

# **Gear Effectiveness, Catch Composition and Co-Management Practices in Oxbow Lakes of Bangladesh.**



**EXAMINATION ROLL NO- MS 970623**  
**SESSION: 1996-1997**

The Thesis Submitted to the Fisheries  
and Marine Resource Technology  
Discipline in partial fulfillment of the  
Requirements for the degree of

Master of Science  
in  
Fisheries and Marine Resource Technology

August, 2002.

# **Gear Effectiveness, Catch Composition and Co-Management Practices in Oxbow Lakes of Bangladesh.**



**Approved as to style and content**

**by**

**Professor Khairul Azam Ph.D.**

**Head**

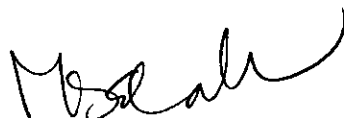
Fisheries and Marine Resource Technology  
Discipline,  
Khulna University, Khulna.  
Bangladesh.

August, 2002.

# DECLARATION

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

## Supervisor



---

**Dr. Md. Saifuddin Shah**

Professor

Fisheries and Marine Resource Technology  
Discipline,  
Khulna University, Khulna.  
Bangladesh.

Candidate



---

**Md. Oliur Rahman**

# **The Memory of My Parents**



# **ACKNOWLEDGEMENT**

All praises are due to the supernatural power of almighty Allah, who created, afterward enabled the author for successful completion of the research work.

It is my great pleasure to express my deepest sense of gratitude and heartfelt indebtedness to my respected teacher Professor Dr. M. S. Shah of Fisheries and Marine Resource Technology Discipline, Khulna University for his kind supervision, encouragement and assistance throughout the study.

I am thankful and must express my gratitude to Dr Khairul Azam, Professor and Head, Fisheries and Marine Resource Technology Discipline for his encouragement and inspiration during the course of this study.

I express my sincere gratitude, heartfelt appreciation and profound regard to MR. A.H. Chisty, Asstt. Professor, FMRT Discipline for his initial help and assistance.

I also express my profound respect and obligation to MR. A. S. M. Jahangir, District Fisheries officer, Jessore for his co-operation and guidance.

I like to express my indebtedness to my respectful teachers Dr. Anisul Haque, Mr. Mohammad Mostafa, Md. Mustafizur Rahman Assistant Professors of Fisheries and Marine Resource Technology Discipline, Khulna University for their kind co-operation.

My appreciation also goes to my teacher Dr. Rezaul Hasan, Professor, Faculty of Fisheries, BAU, Mymensingh for helping me in this work.

It is a great pleasure for me to remember the inspiration, advice that came from Mr. A. Sattar, Ex Project Director, Oxbow lakes Project Directorate of Fisheries, Bangladesh.

I would like to express my heartfelt thanks to all of my colleagues, the Baor Manager, Scientific Officer, and other friends for providing me the necessary assistance when needed.

Cordial thanks are due to my associates and assistants who helped me in this work in various ways.

Thanks are also due to BRAC, RM, AM and POs who were engaged in Oxbow lakes projects during the Course of this work.

My deepest gratitude are due to my parents for their inspiration, sacrifice, blessings and moral support for this study.

Lastly, but not least, I would like to express my heartiest thanks to my partner, my loves, Shirin Sultana, my wife for her constant sacrifice and inspiration.



**Md. Oliur Rahman**

# ABSTRACT

In the south-west region of the country there are 500-600 oxbow lakes covering a water area of 5488 hectares. The lakes produce a large quantity of fish and a big number of poor people depend for their livelihood on the fisheries of the lakes. Since 1980 the Government of Bangladesh has undertaken two projects on the improvement of management of the lakes; the principal issues were being the derivation of a suitable means of involving the fisherman in the management process and sharing of the benefits of the improved production. Six different Lakes VIZ; Katgora, Fatepur, Joydia, Nasti, Sasta and Porapara were subjected for study in the present program. Three lakes, Katgora, Fatepur and Joydia were under the first phase of the GOB project and the other three Nasti, Sasta and Porapara were in the second phase of the project. The present study was aimed at looking into the scenarios of gears that are used for selective fishing, catch composition for the stocked and the non-stocked forage fishes over different lakes and over different gears used and the management benefits that are obtained by the stake holders in the present co-management methods.

Data were collected by questionnaire survey and personal interview of the fisherman. Moreover, various secondary data were used. The data were analysed with the help of statistical test.

Various gears used in the lakes, their design and operation and their selectivity were discussed. Among them kochal fishing was the most prominent. Komor fishing and Vulki fishing were next to kochal fishing in prominence. Some other types of gears were also discussed.

Stocking design was more or less same for all the six lakes, however, there were variations in the harvesting records in the different lakes. Stocking size of the fingerlings, the stocking density and the total volume of the stocked biomass were not maintained in the lakes. Species composition of the liberated and unliberated harvested fishes were observed. The contribution of the unliberated wild fishes to the total lake production was recorded for the lakes.

In the three lakes (Katgora, Fatepur and Joydia) under the first phase the co-management methodology did not work well; the production of fish was not remarkable; in the other three lakes (Nasti, Sasta and Porapara) under the second phase, the co-relations between DOF, NGOS and the fishermen groups were better realized in the improvement of the management conditions though, there were inherent difficulties in the achievement of the objectives in fullest appreciation.

