production were found to be 140kg/acre and 75kg/acre in poly culture. The highest and the lowest fish production were found to be 133kg/acre and 46kg/acre in

integrated culture. White fish production in the study area is shown graphically in the figure-6.

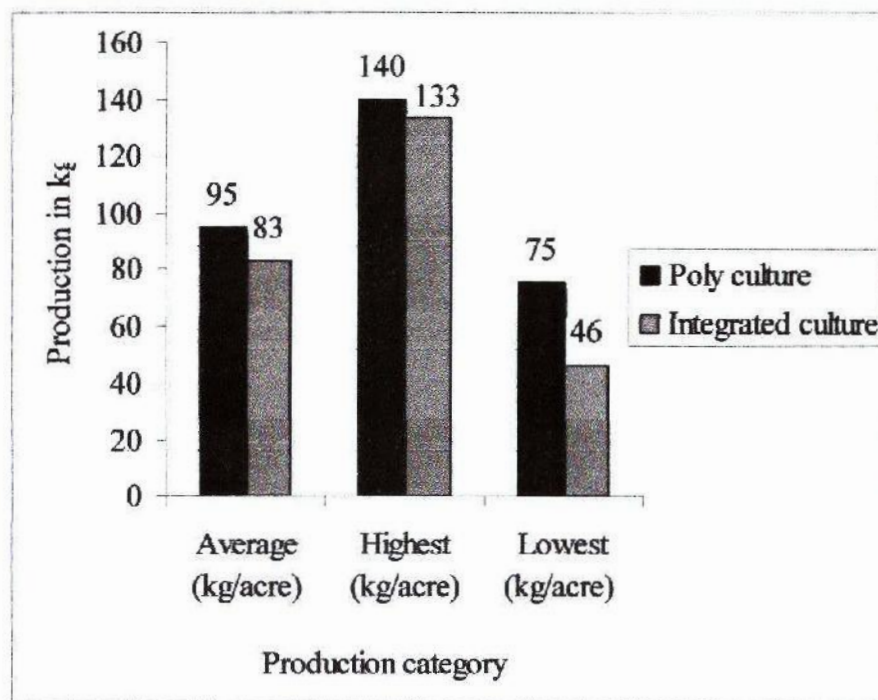


Fig.6: White fish production in the study area

4.1.16.3 Paddy

In the late winter, most of the farmers harvested about two-third of the fish and prawn product. After harvesting this product they cultured paddy in the same gher and vegetable on the dikes. In the study area, it was observed from the survey that among the interviewed farmers, 93% farmers cultivated paddy properly where as only 7% farmers did not show it. The highest about 59.14%(55) of the gher were being produced 1200 to 1600 kg/acre and the lowest about 4.3%(4) of the gher were being produced 400-800 kg/acre. By observing the figure-7 it can say that the average production of paddy/acre were ranging from 1200 to 1600 kg/acre .

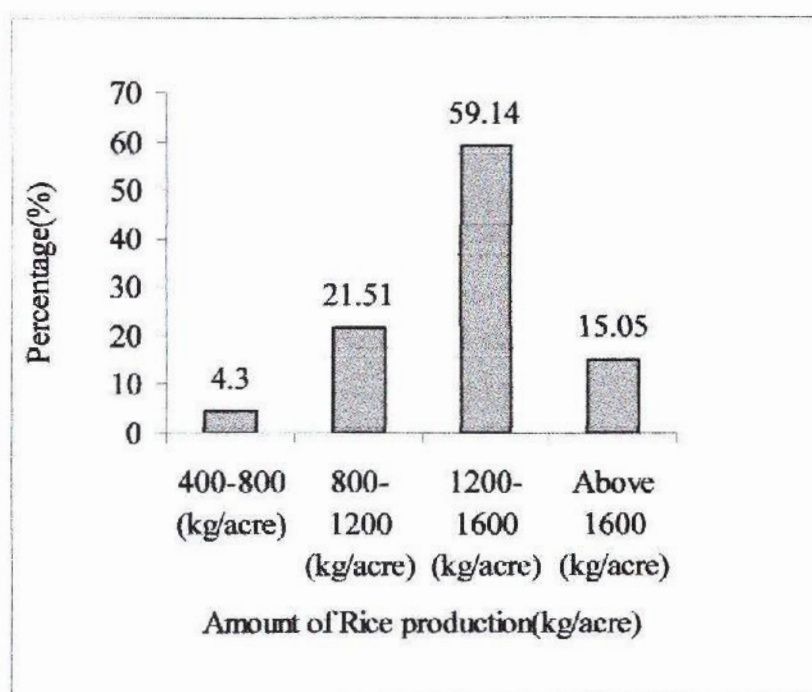


Fig.7: Percentages of production of paddy/acre

4.1.16.4 Vegetable culture and fruits tree

In the study area, it observed that among the surveyed farmers, 70% farmers cultivated vegetable and fruit trees properly on the dyke of their gher where as 30% farmers did not show it. About 6-8 dec/acre land was used for these purpose by the farmer in integrated culture system. Duration for cropping of various vegetables and fruits in the study area of Beel Dakatia is shown in the table-12.

Table-12: Duration for cropping of various vegetables and fruits

Types of vegetables	Ja	Fe	Ma	Ap	Ma y	Ju	J y	Au	Se	Oc	No	D e
Pui shak												
Spinach(Palang shak)												
Red amaranth(Lal shak)												
Bean(Sheem)												
Lady's finger(Dheros)												
Snake gourd(Chichinga)												
Bitter gourd(Karolla)												
Turnip(Salgom)												
Cauliflower(Fulcopi)												
Badhacopi												
Radish(Mula)												
Brinjal(Begun)												
Green chilies(Marich)												
Tomato												
Laaau												
Pumpkin(Kumra)												
Cucumber(Shasa)												
Ridge gourd(Jhinga)												
Barbati												
Types of fruits												
Banana(Kala)												
Papaw												
Date(Khejur)												
Coconut(Narkel)												

It was also seen that the average production of vegetables and fruits in the study area were small in amount. The average production of vegetable and fruits are shown in the table -13.

Table-13: The average production of the vegetables and fruits per acre in the study area

Types of vegetables	Production (kg)	Tk./Kg	Total cost (kg)
Red amaranth (Lal shak)	15	5	75
Spinach (Palang shak)	5	5	25
Pui shak	15	4	60
Bean (Sheem)	20	10	200
Lady finger (Dheros)	20	12	240
Snake gourd (Chichinga)	15	10	150
Bitter gourd (Karolla)	20	12	240
Turnip (Salgom)	7	10	70
Cauliflower (Fulcopi)	12	8	96
Badhacopi	10	12	120
Radish (Mula)	14	4	56
Brinjal(Begun)	12	12	144
Green chilies (Marich)	8	20	160
Tomato	14	10	140
Laau	25piece	12/piece	300
Pumpkin (Kumra)	12 piece	20/piece	240
Cucumber (Shasa)	16	12	184
Jhinga	15	10	150
Barbati	6	10	60
Types of fruits			
Banana (Kala)	300 piece	2/piece	600
Papaw	40	4	160
Coconut (Narkel)	40 piece	7/piece	280
Total			3750

According to the survey, it was found that in the studied area all of the vegetables were not equally beneficial for integrated farming. Among the vegetables, Korolla, Laau, Sheem and Dheros were more beneficial than others.

4.1.17 Cost benefit analysis

Cost benefit analysis is the analysis of total cost for the production and the profit from the production. Khan (2003) emphasized that cost and benefit analysis would provide the information necessary to determine the relative profitability of various production techniques, compare the utility of major inputs, such as land, labor and capital, with that of alternative production activities improve the efficiency of the farm operation.

4.1.17.1 Production cost

The production cost included purchasing of PL, lime, fertilizer, feed etc. Production cost also considered for labor management, house repairing, harvesting gears and transport. Major cost was associated with prawn fry, lease value, feed and labor. In the study area, average 6-7dec/acre was used for vegetation on the dyke. So the cost benefit analysis is considered as 6-8dec/acre. In the integrated culture, paddy and vegetable production cost were also included with the total production cost which is shown in the table 15 and 16. Fish and prawn production cost of poly culture and integrated culture are shown in the table 14.

Table-15. Production cost of paddy in integrated culture per acre

Serial no.	Items	Amount (kg / number)	Unit price	Total cost (Tk.)
1.	Fertilizer and others			
	Seed	15	15	225
	Urea	57	7	399
	TSP	41	16	656
	MP	16	10	160
	Zepsam	22	3	66
	Insecticide	-	-	500
	Pump	-	-	400
2.	Labor cost			
	Seed purpose	2	120	240
	Application of fertilizer	4	120	480
	Made of land	10	120	1200
	Application of pesticide	4	120	480
	Harvesting and transportation	16	120	1920
	Drying and conservation	10	120	1200
3.	Others	8	120	960
4.	Total			8886

4.1.18 Calculation

In case of poly culture system:

Total production cost = 45,627.5Tk

Total income = 96,650Tk

Net profit = 96,650Tk – 45,627.5Tk = 51,022.5Tk

In case of integrated culture system:

Production cost of fish and prawn = 38,214Tk

Production cost of paddy = 8,886Tk

Production cost of vegetable = 1,812Tk

Total production cost = 38,214Tk + 8,886Tk + 1,812Tk = 48,912Tk

Total income = 1,08,585Tk

Net profit = 1,08,585Tk – 48,912Tk = 59,673TK

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Net profit from integrated culture was found to be 59,673TK which was higher than poly culture (51022Tk). Among the two types of culture systems were found in the study area, integrated culture system was widely practiced by the farmers because of its higher profitability than the other others one.

4.2 Capture Fishery Status

Inland capture fishery resource in Bangladesh is the richest in the world. Recently published statistics (FAO, 1995) showing them second only to China. Total inland water body about 43.47 lac ha. Among these water body, inland open water body including river, beel and baor about 40.47 lac ha. The area of Beel Dakatia is about 11609ha. Among these about 297.19 ha (2.56%) is capture fishery area. About 264 people directly and 1320 people indirectly involved in the capture fishery activities. There were found three types of fisherman such as occasional fisherman, full-time fisherman and part time fisherman. A total of 41 different species of fish and 3 species of prawns were identified in the capture fishery study area of Beel Dakatia. Among them 12 fish species were found very common, 11 fish species were commonly found and rest of them were not available in the capture fishery area. Most of fishes are commercially important. There were found only three types of craft including Nouka, Donga (Talgas) and Vella (banna tree). The study also observed that 5 types of gear (Khapla jal, Tana jal, Current jal, Fash jal, Thela jal), 6 types of trap (Ghuni, Vair, Chonga,

Polo, Tubo and Bitte) and 5 types of hook and spear (Chip Borshi, Borshi, Fulkuchi, Jhupi and Konch) used in the capture fishery study area of Beel Dakatia.