# CONTENT

| Sl No   | Title                                      | Page |
|---------|--------------------------------------------|------|
|         | ACKNOWLEDGEMENT                            | I    |
|         | ABSTRACT                                   | II   |
|         | CONTENT                                    | III  |
|         | LIST OF TABLES                             | V    |
|         | LIST OF FIGURES                            | VI   |
|         | LIST OF APPENDIX                           | V    |
| 1.0     | INTRODUCTION                               | 1    |
| 2.0     | MATERIALS AND METHODS                      | 6    |
| 2.1     | Study area                                 | 6    |
| 2.2     | Data collection                            | 6    |
| 2.3     | Data analysis                              | 8    |
| 3.0     | RESULTS AND DISCUSSIONS                    | 9    |
| 3.1     | Fishing Gears                              | 9    |
| 3.1.1   | Description of gears and mode of operation | 10   |
| 3.1.1.1 | Kotchhal fishing (seine netting)           | 11   |
| 3.1.1.2 | Brush park by drag net (Komor fishing)     | 12   |
| 3.1.1.3 | Lift Net (Chak Jal)                        | 13   |
| 3.1.1.4 | Falling net (cast net)                     | 13   |
| 3.1.1.5 | Dip net (lift net)                         | 14   |
| 3.1.1.6 | Gill net (drift net)                       | 14   |
| 3.1.1.7 | Hook                                       | 18   |
| 3.1.1.8 | Spears/ harpoons (wounding gear)           | 20   |
| 3.1.1.9 | Traps- box traps                           | 21   |
| 3.1.2   | Selectivity of gears                       | 22   |
| 3.1.2.1 | Kotchhal fishing                           | 23   |
| 3.1.2.2 | Komor fishing                              | 23   |
| 3.1.2.3 | Vulki fishing                              | 24   |
| 3.1.2.4 | Chak fishing                               | 24   |
| 3.1.2.5 | Angling (Sip barshi)                       | 25   |
| 3.1.2.6 | Gill netting                               | 25   |

| SI No   | Title                                                                                                    | Page |
|---------|----------------------------------------------------------------------------------------------------------|------|
| 3.2     | Catch composition                                                                                        | 25   |
| 3.2.1   | Catch composition of stocked carps in different Lakes                                                    | 26   |
| 3.2.1.1 | Catch composition of the stocked carps under different fishing methods                                   | 26   |
| 3.2.2   | Non stocked fish in oxbow lakes caught by different gears                                                | 32   |
| 3.2.2.1 | Catch composition of non stocked forage fish caught by seine net and cast net                            | 32   |
| 3.2.2.2 | Catch composition of nonstocked forage fish caught by gill net                                           | 33   |
| 3.2.2.3 | Catch composition of nonstocked forage fish caught by traps                                              | 34   |
| 3.2.2.4 | Volume of catch of nonstocked forage fishes and their contribution in the total production in the lakes. | 34   |
| 3.3     | Co- Management : a novel concept in oxbow lakes management                                               | 43   |
| 3.3.1   | Organization and institutions involved                                                                   | 46   |
| 4.0     | Summary and Conclusion                                                                                   | 51   |
|         | Abbreviation                                                                                             | 69   |
|         | Appendix                                                                                                 | 70   |
|         | REFERENCES                                                                                               | 73   |



# LIST OF TABLES

| Table No. | Title                                                                                                                                                              | Page |
|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| 1.        | Profile of 6 studied lakes                                                                                                                                         | 7    |
| 2.        | Particulars of different types of gill net, seine net, lift net and castnet used in oxbow lakes for fishing                                                        | 16   |
| 3.        | Particulars of different types of traps used in oxbow lakes for fishing of non stocked forage fish                                                                 | 17   |
| 4.        | Particulars of different types hooks and line used for fishing in oxbow lakes.                                                                                     | 17   |
| 5.        | Particulars of different types of spears/harpoons used for fishing in oxbow lakes.                                                                                 | 19   |
| 6.        | Harvesting records of stocked carp in the investigated oxbow lakes in 1997, 1998, 1999                                                                             | 28   |
| 7.1       | Catch and recovery percentages of stocked carps in the investigated oxbow lakes (OLP-I) in the year 1999                                                           | 29   |
| 7.2       | Catch and recovery percentages of stocked carps in the investigated oxbow lakes in the year 1999                                                                   | 30   |
| 8.        | Percentage of catch of different species in different fishing methods                                                                                              | 31   |
| 9.        | Catch composition of forage fishes caught by seine net, lift net and cast net.                                                                                     | 37   |
| 10.       | Catch composition of forage fishes caught by different types of gill nets.                                                                                         | 38   |
| 11.       | Catch composition of forage fishes caught by different types of traps.                                                                                             | 39   |
| 12.       | Yield (kg/ ha/ month) and percentage contribution to the total yield (% weight) of non-stocked forage fish groups in the investigated baors from April- June, 1999 | 40   |
| 13.       | Stocked and non stocked fish in the investigated baors in 1999.                                                                                                    | 41   |
| 14.       | Estimated catch (kg) and yield (kg/ha) of non-stocked forage fish in the investigated baors during april-june'1999                                                 | 42   |
| 15.       | Changes of socio- economic conditions of fishermen in some indicators of wellbeing of LFT households.                                                              | 48   |
| 16.       | Changes in facilities to the LFT households between 1993 and 1995                                                                                                  | 48   |
| 17.       | Catching time in respect of fish value/ kg.                                                                                                                        | 49   |
| 18.       | Culture period.                                                                                                                                                    | 49   |
| 19.       | Scientific name and local name of the fish species recorded by different gears from the oxbow lakes                                                                | 50   |

# LIST OF FIGURES

| Figure No. | Title                                                                                                 | Page |
|------------|-------------------------------------------------------------------------------------------------------|------|
| 1.         | Bangladesh's map                                                                                      | 54   |
| 2.         | Location of Baor (Lake)                                                                               | 55   |
| 3.         | Sketch of an ideal Baor with Komor, Kochal, Fry release, Inlet, Outlet, Fish retention structure etc. | 56   |
| 4.         | Sketch of Kochal fishing                                                                              | 57   |
| 5.         | Sketch of Komor fishing                                                                               | 58   |
| 6.         | Sketch of Chak fishing                                                                                | 59   |
| 7.         | Sketch of Kochal and Chak fishing                                                                     | 60   |
| 8.         | Picture of market size fish                                                                           | 61   |
| 9.         | Sketch of Gillnet                                                                                     | 62   |
| 10.        | Sketch of Seine net                                                                                   | 62   |
| 11.        | Sketch of Falling net                                                                                 | 63   |
| 12.        | Sketch of Dip net                                                                                     | 63   |
| 13.        | Sketch of Charo                                                                                       | 64   |
| 14.        | Sketch of Arinda                                                                                      | 64   |
| 15.        | Sketch of Khadom                                                                                      | 65   |
| 16.        | Sketch of Ramani                                                                                      | 65   |
| 17.        | Sketch of Tubo                                                                                        | 66   |
| 18.        | Sketch of Ghuni                                                                                       | 66   |
| 19.        | Sketch of Dhawn Borshi                                                                                | 67   |
| 20.        | Sketch of Nol Borshi                                                                                  | 67   |
| 21.        | Sketch of Sip Borshi                                                                                  | 67   |
| 22.        | Sketch of Chasra                                                                                      | 67   |
| 23.        | Sketch of Koach                                                                                       | 68   |
| 24.        | Sketch of Juti                                                                                        | 68   |
| 25.        | Sketch of Jhupi                                                                                       | 68   |
| 26.        | Sketch of Fulkuchi                                                                                    | 68   |

# LIST OF APPENDIX

| <u>NO.</u> | <b>Title</b>                  | <b>Page</b> |
|------------|-------------------------------|-------------|
| 1.         | Data collection sheet-1       | 70          |
| 2.         | Oxbow lakes information sheet | 71          |
| 3.         | Data collection sheet-2       | 72          |

## 1.0 Introduction:

Bangladesh is endowed with rich and extensive fishery resources both inland and marine with a wide variety of indigenous and exotic fish species. The soil, water and climate of Bangladesh are unique for inland fisheries. Inland fisheries cover an area of 4.34 million hectare of which 93% comprises capture fisheries. The culture fisheries includes ponds (0.12 million ha), oxbow lakes (0.005488 million ha) and coastal shrimp farms (0.14 million ha.). The flood plains and Beels covering 2.95 ha offer tremendous scope and potential for augmenting fish production by adopting culture based fishery enhancement techniques (DOF, 1997).

Fisheries sector plays a vital role in the socio-cultural and economic life of the people of Bangladesh. In 1999-2000 the fisheries constituted 7.75% of the total of taka 18116 million (DOF, 2001). There are about 1.2 million fulltime fishermen and nearly 10% of the population depend for their livelihood on fisheries directly and indirectly. An estimated 9.5 million households or about 73% of all households are involved in subsistence fishing in flood lands. The present population of the country is 130 million, production of fish is about 1.78 million M.T.(1998-99) and the present per capita annual consumption has decreased to 12.0 kg (that is 27 g/head/day). Though fish provides about 63% of the total animal protein intake of the population, the production of fish could not keep pace with the growth of population of the country. Government has the future target for fish production of about 2.405 million M.T. (2002-2007) for 140 million people at the rate of 36 g fish/day/person consumption by the people (DOF, 2001) . To increase fish production Government has to increase fish production through inland culture fisheries. Although the total area of oxbow lakes in the country is 5488 ha, to meet up the local fish demand of the south-west region, the lakes play a very important role. There is no separate statistics of baor (oxbow lakes) fish production at present, however a baseline survey conducted by Bangladesh Centre for Advanced Studies (BCAS) 1987, reported fish production to be 150kg/ha/year. After the project intervention and implementation by adopting culture based fisheries management, production has been increased. The present production rate is between 400-1820 kg / ha / year. There are more than 600 oxbow lakes in southwestern Bangladesh, covering about 5488 ha (O.L.P,1999). As far as it is known up to the year 1900, these lakes were remained as open water without any culture practice. Only in the rainy season fish of various species entered from

surrounding areas to the oxbow lakes and remained there during the winter. After 1900 it was taken over by the Government and on behalf of Government, the Ministry of Land used to lease out these lakes among the individuals, societies and to some organizations. Directorate of fisheries took 6 Baors from the MOL. The Baors are Baluhar, Joydia, Fatepur, Katgora, Bergobindapur and Morjad. They are under the districts of Jhenaidaha and Jessore. With these Baors the DOF constituted a development project named as Oxbow Lake Project( OLP-I) with financial help from the World Bank (WB). During the first phase of the project(1980-87) some development works like deweeding, construction of fish landing centres and the connecting roads were developed. DOF had posted a senior level officer namely Baor Manager(BM). Under the Baor Manager an Assistant Hatchery Officer (AHO), a Field Assistant, some permanent staff and some temporary guards were posted. The Baor Manager's office had organized the fishermen groups, motivated them and trained them for catching fish. The Baor Manager used to stock fish in the Baor with the presence and direct monitoring of a committee constituted by BM,AHO, concerned Thana Fisheries Officer (TFO), Fishermen group leader (5) and Project Director or his representative. Fish stocking was done during April-May and July- August of a year. After that the DOF staff had guarded the stocked fish. No artificial feeding was done; the productivity of the lakes was based on the natural nutrient supply being made from the surrounding agricultural lands. Submerged vegetation was also a source of food for the fish. Fishing was done after 7-8 months of stocking; normally 2-3 times during the period, once being during October- November and another time during March-April and May-June. Fishing was done by the fishermen, by dividing the whole baor in several partitions with different fishermen groups setting komors with bamboo, branch of trees, leaves etc. Each group caught fish by using a seine net locally called Ber jal. The fishing they practice is called kotchhal fishing. Usually kotchhal is done throughout the lake and up to the areas of the komor for 3-4 days. Then komor fishing starts when they encircle the komor with net. Each fishermen group normally fish from 1-3 komors. Harvested fish were taken to a centrally placed landing centre where some of the fish were sold locally; the maximum being taken to nearby bigger markets of Jessore, Jhenaidaha, and Kushtia District towns. The Baor Manager with the help of fishermen group representatives sells the fish. Sometimes Bangladesh Fisheries Development Corporation (BFDC) used to purchase fish from the landing centres. The sale value of fish was proportioned into 60:40. Sixty percent of the sale proceed was deposited