4.2.1 Capture fishery management

The survey observed that there was no proper management system. During the dry season, most of the area in capture fishery about 80% was drying and about 20% having water. The fishermen were no step to manage it. They did not release any fish fry. So the self recruiting species is the main source of fish. At the beginning of the rainy season, the fishermen start indiscriminate fishing in the capture fishery area.

Jalmohals are Government owned areas of water located in the floodplain areas and are particularly productive fishing grounds. They are controlled by the Ministry of Land and are officially auctioned out to fishers' co-operatives, though in practice these organizations are often dominated by influential elites. Enhancement of the fisheries resource clearly benefits the leaseholder. So Government agreed that control of the jalmohals would be transferred to the DoF and leases system cancelled. A Gear Licensing System was introduced in place of leasing. But in the study area leases system were not cancelled.

The observation identified only 4 marsh land having total area about 55ha. The area of 4 marsh land was 17ha, 13ha, 14ha, 11ha respectively. All of the marsh lands were below 20 ha. For these reason, this marsh land were controlled by Upazilla Jubo Unnayan Department. Above 20ha controlled by DC office.

In the study area, the local youth society is taking lease of the marsh lands from the Jubo Unnayan Department by doing registration in the Upazilla Samobay Office. It ranges from 0-20ha leased by Jubo Unnayan Department and above 20ha leased by DC office. There is no jolmohal above 20ha in the study area. Its duration is 3 or 5years and must be renewable every year. To serve this purpose, there is a committee consisting of UNO as president, member-secretary (Upazilla Jubo Unnayan Officer) and 4 members including Assistant Commissioner (land), Upazilla Fisheries Officer, Upazilla Samobay Officer and special social server.

The member of youth society invested equally in this field. They released the fry of different fish species such as rui, catla, grass carp, mrigal, kalbasu, silver carp, mirror carp, common

carp and golda and all the management taken by them. After harvesting the benefits distributed equally among the members of the youth society.

4.2.2 Species composition

There are about 260 species of fishes, 24 freshwater prawn species, 12 exotic fish species present in the inland water bodies (Rahman 1994) and 475 species of fishes, 36 shrimp species are recorded from the marine water of which 65 species are exported commercially (Hossain, 1970).

In the study area, a total of 41 different species of fish and 3 species of prawn were identified. Among these species, 12 fish species were found very common, 11 fish species were commonly found and rest of them were not available in the capture fishery area of Beel Dakatia. Most of fishes are commercially important. The local name, scientific name, abundance of the identified fish and prawn species are given in the table 18 and 19.

Table-18. List of capture fishes of the Beel Dakatia

SL. No.	Local Name	Scientific Name	Abundance
1.	Catal	<i>Catla catla</i>	Very Few
2.	Silver carp	<i>Hypophthalmichthys molitrix</i>	Very Few
3.	Common carp	<i>Cyprinus carpio, var communis</i>	Very Few
4.	Mirror carp	<i>Cyprinus carpio, var specularis</i>	Very Few
5.	Grass carp	<i>Ctenopharyngodon idella</i>	Very Few
6.	Rui	<i>Labeo rohita</i>	Very Few
7.	Mrigal	<i>Cirrhinus mrigala</i>	Very Few
8.	Kalbaus	<i>Labeo calbasu</i>	Very Few
9.	Sarputi	<i>Puntius sarana</i>	Common
10.	Puti	<i>Puntius sophori</i>	Very Common
11.	Chala	<i>Puntius chola</i>	Common
12.	Tit puti	<i>Puntius licto</i>	Very common
13.	Thai sarputi	<i>Puntius goniontus</i>	Few
14.	Pata chela	<i>Chela atpar</i>	Very common

4.2.3 Fishing method

Most of the fishermen are fishing in day and night from the month of July to January. There are three categories of fishermen in the capture fishery area of Beel Dakatia. These are

- 1) Occasional fisherman who primarily catches fish for domestic consumption,
- 2) Part time fisherman who catches fish in the peak season,
- 3) Full-time fisherman who is fully dependent on fishing for their livelihood round the year.

4.2.4 Fishing crafts

There were found only three types of craft for fishing which help to move in the capture area of Beel Dakatia. These are Nouka, Donga (Talgas) and Vella (Banna tree). Size and preservation materials of the identified crafts are given in the table 20. Crafts used by the fishermen in the capture area are shown in the table-21.

Table-20: Different types of craft with their size and preservation material

Name of craft	Size (Feet)	Preservation materials
Nouka	Length – 9-12	Coalter, gab juice
Donga (Talgas)	Length - 6- 10	Coalter
Vella (banna tree)	Length -6-10	--

Tabl-21: Crafts used by the fishermen in the capture fishery area

Type of fishing crafts	% of fishermen
Nouka	79
Donga (Talgas)	17
Vella (Banana tree)	4

4.2.5 Preservation of crafts

The crafts are used in water. So it can be easily spoiled within a short time. In maximum cases crafts are not used properly by our fishermen. After preparation of the boat it should be immediately painted by coalter or Juice of Gub, which protect the boat from the damages caused by water and various aquatic organisms. During the dry season, when the crafts are not used then the fishermen take their crafts and placed it in their home. Coalter or julce of Gub are used as preservative.

4.2.6 Types of fishing gear

According to the survey in the capture fishery area of the Beel Dakatia, various types of gear were found for fish catching. Choice of gear depends on season, cost, durability and target species. Generally these gears are made and repair by fishermen themselves. Women are also engaged in building and repairing gears. After the operation of these gears is dried in sun and preserved by Gub Juice and coalter. It observed from the survey that there was found only 5 types of gear which was used for fishing. The percentage of user, using period, species catch are given in the table 22.

Table-22. Information about fishing gear

Fishing gear	% of the fishermen	Using period	Species catch
Khapla jal	65	All the year round	Taki, Kholsha, Baim, Koi, Singi, Punt, Tengra, Chanda, Bele, Mola, and Small prawn
Tana jal	18	September to January	Mola, Bele, Puti, Chela, Chanda and Baim
Current jal	35	October to December	Tengra, Baim, Kalibaus and Chanda
Fash jal	52	September to January	Khalisha, Chanda, Puti and Sar-puti
Thela jal	28	September to January	Singi, Koi, Puti, Kholisha, Baim, Small fish and Prawn

4.2.7 Fish trap

Fish traps are another type of fishing gear those are used in the capture area of the Dakatia Beel. There were 6 types of trap which used in the observation area. The percentage of user, using period, species catch are given in the table 23.

Table-23. Information about fish trap

Type of fish trap	% of the fishermen	Species catch
Ghuni	75	Kholisa, Baim, Bele and Small prawn
Vair	18	Shingi, Magur, Koi, Shoal, Kholisa and Baim
Chonga	15	Baim
Polo	52	Koi, Taki, Magur, Shingi, Soal and Small fish.
Tubo	41	Punti, Bele, Magur, Shingi and Kholisa
Bitte	26	Baim, Bele, Kholisha, Small fish and Prawn

4.2.8 Hook and Spear

Hooks and spears are used in the capture fishery area of the Dakatia Beel. There were found 5 types of hook and spear which used in the study area. Description of the hook and spear is given as below. The percentage of user is shown in the table-24.

Table-24. Hook and spear used by the fishermen in the capture area

Type of hook and spear	% of the fishermen	Using time	Species catch
Chip- barshi	33	June to December	Punti, Tengra and Bele
Barshi	45	July to December	Shoal, Shingi, Puti, Baim and Other small fish
Fulkuchi	15	September to February	Shoal, Taki and Magur
Jhupi	32	June to December	Shoal, Taki, Shing and Gojar
Konch	21	September to November	Shoal, Gojar and Taki

4.3 Agricultural status of Beel Dakatia

This Beel is used for many purposes as aquaculture, agriculture, housing etc. Among these about 2819.07 acre (9.83%) is pure agriculture land. The geographical position of this land is more or less middle point of the Beel. About 1014 people directly and 5071 people indirectly involved in the pure agricultural activities of Beel Dakatia. In these area, the farmers planted different types aush and amon rice. These are planted from June to July and harvest is done from November to December. The production was found to be average 960-1280 kg per acre in the pure agricultural area. In winter, most of the gher farmers reduced the water of the gher and used for winter cropping. About 14912.75 acre of the total area is used both fish, prawn cum paddy culture. In this area, various types of IRRI are cultivated in the Dakatia Beel. These are planted from December to January and harvest is done from April to May. The production performance was better than aush and amon rice. The good quality paddy production was found to be 1600-2000 kg per acre and the lower quality production was 1200-1600 kg per acre. The agri-fisheries activities is more benefited than only agiculture. So the pure agricultural land reduced day by day in the Beel Dakatia region. Cropping pattern of Beel Dakatia are given in the table 25.

Table-25. Cropping pattern of the Beel Dakatia

Name of the crops	Planting time	Harvesting time
IRRI (B.R.4)	December to January	Apri to May
IRRI (B.R.4)	”	”
IRRI (B.R.4)	”	”
IRRI (B.R.4)	”	”
IRRI (B.R.4)	”	”
Aush	April to May	August to September
Amon	June to July	December to January

4.4 Socio-economic condition of the farmer

Wide ranges of data were collected from the study for the analysis of the socio-economic characteristics. These were on the age group, religion, marital status, education, type of fish farmer, family type, no. of family member, school going children and school dropout, causes of school dropout, ownership of the house, house hold assets, use of electricity, occupation, occupation, sanitation practice, area of the gher, pond ownership, harvesting, marketing, problem in culturing, credit availability, yearly income etc. A details analysis was made on these parameters and presented in this section.

4.4.1 Demographic profile

Knowledge of age distribution of the fish farmer is important in estimating potentiality of the human resources. Planning of education, health, and employment etc. rely on age distribution. In the present experiment, depicted in table 26 shows that among the engaged people in the study area of Beel Dakatia, maximum participation of respondent was found at age group 21-40.

Table-26. Age group of respondent in the study area

Age group (years)	Involved in aquaculture (Number of the respondents)	Involved in capture fishery (Number of the respondents)	Involved in agriculture (Number of the respondents)
21-30	26	24	22
31-40	39	34	32
41-50	17	21	25
51-60	12	17	14
61-70	6	4	7
Above 71	0	0	0

4.4.2 Sex Ratio

The survey revealed that all most all of the respondent in the study area were found male. There was no female farmer involved in fish culture. It also focused on the high involvement of male farmers in fish culture in our society.