into treasury in favour of the government and 40% was taken by the fishermen. Within the fishermen group equity is maintained for distribution of that 40% sale proceed. It is known that some group leaders take 50% money from the 40% sale proceed who bear the costs for supply of nets, boats and komor installation. The rest 50% was distributed among the general fishermen equally. The management at this stage could be corrupted; the Baor Manager by being unscrupulous could establish unholy contact with the fishermen leaders for misappropriation of the sale proceed (personal communication). As such the lesson learnt from the first phase of the project that the DOF officials could be corrupted by being involved in the management; the mode of management did not allow the growth of leadership and sense of ownership in the fishermen for the resources. The further findings of the management suggested that for better management of the fishermen groups and social and community advancement, involvement of NGOs was necessary.

Based on the previous experience (OLP-I), 2nd phase of the project (OLP-II) was formulated and successfully executed (1989-97) by the government. The second phase included 23 lakes for development. During this phase the International Fund for Agriculture Development (IFAD) provided the fund. The necessary loans were disbursed among the fisherman groups through the national NGO-BRAC. Fishermen themselves, by their lake fishing team (LFT) stocked the fingerling, guarded the lake, harvested the fish, marketed the fish and got the 100% sale proceed. In this phase three criteria were adhered to in selecting the fishermen for formation of fishermen groups. These were :- a fisherman was enlisted i) if his annual income was not more than 10,000 taka.; ii) if a fisherman had a minimum of 50 decimal of land and iii) if a fisherman spent 80% of his time for fishing. Beside these criteria, preference of selection was given to those fishermen who used to live within 1 kilometer area of the lake. The Thana Fisheries Officer (TFO) of the concerned thana provided the technical know-how, and the Area Manager BRAC had given the necessary organizational support in group formation of the fishermen. The sustainability of the management was more in this phase than in OLP-I. After implementation of the second phase of the project, it was observed that fish production increased significantly than in first phase of the project. However, the security of tenure of the fisherman right in cases of any litigation could not be assured and that needed attention. Both of these community based development options created part time employment of many unemployed youths.

To expand employment opportunities for the rural youth, woman, landless people and fishermen through productive activities and to improve socioeconomic conditions of rural people as a whole, out of the six objectives as set in the second five year plan of Bangladesh for fisheries development, two were adopted in the second phase project of baor fishery. These social objectives were quite important because without the development of fishermen, it is hardly possible to develop the fisheries sector (Rahman, 1986).

In view of the importance and long term potential of fisheries development, the fourth five year plan (1990- 95) also had given emphasis on increase of fish production, improvement of the socioeconomic conditions of the fishing community and creation of additional employment opportunities for poverty alleviation.

The requirements of fish has sharply increased over the last few years as a result of rapid increase in population. However, fish production has not increased proportionately although the total production has been increased. In the recent years, fish production from the oxbow lakes has alarmingly dwindled due to various reasons. Fish production differs largely between lake to lake and even between 1<sup>st</sup> phase lake to 2<sup>nd</sup> phase lake. Various types of gears are operated in the Oxbow Lakes for exploitation of fishes since time immemorial. Many of these gears are now being used in catching stocked carp fingerlings before they attain minimal marketable size. Unplanned use of some gears has posed a serious threat in achieving the target of production from the lakes.

In the present study it was revealed that the fishermen community in all the six Baor areas had stocked the baors during the month of July –August and started harvesting three month after the stocking. However they did not harvest selectively i.e. the gears they used were not selective. They harvested fish of all sizes. As such there was no practice of re- releasing of under sized harvested fish to the waters. Again, there was no tradition of restocking the Baors after the initial harvest at the 3<sup>rd</sup> month of the stocking ; neither there was any planned stocking though a continuous periodical harvesting went on in the Baors up to the month of June.

The co-management methodology of management involving the DOI, BRAC and different beneficiary groups of the fishermen for the six baors under the study did not appear to work well. The fishermen groups could not be made well aware about the biological basis of the management of the water bodies like the baors; the technical understanding of fish stocking, seasonality, gears used and harvest of the product was found lacking at large in the beneficiary groups.

As a result, the prescribed stocking rates for various species were not maintained. The gears used were not selective; the season of fishing and restocking of the waters were not strictly maintained.

The present study was conducted to gather data on the catch composition of the targeted stocked species of Indian major carps and Chinese carps together with the wild forage species. The data were collected right from the place of harvest in the baors and from the principal landing centers of the six different baors. The information about the crafts and gears used in the fishing were obtained from personal visits and interviews with the fishermen communities ; the data /information were duly analyzed and evaluated as for the implications of management methodology adopted for the six baors under investigation. It appeared that the expectation for the derivation of a sound and biologically sustainable management methodology through the process of the present co- management methodology did not work for various reasons. The beneficiary groups could not be made an effective partner of the management ; the leaders and sub leaders of the groups did not maintain the equity in the share of the benefits obtain from the management. They could not be made aware about the biological basis and technical understanding of the biological population management in the waterbodies, like baors.

As a result proper stocking ratio among various species of the fish were not maintained even the ideality about which species should be preferred as functional species in what lake were not maintained. However, the study has been undertaken with the following objectives:

- i) to find out the efficiency of the gears used in fishing in the oxbow lakes
- ii) to obtain the catch composition of the gears, and
- iii) to assess the effectiveness of the co-management methodology of the lakes.

## **2.0 : Materials and Methods**

### **2.1 : Study area :**

The study was carried out in 6 oxbow lakes under ‘‘Oxbow lakes Small Scale Fishermen Project’’ phase-1 and phase-2. Three lakes were under the phase-1 and 3 were under phase-2. The study area thus comprised of the 6 lakes covering 566 ha. The lakes were Katgora, Fatepur, Joydia, Sasta, Nasti and Porapara under Jessore and Jhenaidaha district. Water remained in these baor basins throughout the year and sources of water was from rain and surface water drainage. Fish farming in these baors was carried out in extensive culture system without supplying any food or fertilizer. Nutrient comes from flashing of rain water. Natural food was the only source of food for fish. The baor basin covered 70-80% with submerged vegetation (Macrophytes) named as *Ceratophyllum*, *Vallisneria*, *Hydrilla*, filamentous algae etc. The nearby fishermen were listed and groups were formed with majority of them. The fishing was done for 2-3 times a year, starting from October and continued up to June. Some fishermen were involved in fishing of forage fish throughout the year. However, the peak fishing season in the Oxbow lakes was during the period from November to January.

### **2.2 : Data collection :**

Data were collected from the six lakes mentioned in table-1 below

Selection of the lakes were based on their location and physico-chemical and biological characters. The data were collected during the fishing season (April-June) when the harvesting took place. Data collection period was different for the different lakes because of the differences in the harvesting period followed in a particular lake. A sampling schedule for collection of data was maintained for collecting data from the fishing grounds directly. Data were collected from the fish landing centers also. The detailed description of the nets (mesh size, size of the net, material used etc) were recorded (Appendix-I). The different gears found to be used in the lakes were seine nets, drag nets, lift nets, gill nets, cast nets, the

different kinds of hooks and line, the different types of traps and wounding gears of different types.

Mode of operation (time, place, habitat, accessories etc) of the gears were recorded when they were in operation. Catch composition. (% by number of species) for each type of gear was recorded through the examination of 10-15% of the catch from the respective gear. Sometimes, the entire catch was examined from the landing center. Also, the fishermen, NGO worker/officer, GOB staff or officer and the local people were interviewed for collection of information regarding the prevailing management practice. A set of questionnaire was used for collecting the information. In selecting the respondents, a stratified random sampling procedure was adopted. The respondents were selected from among the lake fishing team leaders and from the general fishermen who were involved in fishing in the lakes.

**Table-1 : Profile of 6 oxbow lakes studied**

| Sl. No.         | Name of Oxbow lakes | Thana/Upazila | District  | Water body (area in hectare) | Remarks |
|-----------------|---------------------|---------------|-----------|------------------------------|---------|
| 1.              | Katgora             | Chougacha     | Jessore   | 75                           | OLP-I   |
| 2.              | Fatepur             | Moheshpur     | Jhenaidah | 47                           | OLP-I   |
| 3.              | Joydia              | kotchandpur   | Jhenaidah | 189                          | OLP-I   |
| 4.              | Sasta               | Moheshpur     | Jhenaidah | 98                           | OLP-II  |
| 5.              | Nasti               | Moheshpur     | Jhenaidah | 66                           | OLP-II  |
| 6.              | Porapara            | Moheshpur     | Jhenaidah | 91                           | OLP-II  |
| Total Area (ha) |                     |               |           | 566                          |         |

\* OLP = Oxbow Lakes Project.

### **3.0 Results and discussion:**

The results of the present study on catch composition and the gears used in the co-management methodology adopted for management of the six oxbow lakes have been presented and discussed in the following sections.

#### **3.1. Fishing gears:**

The fishermen of the Oxbow lakes were found to fish by netting followed by two techniques such as trapping and angling. The gears found to be used in the six studied oxbow lakes were classified into 4 major categories viz. fishnet, fish trap, hook and line and wounding gears. Each of these has again been classified into a number of sub-types. Fish net have 6 sub-types - gill net, seine net, lift net, brush park, cast net and push net. Fish traps are classified as box trap and basket trap. Hook and line and wounding gears were considered as two individual sub-types. Again most of these sub-types have different forms. Gill nets were mainly of 3 forms- Punti jal, maya jal and fash jal. Seine nets were of 2 forms – ber jal, ( large seine with float-weight) and Brush park net. Lift nets were of 3 forms -Veshal jal with large triangular shape, Thela jal, Chak jal with small triangular shape operated by hand. Similarly hook and line have 4 forms and wounding gears have 4 forms. All of these fishing gears were not used in all the Baors at the same time. Ahmed (1954 ) records a total of 23 types of fishing gears used in harvesting fish from the beels while Rahman (1996) mentions 21 different types of gears used in fishing in open water.

Mainly Kotchal fishing (Purse seine net), Komor fishing (Brush Park net) and Chak jal fishing comprised 90% of total harvesting in the Oxbow lakes. But most of the fishermen were involved in Komor (Brush park) fishing in the lakes.



### 3.1.1. Description of gear and mode of operation:

In all the six studied oxbow lakes the following types of gear were found to be used in fishing. Fish were harvested by the fishermen with their own gears; the poachers were also reported to use the same types of gears. Oxbow lakes fishing is done in different period of time in different methods due to the variability of the conditions of the different lakes; some lakes are deep and some are shallow, some are covered with floating and submerged vegetations and some are more or less clear.