4.4.3 Religion status

According to the survey, it observed that the highest 71% people were found Muslim who involved in aquaculture but 74% people were found Hindu engaged in capture fishery in the study area. None was found to belong to other religion (Christian/Buddhist/others etc). Religious Status of study area is shown graphically in the figure-8.

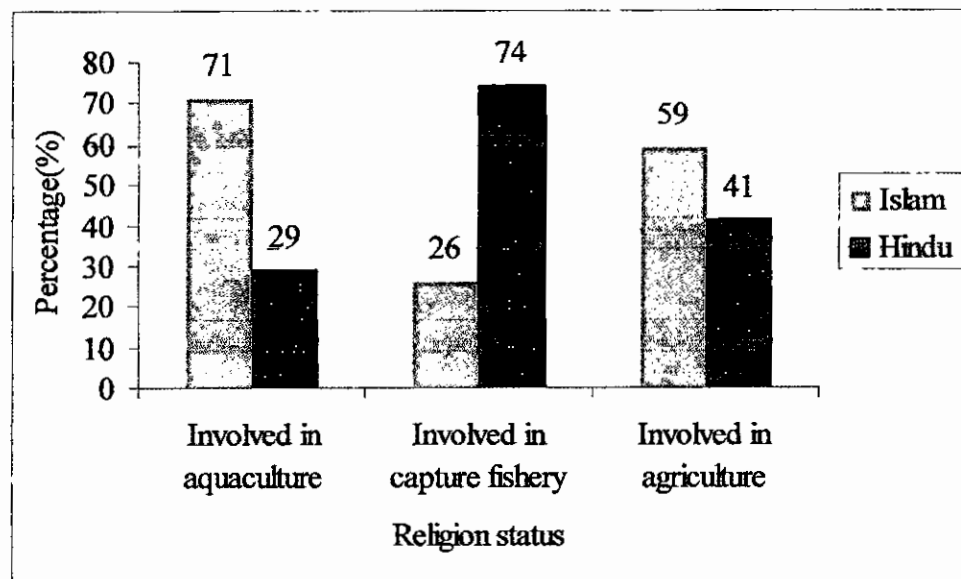


Fig.8: Religious Status of the people in the study area

4.4.4 Marital Status

Survey was made to see the marital status of the farmers in the study area of Beel Dakatia. It was found that the majority of the people who involved in aquaculture, in capture fishery and in agriculture were married while a few people were found to be single or separated. Marital status of the study area is shown graphically in the figure-9.

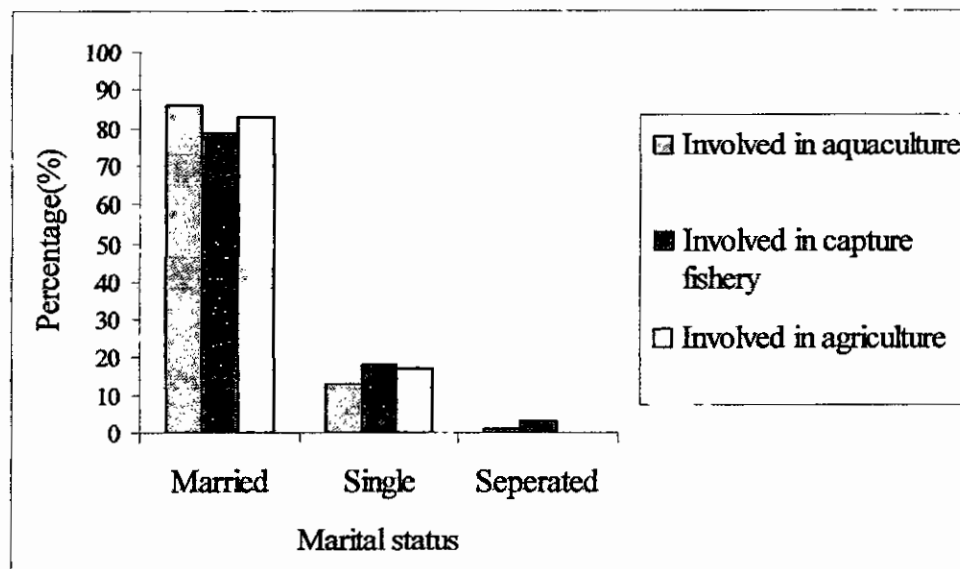


Fig.9: Marital status of the people in the region

4.4.5 Education

The survey result revealed that 91%, 76% and 96% of the people who involved in aquaculture, in capture fishery and in agriculture respectively were found literate and the highest 24% people engaged in capture were found illiterate. Educational status of the study area is shown in the table-27.

Table-27. Educational status of the study area

Level of status	Involved in aquaculture (Number of the respondents)	Involved in capture fishery (Number of the respondents)	Involved in agriculture (Number of the respondents)
Illiterate	9	24	14
Can sign	20	16	24
Class I-V	21	17	16
Class VI-VIII	13	23	24
Class IX-Below SSC	28	15	15
Above SSC	9	5	7

4.4.6 School Going Children

The survey had been found that maximum children were going to school because of getting various facilities. It was informed that our government had declared scholarship for the children who were going to school. Besides that the female student, up to HSC level they can take education without giving any fees to the institution. Moreover they were getting scholarship for continuing their education. It encouraged them to go to school. So for the above reasons, the percentage of school going children were high and the percentage of school dropout children were low. In the study area, it observed that 81%, 63% and 77% children who involved in aquaculture, in capture fishery and in agriculture respectively were found as school going and the highest 37% children in capture fishery were found as dropout. So the education status of people who involved in capture fishery was poor than other people in the study area of Beel Dakatia. The condition of school going children is shown graphically in the figure-10.

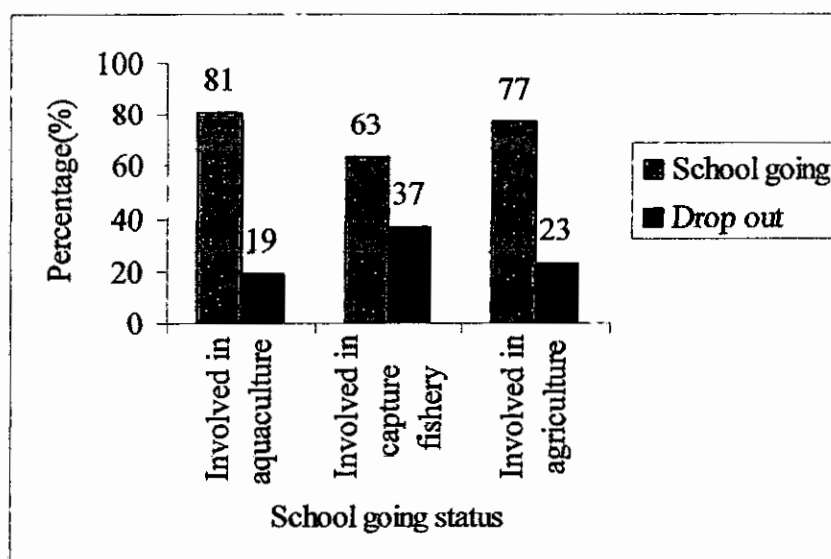


Fig.10: School Going Children in the study area

4.4.7 Causes of School Dropout

The survey was made to find out the causes of dropout of the children. It was clear that the economic problem was the main factor for dropouts of the children who engaged in aquaculture, in capture fishery and in agriculture. Involvement in income was second cause of dropouts. Causes of school dropout children of respondent's are graphically shown in the figure-11.

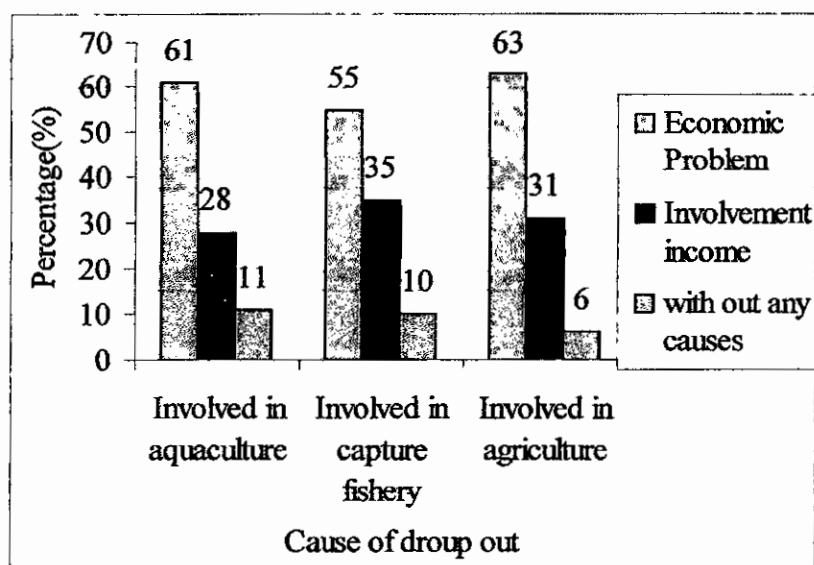


Fig.11: Causes of school dropout children of respondent's

4.4.8 Types of family

This result showed that the numbers of joint family were declined from time to time in our society though it was not totally eliminated from our society. Day by day the number of single family would be increased more in our society. This was due to the economic condition of the people. This effect was also found in the study area of Beel Dakatia. The percentage of single family was found to be 74%, 62% and 71% in aquaculture, in capture fishery and in agriculture respectively. Maintaining the single family is more convenient than the joint family for its small in size. Types of family are shown graphically shown in the figure-12.

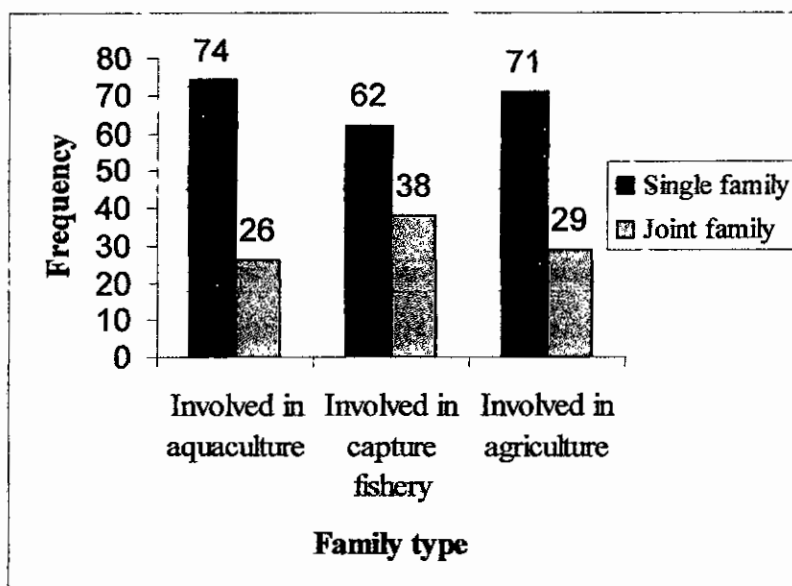


Fig-12: Types of family of the respondents

4.4.9 Family size

Family can be defined as the total number of persons living together and taking meals from the same house. The family size is related to the income of respondents. The highest 53%, 46%, 57% family involved in aquaculture, in capture fishery and in agriculture respectively was found to be 4-6 members. Family size is graphically shown in the figure-13.