Bangladesh is a tropical country. Even though the winter is short here some high yielding exotic species of the cold countries have been introduced here. The Indian major carps are stocked with these exotic carps for achieving the target of increased production. Fingerling of 13- 15 cm size of different species were stocked at the rate of 2800-3500 / ha / year, though it varied from lake to lake. They were allowed to grow for a period of time and harvesting was done when the fish grew to table size. Two years old fish were generally harvested. But fish of minimum weight of 500g was also caught

Generally in the lakes, fishing starts just after the rainy season. Though it was generally variable from one lake to another, it usually took 2-3 months for completion of one round of fishing. During the investigation period, the first fishing was started on October and continued up to December followed by the second from February to March and third from May to June. Ten to twenty six groups of fishermen were found to be involved in fishing in one lake. The average size of the fish to be caught and the total amount to be harvested were decided before hand and regulated by the management body.

### 3.1.1.1 . Kochal fishing :

This is the most usual method of harvesting in lakes. The kochal Jal employed in fishing was about 80-110 meter wide; the mesh size was 8-10cm. A group of fishermen consisting of 12-14 people with two boats of 6-7 meter long were involved in this type of fishing. Each member had one piece of net of the said specification of 8-10 meter long. The pieces were tied together to make the required length for encircling the fishing spot. ( Fig- 4)

The net is locally called kochal jal. The group of fishermen involved in the fishing were locally called kochal party. Depending upon the size of the lake and the fishing area the kochal jal is operated with the help of two boats, where the net is held apart by the boats equally in such away that the two boats become separated to encircle a certain area when the net is released from both the boats. Fishermen became divided into two groups and pulled the net from one end to other end made a circle. The fish were surrounded by the net. To protect the fish from jumping out from the encircled net, the fisherman at this stage made sounds in the water with bamboo sticks. The net was then further pulled to narrow down the circle when the fishermen lifted net with the entangled fish in it.

This practice is adopted in the deeper portion of the lake, however, soon the fish resort to places where there are shelters to hide (Fig-5)

In some shallow lakes kochal jal is pulled from bank of the lake, first with the help of boat encircling a definite area and then pulled from bank. In maximum cases Silver carp, Bighead and Catla are caught by this fishing method.

In some lakes where komor is not installed, maximum fishes are caught by kochal jal, but in case of komar 10- 30% fish are caught by this technique (Table-6).

### 3.1.1.2. Brush park by Drag net :

Komor is referred to as a shelter place of fish in the deepest area of the lakes. There were many Komors in a lake; in Joydia baor there were 36 komors. A komor is constructed with unclean bamboos, stems of mango and other trees that have plenty of leaves. Area of such a komor could be 2-5 hectares and the total expense in setting such a komor was reported to vary between Tk 20,000 to Tk 30,000. After kochal fishing when fish took shelter in the komors fishermen then encircle the komor by the drag net. The net was fixed at the bottom of the ground with the help of bamboo sticks ( Fig-5). A net of 30-40 pieces of separate nets of 7-9 meter long and 9-10 meter width with 3-4 cm mesh was used. The fishermen cleaned off the stems of trees and bamboo within the encircled komor area and placed them to another previously cleaned nearby komor. Every komor was regularly round in shape. The fish from the komor were caught in 3 steps.

**First steps:** After the komor is encircled, the fish inside look naturally for gaps and try to escape through that. To capture the escaping fish through the gaps, the fishermen put bag nets in the gaps and catch the fish. This contrivance of catching the escaping fish through the gaps is locally known as Vulki fishing

**Second step:** Seine netting within the komor proper is practiced to harvest most of the fish encircled.

**Third step:** Fixed drag net one side of which was fixed with the bottom and another side was fixed with bamboo sticks, was tried to squeeze and a time comes when it becomes lifted from the water with the fish on the bank or in the boat. Generally all types of carps are caught in this fishing. Some carnivorous fish like Taki, Shoal, Gajar, Air are also caught in this fishing method. There were 8 komors in katgora and 12 in Fatepur. Sixty to Seventy percent of the total harvested fish from the lakes came through this fishing. (Table - 6)

### 3.1.1.3 . Lift net (Chak Jal) :

In some cases where it was not possible to harvest all fish by kotchal jal due to dense vegetation and shallowness of the area ; chak jal fishing was found to be very effective. By this method it was possible to catch many fish species specially rohu, mrigal, common carp, grass carp etc. Chak jal was made of 15 no. cord twine with the mesh size of 4-5 cm. The diameter of the wide end was 7-8 meter and diameter of the narrow end was 2.5 meter.

The net is conical in shape and fixed with a bamboo frame ; the depth of the net varies depending upon the depth of water when they are operated. One boat with two men are needed for operation of chak net where one man operates the net and other man drives the boat. Chak jal is dropped from the operating boat on spot where there are signs of presence of fish being gusseded with bubbles coming out from the water. Once a fish/ fishes are trapped in it, one fisherman gets down in the water, dive in, get hold of the fish and comes out with the net. Among six lakes only katgora had chak fishing and the contribution of fish among the harvested total fish is about 13 - 18 %.

### 3.1.1.4. Falling net:

The cast net is a conical shaped circular net made of nylon or cotton twine. The mesh size varies from 0.5-2 cm depending upon the fish to be caught. A long string of about 5-7 meter is attached to the appendix of the cone. Iron/lead weights in cylindrical form are attached at a regular interval around the peripheral end with the help a of string. The string with the weight is attached to some upper meshes directly about 10-20 cm above the bottom forming pocket all along the circular end inside the net (Fig-11). When the net is cast it spreads out over the water surface circularly and when it is lifted it comes out in conical form. In oxbow lakes fishermen usually do not use this net for fishing of stocked carp fish, but for fishing the miscellaneous small fish, the fishermen use this net throughout the different areas of the lake.

### 3.1.1.5 . Dip net :

Locally the lift net is known as veshal / khora jal; mainly used for fishing the non-stocked fish. This type of net is triangular in shape. The net is attached with a 'V' shaped frame made of two bamboo poles. The two arms of the net are fastened to the two bamboo poles fixed at the bottom of the water body. The two poles also act as fulcrum on two arms for dipping and lifting the net. There is a platform by the side of the cone – end from which a fisherman operates the net (Fig-12). The mesh size of the net varies from 0.5 cm (at center) to 1.5 cm (in front of the net). The net measures 12-15 m in length and 10-12 m in breadth i.e. in front of the triangular net.

In Oxbow lakes fishermen generally use this net in slow flowing water at the end of the lakes or khal for catching non-stocked fish. One fisherman operates the net by dipping the front side in to water against current while the cone-end of the bamboo frame remains above the water. The pressure of the water current forms a bag at cone-end of the net. The net is kept under water for about 10-20 minutes and then lifted by standing on the cone – end of the frame. Due to fulcrum action, the front side of the net rises above water level as the result of pressure at the cone- end, and the fisherman collect the fish from the cone-end. A small boat sometimes is used for the operation.

### 3.1.1.6 . Gill Net :

Gill nets are rectangular in shape with variable length and width which depend on the size and depth of the water body. The mesh size of the net varies with the types and sizes of fish to be caught. They are made of mono-filamentous nylon twine or tier-cord or double cotton twine.

In the present study 3-4 types of gill nets were found to be used by the fishermen for catching fish. These are locally known as punti jal, maya jal, and fansh jal (Fig- 9 ). Punti jal was used to catch mainly punti, maya jal to

catch mainly maya and fansh jal to catch medium to large size fishes mostly major carps. Fansh jal (current jal) are used in oxbow lakes by poacher for

harvesting carps at night. The length and width of nets varied from 10-12-meter and 0.5-1 meter respectively. Mesh sizes of the nets were found to vary from 0.5- 1 cm in punti jal, 3.0-3.5 cm in maya jal and 2.5 cm in fansh jal.

It is set in the evening and lifted in the early morning or set in the morning and lifted in the afternoon. The net may be set near the surface of water or in the mid – depth depending upon the water depth. It is a secondary fishing gear in oxbow lakes for fishing of non-stocked fish.

Table- 2 : Particulars of different types of gill net, seine net, lift net, cast net used in oxbow lakes for fishing

| Types of fishing | Name of Gear |                                  | Size (m)                |                       | Mesh size (cm)          | Materials used in fishing gear                   | Nature of Gear         | Fishing period                         | Fishermen & Boat needed for operation                               | Frequency                                                           |
|------------------|--------------|----------------------------------|-------------------------|-----------------------|-------------------------|--------------------------------------------------|------------------------|----------------------------------------|---------------------------------------------------------------------|---------------------------------------------------------------------|
|                  | Name of Gear | Local name of Gear               | Length                  | Breadth               |                         |                                                  |                        |                                        |                                                                     |                                                                     |
| Kochal           | Seine Net    | Berjal                           | 80-110                  | 15-20                 | 8-10                    | Nylon twine                                      | Selective              | Oct-Dec<br>Feb-March<br>May-June<br>Do | 12-14 Fm<br>2 boats<br>Fm number depends upon size of komor & group | Maximum lakes covers this fishing techniques. Some lakes cover this |
| Komor            | Drag Net     | Komorjal                         | 300-400                 | 9-10                  | 3-4                     | Nylon twine                                      | Selective              | Do                                     | One boat and two FM.                                                | Technique s. It is expensive                                        |
| Chak             | Lift Net     | Chakjal                          | 8-10                    | 7-8 round dia         | 4-5                     | Cod twine with bamboo frame                      | Selective              | Do                                     | One FM.                                                             | Few lakes cover this fishing techniques.                            |
| Cast             | Cast Net     | Jhakijal                         | 8-10                    | 8-10 round dia        | .5 -1.4                 | Nylon twine                                      | Non selective          | All over the year<br>Rainy season      | Sometime boat l                                                     | Few lakes cover this fishing techniques.                            |
| Lift             | Lift Net     | Vasajal                          | 12-15                   | 10-12                 | 0.5 center<br>1.5 Front | Nylon twine                                      | Non selective          | All over the year                      | One FM.                                                             | Few lakes cover this fishing techniques.                            |
| Gill netting     | Gill Net     | Puntjal<br>-Mayajal<br>-Farshjal | 10-12<br>10-12<br>10-12 | 0.5-1<br>0.5-1<br>2-5 | 5-1<br>5-1<br>5-8       | Nylon twine<br>Nylon twine<br>Monofilament nylon | More or less Selective | All over the year                      | One FM.                                                             | Few lakes cover this fishing techniques.                            |

N.B. FM = Fisherman Number



**Table - 3 : Particulars of different types of traps used in oxbow lakes for fishing of nonstocked (forage) fish**

| Type of gear | Name of gear | Sign of the Gear (Cm) |        | Mesh size (Cm) | Materials used in making traps                | Fishing time                     | Number of trap unit | Fishers & boat needed for operation |
|--------------|--------------|-----------------------|--------|----------------|-----------------------------------------------|----------------------------------|---------------------|-------------------------------------|
|              |              | Length                | Height |                |                                               |                                  |                     |                                     |
| Trap         | Rama ni      | 100-150               | 60-80  | 1.5-2.0        | Split of Bamboo and Cane material/ Steel wire | June-Aug<br>June-Aug<br>June-Aug | 5-110<br>15-30      | 1 & donga<br>1 & donga              |
|              | Arinda       | 45                    | 25     | 0.8            | Steel wire                                    | June-Aug                         | 15-30               | 1 & donga                           |
|              | Charo        | 40                    | 25     | 1.0-1.5        | Steel wire                                    | June-Aug                         | 15-30               | 1 & donga                           |
|              | Ghuni        | 25-40                 | 25-40  | 0.2-0.5        | Steel wire                                    | June-Aug                         | 20-30               | 1 & donga                           |