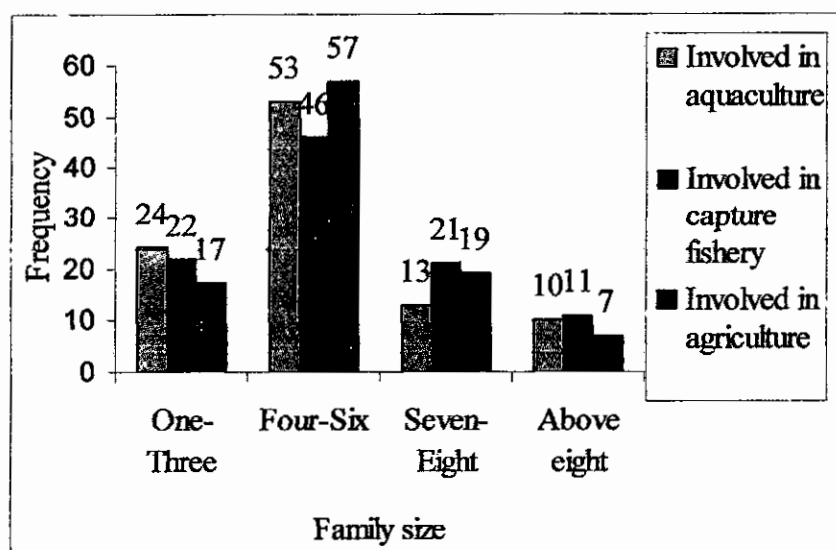


Fig.13: Family size of the study area

4.4.10 Household facilities

4.4.10.1 Use of electricity

The survey result revealed that the highest 69% people who involved in aquaculture had electricity facilities where as the lowest user was found among the people who involved in capture fishery as 41%. Electricity status is graphically shown in the figure-14.

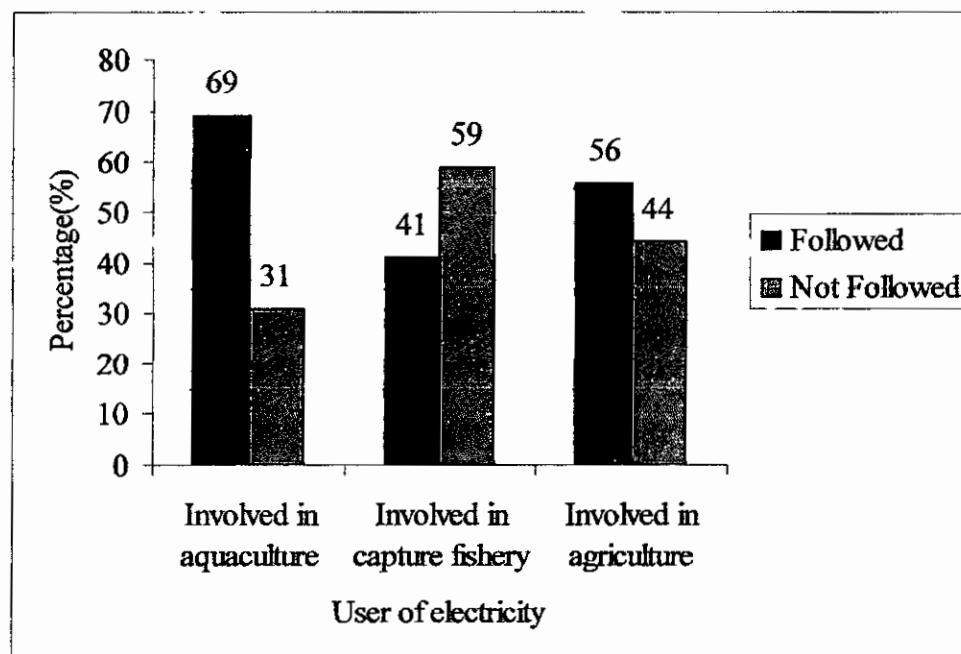


Fig.14: Use of electricity in aquaculture, capture fishery and agriculture.

4.4.10.2 Sources of Drinking water

It was found that the entire respondent who involved in aquaculture, in capture fishery and in agriculture respectively used tube-well water for drinking. Most of them used community tube-well.

4.4.10.3 Sanitation facilities

According to the survey, it observed that the highest 69% and the lowest 6% people in aquaculture used sanitary latrines and kanch latrines respectively. The highest 17% people in capture fishery used kanch latrines. Sanitation status of the fish farmer is shown graphically in the figure-15.

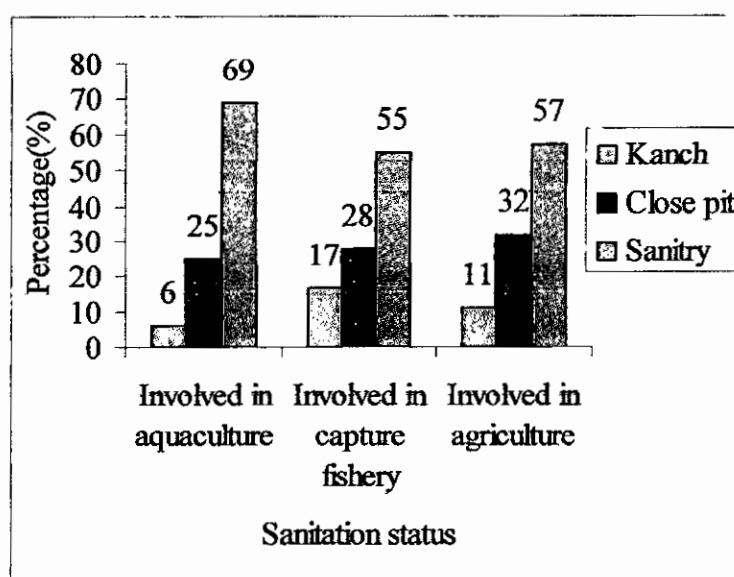


Fig.15: Sanitation status of the farmers

4.4.10.4 Common diseases

The survey results showed that people who involved in aquaculture had well health condition than others. Among the respondents, 74%, 86%, 81% people in aquaculture, in capture fishery and in agriculture respectively were found to be suffered different types of diseases including rumatic fever, dysentery, jaundice, mal nutrition, gastric, diarrhoea, fever etc. Diseases condition is shown graphically in the figure-16.

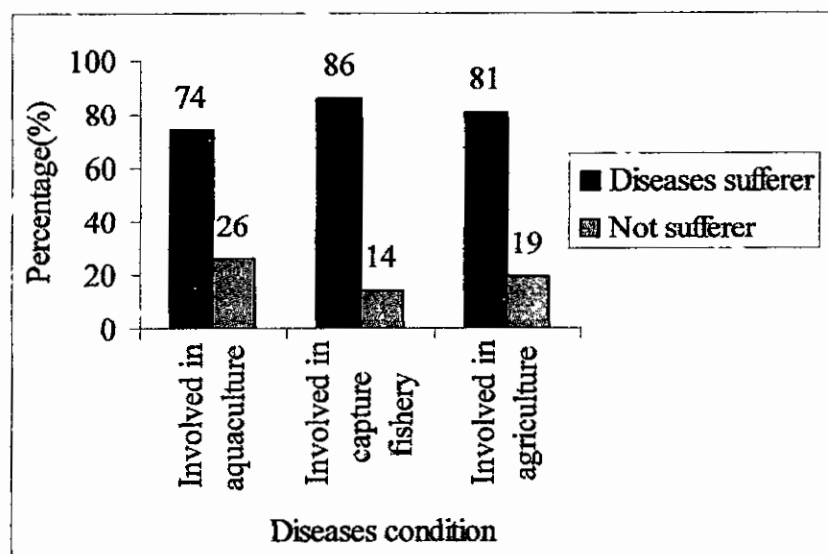


Fig.16: Common diseases of the Respondents

4.4.10.5 Treatment Received for the diseases

It observed from the survey that the highest 66%, 52% and 57% respondents who engaged in aquaculture, in capture fishery and in agriculture respectively were found to be received allopathic treatment. Nature of treatment received for diseases is shown graphically in the figure-17.

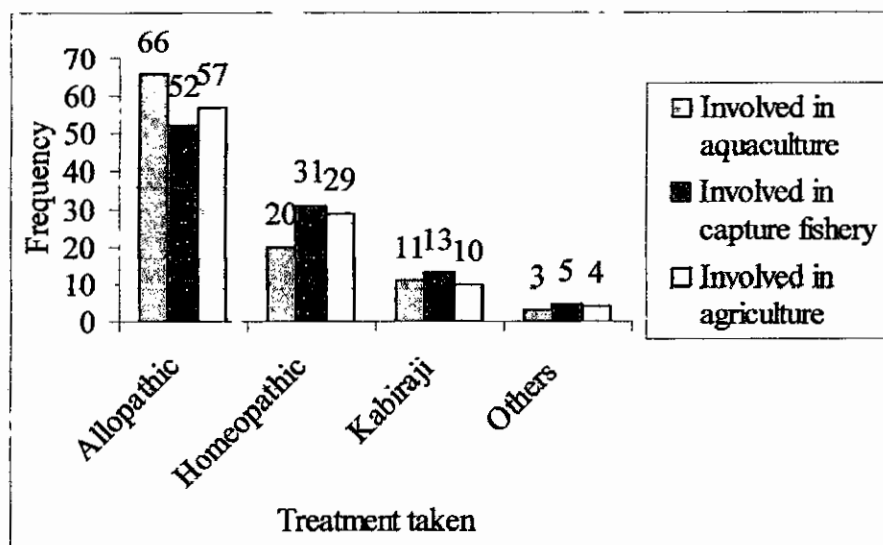


Fig.17: Nature of treatment received for diseases

4.4.11 Household assets

4.4.11.1 Ownership of the House

Average 96% families of the respondents in the study area were living in their personal land. The rest of the farmers had no ownership of their house. In this case the owner of their house was their parents or the older most person of their families.

4.4.11.2 House condition

From the study it was found that 65, 63 and 67 percent of people were found to be tin shed dweller among the respondent who involved in aquaculture, capture fishery and agriculture respectively whereas 22, 7 and 12 percent were found as pucca house dweller and 13, 30 and 21 percent were identified as kancha house dweller in these regions respectively. The nature of house was indicated that the social status of the people. Housing condition of the study area is graphically shown in the figure-18.

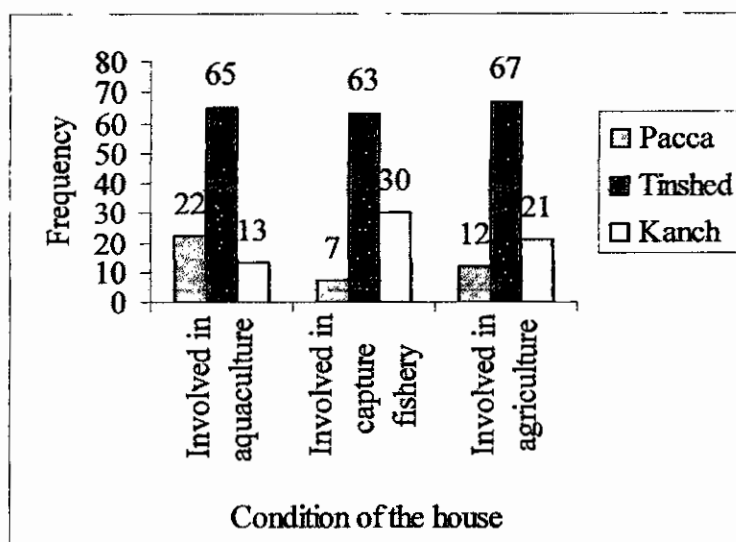


Fig.18: House condition of the study area

4.4.12 Agricultural land ownership

The study was conducted to find out how much agricultural land was owned by respondents. Agricultural land was one of the most productive assets of them who lived in the villages. In the study area it was found that, in aquaculture, capture fishery and agriculture 92%, 66% and 100% people had own agricultural land. Average area of cultivable land was found below 2 acre in the study areas. The average area of the people who involved in aquaculture, capture fishery and agriculture were found to be 1.5acre, .75acre and 1.3acre respectively. The pure agriculture land is decreasing day by day with increasing

aquaculture activities in the study of Beel Dakatia. Agricultural land ownership condition is shown graphically in the figure-19.

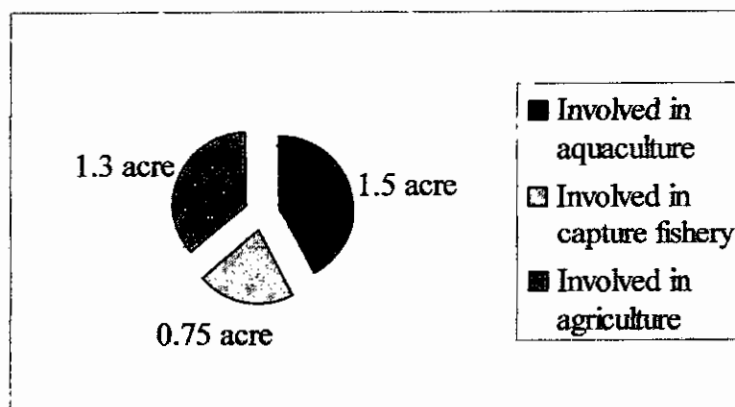


Fig.19: Agricultural land ownership of the people

4.4.13 Other Assets (livestock and poultry)

The study revealed that there were found to be 30% of the whole respondents having cow, goat, hen and duck; about 22% of the respondents had both Cow and Goat, about 13% respondents had no domestic animals. Other assets are shown in the table-28.

Table-28: List of other assets (livestock and poultry)

Name of the domestic animals	Percentage of the respondent
Hen / Duck	12
Cow	15
Goat	8
Both Cow and Goat	22
Cow, Goat, Hen and Duck	30
No asset	13

4.4.14 Credit facilities

When the survey was conducted, it observed that respondents taken credit from Relatives, Neighbors, Bank, NGO's and Moneylender (Imprest trade) 5%, 3%, 18%, 30% and 14% respectively. The highest 30% and lowest 3% respondents had taken credit from the NGOs and the neighbors respectively. 14% respondents had taken dadon (advanced money) from the money lender as a high interest rate as well as the respondents had bound to sell their

product to the moneylender as low price. About 30% respondents had not taken any credit. Credit supply condition is graphically shown in the figure-20.

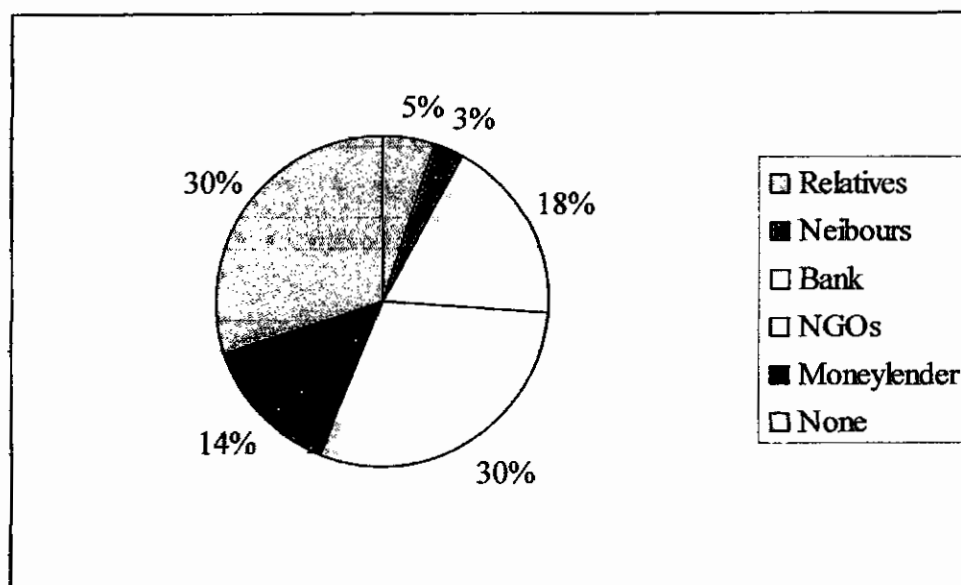


Fig.20: Credit Supply of the respondent's fishermen

4.4.15 Purpose of borrowing money

The loan recipient farmer not only use credit for fish cultivation but also others familial purposes. Some familial uses of loan are to manage food, education purpose and daughter marriage. Some fish farmer is also engaged in fish and golda fry trading i.e. one of the strongest used of loan. It was also used in different crop cultivation.

4.4.16 Amount of borrowing money

In the study area it was found that, in aquaculture, capture fishery and agriculture 47%, 40% and 26% people did not get any loan. In aquaculture, about the highest 33% people got loan ranging from 5000-10000Tk and the lowest 2% people got loan ranging from 15000-20000Tk. In capture fishery, about 24%, 27% and 9% people got loan ranging from 1000-5000Tk, 5000-10000Tk and 10000-15000Tk respectively and among the agricultural involvement people, the highest 36% got loan ranging from 5000-10000Tk and the lowest 3% people borrowed money ranging from 15000-20000Tk. Agricultural related people got more loan than other people in the study. Condition of the borrowing money is shown in the table-29.

Table-29. Loan distribution in different sectors

Amount of money (Tk)	Average interest rate (%)	Involved in aquaculture (%)	Involved in capture fishery (%)	Involved in agriculture (%)
1000-5000	15%	7	24	16
5000-10000	15%	33	27	36
10000-15000	15%	11	9	19
15000-20000	15%	2	0	3
Above 200000	15%	0	0	0
Not followed	0	47	40	26

4.4.17 Yearly income and saving

It was found from the survey that about 33% people in aquaculture and 7% people in agriculture earns more than TK 100,000 per year and in capture fishery area, most of the respondents earn less than TK 100000 per year. Only 15% respondent in aquaculture saved some money which was below Tk 10000. Most of the people did not saved money because their spent more than income in the study area. Income condition is shown in the table-30.

Table-30: List of different income group

Taka	Involved in aquaculture (%)	Involved in capture fishery (%)	Involved in agriculture (%)
< 25,000	0	1	0
25,000 – 50,000	4	55	23
50,000 – 1,00,000	63	44	70
> 1,00,000	33	0	7

4.4.18 Alternatives livelihood

From the survey it observed that people who engaged in capture fishery and agriculture, they also involved in different works for earning as alternative livelihood. These are described as bellow:

1. Poultry farming

Some family in this investigation was found to have poultry stock (hens and ducks). They thought about farming of small scale poultry farming in commercial bans, because of the availability of poultry feed easily maintenance and good market demand of the poultry product both in local and outer markets.

- Fish harvesting through marsh drying: In the study area, it was observed that all types of native species were destroyed while harvesting through marsh drying.
- Absence of sanctuary: Sanctuary is a safety place for fish breeding, but no fish breeding ground is available in the study area. For this, fish production is being the decrease.
- Social conflicts are arisen between farmers and non-farmers due to jealousy. Sometimes there are prawn robberies in the farming area during harvesting season
- Most of the farmers think that lack of money is the single most important problem for prawn farming. There is no proper credit facility to the prawn farmers. Therefore, farmers borrow money from moneylenders (with high interest rate), neighbors, banks, NGOs and sometimes they sell their cattle and gold jewelers for financing the prawn farming.

Chapter five

Discussion



Discussion

The study was conducted to observe the present condition of culture and capture fishery in Beel Dakatia and to find out the present status of socio-economic condition of the people concerned in the region. As mentioned before, during the study ten villages were randomly selected from the study area and at least 10 households were selected randomly from each village as samples. A household has been identified as one who has involved in aquaculture, capture fishery or agriculture and therefore has a right to participate in decisions making. The background of the study was before 1980 when people based on the cultivation of agricultural product and another is after 1980 when people switchover their income earning activities in fishing as a result of water logging problem. After connection to the river, the vast area of Beel Dakatia was raised by siltation. As a result, from 1995, the aquaculture farming area is gradually increasing up to now. This area is used as aquaculture, agriculture, capture fishery as well as housing.

The area distribution is gradually changing in past ten years as a result of aquaculture area increasing. Now this area is very potential as aquaculture farming and the socio economic condition of the people in Beel Dakatia area is developing day by day.

It was observed that most of the farmer,s gher size was on an average .75-1.5 acre and average tenure of the respondents in aquaculture farming was about 5.75 years. Islam (1999) found that 46.87% gher size was between 0.21 to 0.84 ha, 28.12% gher was below 0.21 ha, 16.62% gher was about 0.42 to 0.63 ha and 9.37 % gher was between 0.63 to 0.84 ha. This observation report is more or less different from the present study because the average gher size in this area is bigger than that area.

Ahmed (2001a) conducted a study on gher based prawn farming in Bagherhat district where he found that 10.71% prawn farmers started gher farming in or before 1991, 15% farmers started gher farming in 1992, 24.75% in 1993, 31.75% in 1994 and the rest 17.75% in or after 1995. This historical information is closely related to present study. Almost all interviewed farmers said that the prime reason for converting their land into aquaculture was the profitability of aquaculture over agriculture.

About half of the farmers had their own land for aquaculture and the average lease value was found at 7750 Tk in the study area. Ahmed and Hossain (1998) conducted another study where they found that 151 (86.29%) farmers cultured prawn in their own gher and 24 (13.71%) farmers had their own gher as well as leased gher in Bagerhat district. This result was quietly different from the present observation.

About 74% farmers properly followed gher preparation practice and 22% farmers partially followed it and 4% farmers did not follow it. Ahmed (2001a) found that the dry season (February to April) was the peak season for gher preparation, which involved earth cutting for an encircling canal, perhaps two meters wide and a meter and a half deep, dug just beside the perimeter of the field, the soil used to build up dykes on the outer side. Kahnem (1999) found that gher preparation included a series of activities involving drying, repairing, ploughing, liming, manuring and watering. Islam (1999) stated that out of 32 gher owners 4 (12.5%) did nothing during pond preparation, 5 (15.62%) gher owners did only manuring and 23 (71.87%) were done both manuring and liming. These results were more or less similar to this present study. Though all of the farmers in this present study area were found as traditional farmers but most of them tried to prepare their cultural pond as drying, ploughing, liming, fertilizing etc.

About 83% farmers would not use pesticide in their gher where as 17% farmers used pesticide. The high percentages of farmers did not use pesticide due to lack of knowledge about the proper use of pesticide i.e. which pesticide should use on which disease and the appropriate doses of pesticide. Another cause was due to high cost and the unavailability of pesticides. Khanom (1999) observed similar report that out of 30 gher owners, only 2 (6.67%) were found to use rotenone to remove undesirable species of fish and the majority of them 28 (93.33%) were not found to use pesticides to control predators.

Most of the farmers preferred integrated culture to poly culture because integrated culture was more profitable than poly culture in the Beel Dakatia region. Only 7% respondents practiced poly culture and 93% respondent practiced integrated culture in the study area.

All of the farmers collected hatchery produced fish fry due to lack of wild fish fry as well as cheap rate while most of the farmers collected wild prawn fry due to more benefit. Prawn culture in greater Khulna mostly depends on naturally collected PL. Khanom (1999) found similar results that all farmers (100%) used wild prawn fry for stocking in their gher.

In the poly culture the average prawn fry stocking density was found at 7000PL/acre and in the integrated culture, the average prawn fry stocking density was found at 6200PL/acre. The average stocking density of white fish was found at 500/acre in the poly culture and 400/acre in integrated culture respectively. These figures can be compared with the stocking rates of 20,000 PL per hectare, suggested by Hoq et al. (1996) and 30,000 PL per hectare noted by Khatun (2000). It was informed from the statement of the farmers of the study area that the stocking density was fully dependent upon their financial ability. Farmers of the study area stated that they prefer to use natural PL than the hatchery produced PL because of their better performance in terms of growth and survivability. Due to lack of development of hatchery and nursery facilities in these regions, they didn't get good quality seed and had to depend on natural sources.

About 96% respondents followed liming in their gher and 4% farmers did not follow it. Khanom (1999) observed the similar report that out of 30 gher owners, 25 (83.33%) were found to use lime, while 5 (16.67%) were not found to use lime in their gher. The amount of lime applied depends on the pH of soil and water. Liming strictly regulates the pH of water and soil of the prawn gher. Lime also played a role for transparency and hardness of water. The average rate of lime was found at 0.75kg/dec in poly culture where as in integrated culture, the average rate of lime was found at .50kg/dec. Khanom (1999) stated that out of 30 gher owners 9 (30%) applied lime at a rate of below 0.25 kg lime/decimal while only 1 (3.33%) of the farmers applied at a rate of higher than 1 kg lime/decimal. This result is not supported to the present study because most of the farmers used lime on an average 0.75kg/dec in their gher.

It was observed that out of interviewed farmers 71% farmers used organic fertilizer, 6% farmers used inorganic fertilizer and 23% used both organic and inorganic fertilizer. Khanom (1999) reported that out of 18 gher owners, 10 (55.56%) were found to apply organic fertilizer, 2 (11.11%) were found to apply inorganic fertilizer and the rest 6 (33.33%) were found to apply both organic and inorganic fertilizer. This result is closely related to the present study but the organic fertilizer using practices is increasing day by day in the study area of Beel Dakatia.

The average use of organic fertilizer in poly culture and integrated culture were found at 1.8kg/dec and 1.5kg/dec respectively. Khanom (1999) reported the closely related information that out of 10 gher owners, 4 (40%) applied organic fertilizer at a rate of below 2 kg organic fertilizer/decimal, while 2 (20%) farmers applied organic fertilizer at a rate of above 8 kg organic fertilizer/decimal.

Most of the farmers used both type of feeds including commercial and prepared for better production in poly culture and integrated culture system. Different feeds brand named Abtab fish feed, Niribili fish feed, Saudi Bangla fish feed and CP fish feed were found to be used as commercial feed. The major ingredients of prepared feed were found as flat rice, crashed snail, boiled rice, wheat flour, rice and wheat bran, mustard oil cake and soyabin oil cake. It was also found from the study that home made feed using practice is increasing day by day in the study area because home made feed reduced the production cost of prawn and fish instead of the use commercial ones.

New and Singhloka (1985) reported that the exact level of feeding depends on the growth and survival rate of Golda and standing crop in the gher at any one time. A highly balanced feed containing 48.93% crude protein and an attempted protein and energy ratio of 11:2.2 mg protein Kcal should be formulated and pelletized from Bangladesh ingredients of mysid shrimp meal, ground nut, oil cake, duck weed meal, wheat starch, potato starch, cod/shark liver oil, molasses, cholesterol in the diet corresponded to the level optimum for Bagda under culture reported by Paul (2000). But in the present study

area, all of the farmers did not follow the exact level of feeding in their gher due to lack of knowledge about aquaculture.

About 92 % gher were attacked by different diseases including antenna cutting of prawn, sudden death during over wintering of prawn during culturing period. Disease is a minor problem in Golda farming system because of growth retardation, physical deformities, physiological malfunction and mortalities of the growing stock; it is also a threat of economic loss for the farmers.

The prawn production performance was better in poly culture than integrated culture in the study area. The average prawn production was found to be 225 kg/acre in poly culture and 198 kg/acre in integrated culture. Ahmed (2001a) published the similar results that out of 400 prawn farmers 105 (26.25%) farmers produced 184 kg/acre in the Fakirhat and Mollarhat thana, 99 (24.75%) farmers produced 174 kg/acre in the Chitalmari thana, 102 (25.5%) farmers produced 178 kg/acre in the Bagerhat Sadar thana and 94 (23.5%) farmers produced 164 kg/acre in the Kachua thana.

The average white fish production in poly culture and integrated culture were found to be 95kg/acre and 83kg/acre respectively. The white fish production performance in poly culture was higher than integrated culture in the study area of Beel Dakatia.

It was observed from the survey that among the interviewed farmers, 93% farmers cultivated paddy properly where as only 7% farmers did not show it. The average production of paddy/acre was ranging from 1200 to 1600 kg/acre.

After preparing the dike properly, the seeds of various vegetables, fruits and wood trees were planted in and around the dikes. The household women played a vital role in looking after these crops. Some fruit trees like coconut, dates are planted as permanent fruit trees. For the protection of various dike crops like jhinga, bean, laau, shasa, pui shak, chichinga, kumra macha or bera was use. Some inorganic fertilizers are applied for vegetables and fruit trees. After 3-5 months they consumed these various crops, gives to

their relatives and sometimes sell in the market. After the completion of one seasonal cultivation another seasonal crops were again cultivated. It was also seen that the average production of vegetables and fruits in the study area were small in amount.

Total income from the integrated culture per acre was 1,08,585TK and from poly culture was 96,650TK. Net profit from integrated culture was found to be 59,673TK which was higher than poly culture (51,022Tk). Integrated culture system was widely practiced by the farmers because of it is higher profitability than others one.

About 297.19 ha (2.56%) is found as capture fishery area and about 264 household directly and 1320 people indirectly involved in the capture fishery activities. There were found three types of fisherman such as occasional fisherman, full-time fisherman and part time fisherman. A total of 41 different species of fish and 3 species of prawns were identified in the capture fishery study area of Beel Dakatia. The capture fishery area is decreasing rapidly with increasing aquaculture area.

Inland open water capture fisheries have traditionally played an important role in the overall production in Bangladesh. There has been a gradual decline in the production of freshwater fish from these open water fisheries during the last three decades. Carp, which once contributed 30% of the catch, now only contributes 5–6%. Assemblage changes have occurred as a result of over fishing and the effects of unplanned flood control drainage and irrigation schemes (FCDI) These have disrupted fish migration, reduced aquatic habitat both temporally and spatially, and have increased the vulnerability to capture.

Open water fish production declined from 6,90,000 tones in 1972 to a low of 4,24,000 tones in 1989. One of the reason for the decline has been over fishing caused by a large and increasing population. But other reasons are related to the loss of aquatic environment and fish migration routes caused by implementation of flood control measures, drainage and irrigation schemes and road building programme which usually involve construction of embankments, closure or diversion of rivers and other structural

changes with resulting negative effects on fisheries resources. A further cause of fish stock losses has been pollution of the open waters by industrial and agro-chemical effluents (FAO, 1995).

The present study observed the similar reasons in the capture fishery study area of Beel Dakatia that declines the fisheries resources gradually. These causes are described as below :

- Excess harvesting: The population is increasing very rapidly, but fishery production is not increasing accordingly. For this, the fishermen are indiscriminately harvesting the native species as well as are destroying their breeding ground day by day.
- Use of Current jal: Current jal with small mesh is a great obstacle to fish production in the capture fishery study area.
- Fish harvesting through marsh drying: In the study area, it was observed that all types of native species were destroyed while harvesting through marsh drying.
- Absence of sanctuary: Sanctuary is a safety place for fish breeding, but no fish breeding ground is available in the study area. For this, fish production is on the decrease.
- Use of pesticide: Pesticide used for paddy cultivation which has negative effect on fish production in the capture fishery area.
- Involvement of Government: In the study area, fish breeding ground is being destroyed as there is no careful involvement of government in this field. As a result fish production is being hampered.

The paddy production was found to be average 800-1280 kg per acre in the pure agricultural area. The agri-fisheries activities is more benefited than only agriculture. So the pure agricultural land reduced day by day in the Beel Dakatia region.

Wide ranges of data were collected from the study for the analysis of the socio-economic characteristics. These were on the age group, religion, marital status, education, type of

fish farmer, family type, no. of family member, school going children and school dropout, causes of school dropout, ownership of the house, house hold assets, use of electricity, occupation, sanitation practice, area of the gher, pond ownership, harvesting, marketing, problem in culturing, credit availability, yearly income etc.

Maximum participation of respondents was found at age group 21-40 years. Similarly, age composition of the fishermen by many researchers recorded majority to be less than 40%. About 66% farmers in Tangail and 70% in coastal region were under 40 years of age reported by Ahmed (1996) and Ahmed (1999) respectively.

There was no female farmer involved in fish culture. It also focused on the high involvement of male farmers in fish culture in our society. Ahmed (1996), Mannu (1999) and CPP (1996) reported on the sex composition of the prawn farmers also support this result.

Highest 71% people were found Muslim who involved in aquaculture but 74% people were found Hindu engaged in capture fishery in the study area. This result was agreed by other reporters (DoF, 1990 and DoF, 1993). Ahmed and Hossain (1998) reported that 67.43% farmers were Muslims while the rest were Hindus in five thanas of Bagerhat district. Different picture was found by the study of Chantarasri (1994) and Rabbani and Sarker (1997) in Sundarbans Reserve Forest and stated that most were Hindu.

Most of the fish farmers were literate at various stages of education. Rahman (1994) had noted the different results that, in Bangladesh most of the fishermen were illiterate and few had primary level of education. Bailey and Doulman (1994) also stated that coastal fishermen in Bangladesh had the lowest level of education. Most of the sampled fish farmers were engaged in fish culture in their early stage due to poor economic status of their parents and lack of awareness about education. The fishermen's economic condition is so poor that they cannot often afford to educational expense of their children. Other causes are due to illiteracy, due to unconsciousness of family members, some of children like girls had married, so they were not interested to go to school.

It is clear that most of the family size was found to be 4-6 members in the study area. Ahamed (1999) found coastal fishermen family size to be 6.4. Similar results were found by DoF (1993). This result is closely related to the present study.

It was found that rural people of our country didn't get available facilities for the use of electricity though they had the capability of using electricity. It was also found that electricity facilities were comparatively higher than other area. DoF (1993) reported 2% fishermen household used electricity. This result is very quit different from the presently study.

Most of respondents used community tube-well as a source of drinking water. Similar result was recorded by DoF (1993) at Chanda beel. But Ahmed (1999) mentioned that most farmers used pond water due to lack of tube-well in coastal area. Mahbullah (1986) noted that 41% fishermen used tube-well water for drinking, cooking, bathing and washing.

The people who involved in aquaculture have better sanitation status than others who involved capture fishery and agriculture in the study area. Another study conducted by CPP (1996) in Tangail reported different results that 4 % farmer's household used no latrines.

The study revealed that most of the people were careful about their health and it was proved again their well economic and social condition. Ahmed (1999) in coastal area observed that less than 5 % farmers went to doctors. This result is quiet different from the present study. The survey revealed that the people availed themselves of treatment facilities like services from allopathic, homeopathic, Kabiraji and others.

Most of the farmers in the study area of Beel Dakatia had own house. Al-Muhit (2000) study on the fishermen communities of the Dhaleswari River near Jamuna Bridge shows the similar results that 97.22% people lived in their own house.

Al- Muhit (2000) showed that 97.78% roof material of the fishermen house were made of tin and CPP (1996) reports that 89.23% roof materials of the fishermen houses were made of tin. This result is more or less similar to the present study. The housing status of the study area is developing gradually with increasing the involvement of aquaculture.

There were found to be 30% of the whole respondents having cow, goat, hen and duck, about 22% of the respondents had both Cow and Goat, about 13% respondents had no domestic animals. Different picture was found by the study of Chantarasri (1997) in Sundarbans Reserve Forest reported at 50% cattle owned prawn farmers. Another study by Mahbubullah (1986) showed 82.3 % prawn farmers had no animal and poultry.

The highest 30% and lowest 3% respondents had taken credit from the NGOs and the neighbors respectively. CPP (1996) observed the different report that 70% took loan from moneylender. Ahmed (1996) also found out the different results that 92% of fishermen were member of some associations, clubs and co-operatives and they got some facilities from that organization. According to the survey, NGOs awareness is increasing rapidly about aquaculture in the study area.

It revealed that the families under the study spent more money when their income was more and spent less when their income was also less. People who involved in capture fishery and agriculture did not save any money in the last year. Only 15% respondent in aquaculture saved some money which was below Tk 10000. Most of the people did not saved money because they spent more than income in the study area.

People who involved in aquaculture were better economic condition than others. People suffered many problems in this study area. So there is a necessity of proper organizational involvement to make a proper guideline for the proper use of resources by the community people to ensure their livelihood pattern. Over all socio-economic condition is developing day by day with increasing aquaculture activities in this study area of Beel Dakatia.

Chapter six

Conclusion

Conclusion

Beel Dakatia has the vast area which is used as aquaculture, agriculture, capture fishery as well as housing. But before 1980 when people based on the cultivation of agricultural product and another is after 1980 when people switchover their income earning activities in fishing as a result of water logging problem. After connection to the river, the vast area of Beel Dakatia was raised by siltation. As a result, from 1995, the aquaculture farming area is gradually increasing up to now. About 52% area of Beel Dakatia is used as aquaculture. So this area is very potential as aquaculture farming. There are found two types of culture system like integrated culture and poly culture. About 93% farmers practiced integrated culture and only 7% farmers practiced poly culture. Because integrated culture is more beneficial than poly culture. Although integrated fish farming is comparatively a new concept in Bangladesh but it is very much beneficial for the farmers because in this culture system, more than two commodities are produced in same area and the production cost are significantly reduced. But most farmers were not aware of the necessity of gher preparation and appropriate ratio of stocking and feeding. For these reason necessary information and modern technology have to be transferred to the farmers. To properly manage the gher, continuous monitoring and supervision are necessary. Capture fishery area is decreasing very rapidly with increasing aquaculture activities. So the native species is also reducing in the study area. Pure agricultural area is reducing day by day past ten years with extend aquaculture activities. The aquaculture area is very potential in the study area. Integrated culture system is very much profitable in our environmental condition. As a result if integrated prawn farming can be adopted in all over the country, fish production will be increased and from this we can earn foreign exchange from exporting fish and fishery products and also better contribution in national economy. As Bangladesh is a poor country, so we should utilize our lands and water resources in maximum level to produce maximum output from this culture system so that our poor farmers can be benefited. There is a necessity of proper organizational involvement to make a proper guideline for the proper use of resources by the community people to ensure their livelihood pattern. People who involved in aquaculture were better economic condition than others. People also want to use the natural resource of Beel Dakatia, but they do not know the appropriate procedure to use. So there is a need of proper organizational attention.

The following suggestions can be made to increase the fish production as well as to improve the socio-economic condition of the study area.

Harmful nets and traps should not be allowed in harvesting fingerling, brood fish randomly through the year in Beel.

Over fishing must be stopped and fish sanctuary should be established during breeding season.

Government and Non-Government agencies, research organization, local administration and law enforcing authority should together to formulate an integrated policy to intelligently manage and conserve fisheries.

Fisheries rules and regulations must be updated and enforced strictly at every steps of fisheries level.

School, college should be established in Beel area, free education and scholarship should be given to the poor people.

There should be a good relation among people of Beel area with fishery, agriculture, animal husbandry and poultry management sector.

There are few roads in Beel area and these are kacha and broken condition. So no vehicle can move smoothly on these roads. So road connection of Beel area with main roads should be improved.

Health and sanitation condition in this area are very poor. Many people die every year without having proper treatment. So hospital should be established and there should be available advice for the poor people.

Licensing system should be established in lieu of leasing system and true fishermen should be given priority.

Water pollution by any means should be minimized and existing rules and regulations on water pollution should be effectively enforced.

Rare species can be increased by establishing fish sanctuary in their habitats, breeding areas, nursing grounds.

Technical supports and fishing training should be provided to develop socioeconomic condition of the fishermen.

It is necessary to emphasize in modernization of Beel Dakatia area as to utilize resource properly.

Chapter seven

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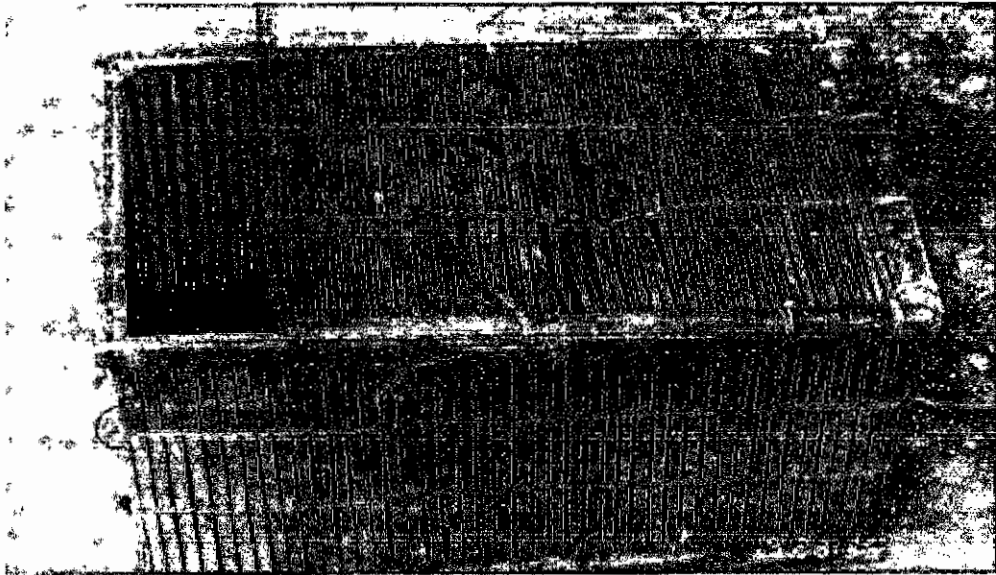
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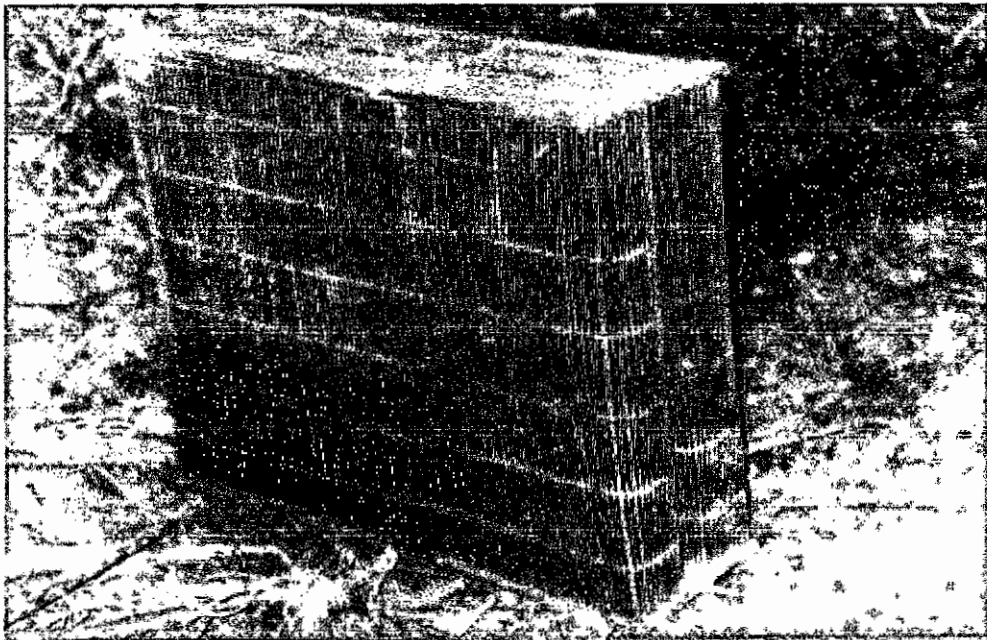
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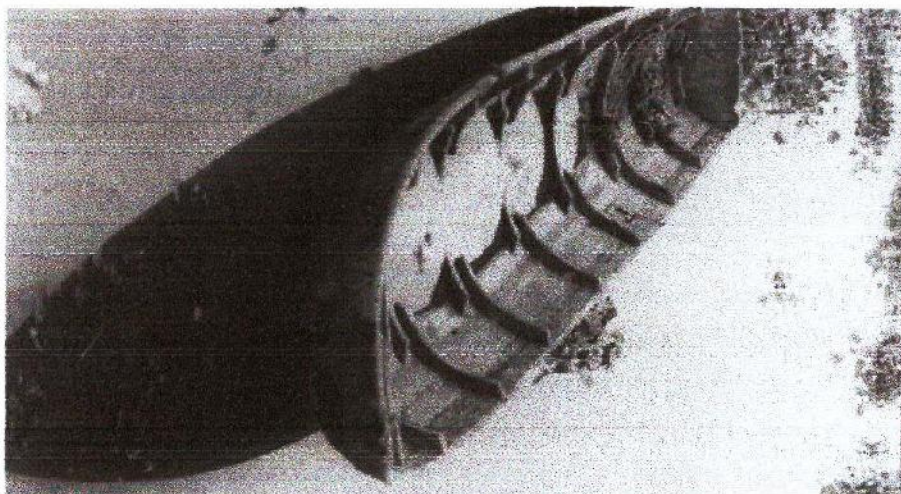
Appendices



Photograph-1: Ziana



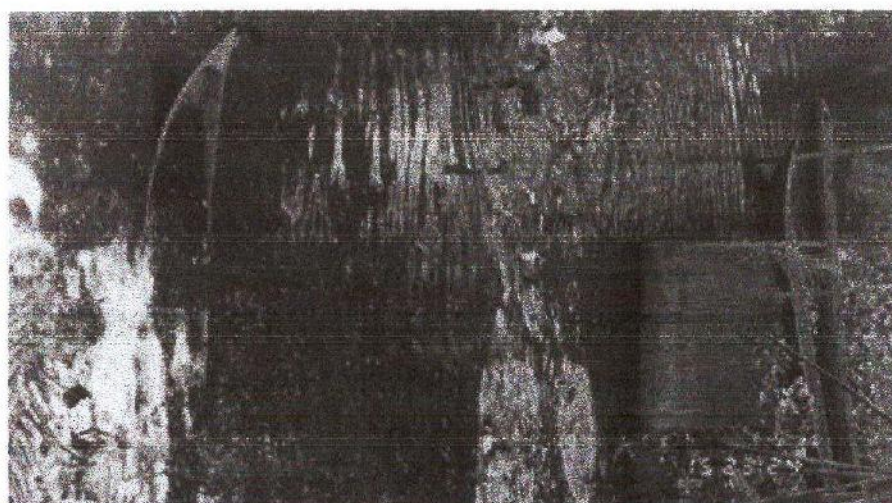
Photograph-2: Tubo



Photograph-3: Noauka



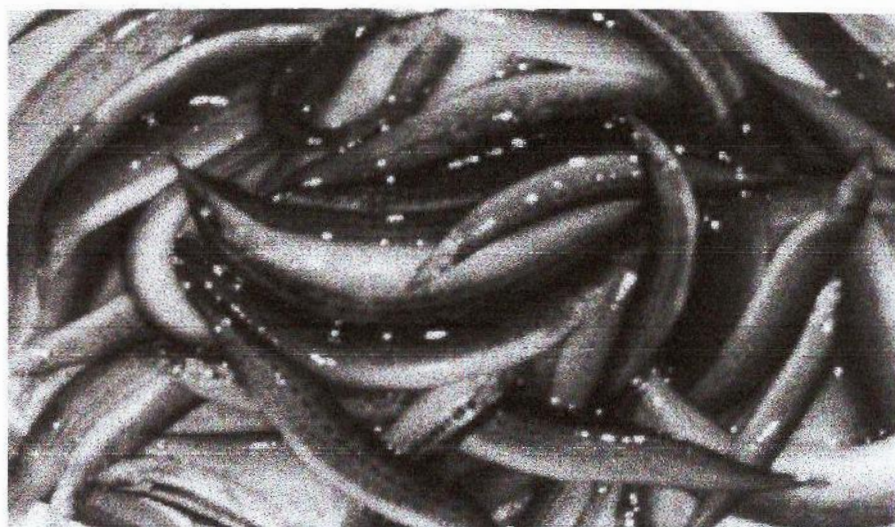
Photograph-4: charo-pata



Photograph-5: Polluted water in capture area



Photograph-6: Puti



Photograph-7: Ban



Photograph-8: Bele



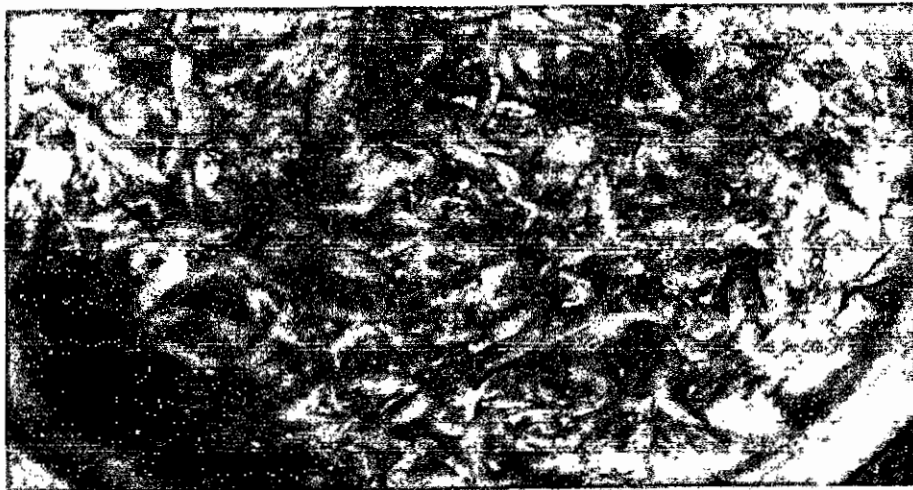
Photograph-9: Taki



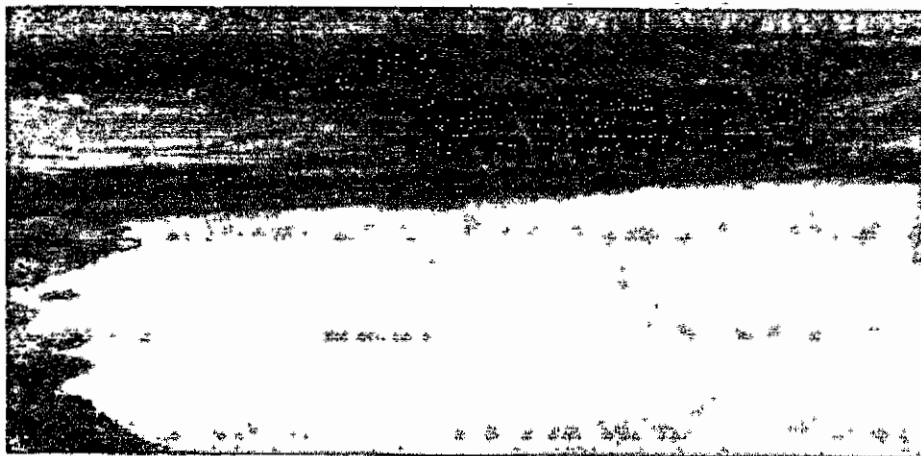
Photograph-10: Shoal



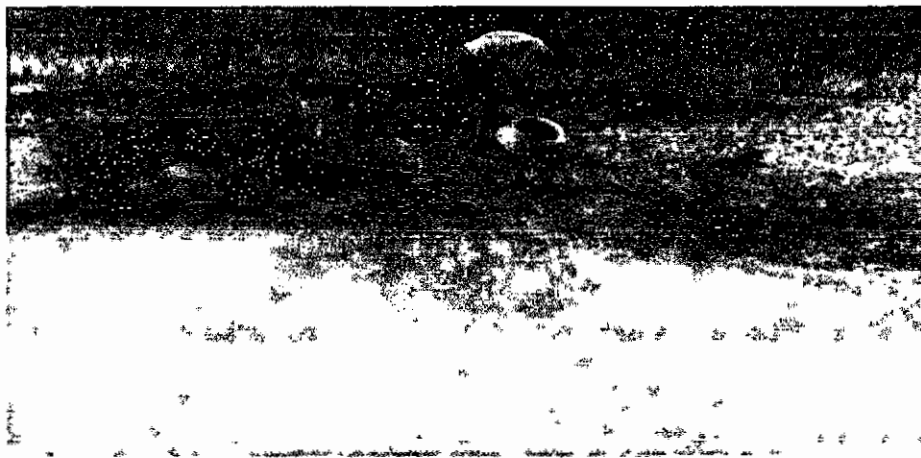
Photograph-11: koi



Photograph-12: Small Chingri



Photograph-13: Integrated pond-1



Photograph-14: Integrated pond-2