**Table - 4 : Particulars of different types of hook and line used for fishing in oxbow lakes**

| Hook and line |                    |                                  |                        |                                       |                                       |
|---------------|--------------------|----------------------------------|------------------------|---------------------------------------|---------------------------------------|
| Type of Gear  | Name of donga Gear | Number of hooks per line of lift | Bait used/ not Qualify | Fishing period                        | Fisherman & boat needed for operation |
|               | Dhawn borshi       | Several hundred                  | Bait used              | June- Sept                            | 1 & 1                                 |
| Hook and line | NoI/ Dhap borshi   | Several hundred                  | Bait used              | June- January                         | 1 & 1                                 |
|               | Sip borshi         | 1 hook                           | Bait used              | All seasons except rainy day & winter | 1 and sometimes 1 or not              |

### 3.1.1.7. Hook :

Hook and line fishing is not a general type of fishing in oxbow lakes. For harvesting of the fish like taki, shing etc. sometimes the hook and line is used.

Some Jhupa borshi are used by poacher for fishing of carps. Sometimes wheel borshi is also used by the angler for fishing of carps. But it is not so much remarkable.

For harvesting miscellaneous fish like taki, shoal, shing etc. the fishermen set borshi in the surface water or in the bottom by attaching the two ends of the long rope with two fixed bamboo poles. Fishermen use different types of bait in the hook to attract fish. The bait used in hook are mainly shrimp, earth worm and other small fish. Usually one lifting is done per day for collecting fish. It was found to be used in the studied lakes in shallow water area. It is used all over the year.

Nol borshi / Dhap borshi/ Dati hook consists of a stalk of water-hyacinth or a portion of well dried jute stick of length 30-45 cm. A string with a hook is attached at the middle portion of the stalk or jute stick (Fig-20). Fishermen are found to use nol borshi in the water hyacinth area or submerged vegetation area during the fishing season. At the time of operation they set several nol borshi in a series of spots by replacing the water- hyacinth or vegetation. Baits, same as long line are used at each hook to attract fish. The fishermen start lifting nol borshi from the first installed spot immediately after setting all the borshi to collect fish.

Chip borshi in the name of wheel, some anglers used in the oxbow lakes for angling. It is usually made of bamboo stick or folding iron stick of suitable length gradually tapering at one end known as chip (rod). A long nylon rope of desired length is attached to the tapering end of the chip by one end and one hook with barb is attach to other end of the rope. A piece of light wood or shola is attached to the rope as a float and a piece of lead or iron is also tied with the rope near the hook as sinker ( Fig- 21).

It's method of operation is very simple. One man sitting on the embankment or boat can set the chip in the water with a bait. Bait is made of bread, banana, egg of bagpiper, methi, decomposed meat, honey, juice of sweet etc. It is found to operate in the oxbow lake by the angler throughout the year except winter and rainy day. It is also a selective gear.

**Table –5 . Particulars of different types of spear/ harpoon ( wounding gear) used for fishing in oxbow lakes.**

| Type of gear                   | Name of gear | Number of spear | Fishing Period | Fishermen and boat needed for operation | Comments                   |
|--------------------------------|--------------|-----------------|----------------|-----------------------------------------|----------------------------|
| Spear/ harpoon (wounding gear) | Koach        | 1               | July –January  | 1 –2 and 1                              | Poacher's generally use it |
|                                | Juti         | 1               | July –January  | 1 –2 and 1                              |                            |
|                                | Jhupi        | 1               | July –January  | 1 and 1                                 |                            |
|                                | Fulkuchi     | 1               | July –January  | 1 and 1                                 |                            |

### 3.1.1.8. Spear (Wounding gear) :

The wounding gears like koach, juti, and fulkuchi are not allowed in fishing in the oxbow lakes, however they were reported to be used by the poachers. The gears consist of either bamboo/iron shafts(handle) with forks or group of pointed iron spike firmly fixed at one end of it.

The koaches consist of a bamboo handle or shaft. A bunch of 6-15 split bamboo pieces are firmly fixed with one end of the handle and the diverging free and pointed end of each split is covered with a sharp iron point (Fig-23). The koach is thrown at the fish with great force while wounding the fish. It is normally operated by the fishermen from a boat or shore/embankment.

Juti is almost similar to koach however, in case of juti the pointed end of bamboo splits is attached with the detachable barbed points. The iron points attached to the shaft by cords. The mode of operation of this spear is almost as same as the koach. The difference is that, in case of juti, the barbs which pierce the fish body get detached from the bamboo splits and prevent the fish from escaping.

Jhupi consists of a bamboo handle. A bunch of 7-12 relatively long and sharp pointed iron rod is firmly attached with one end of the bamboo handle. The sharp edge of the rods is provided with barbs. The mode of operation of it is as same as other spears. It is also used to catch fish by throwing it at moving shoal of fishes.

Fulkuchi consists of 10-15 sharp pointed iron rods (spokes of umbrella or ricksaw ) tied in a bunch and fixed to a bamboo handle. It is thrown with a great force at the moving shoal of relatively small fishes.

It was also observed that these type of wounding gears are used by professional or non-professional poacher ; lived at the bank of the oxbow lakes. Intensive use of these gears by poacher occurs during stuffy environmental condition when the fishes come near to the surface of the

water. The poachers then can easily understand the movement of the fish and prey on them. This is locally called 'Nirik' fishing. But the intensity of use of these gears increase considerably during the period of rainy season. Sometimes, at night these type of wounding gears are operated. By using light trap (Alo kata) fishermen used to catch fish which is locally called "Alo fishing".

### 3.1.1.9 . Traps :

Box trap :- Different types of trap are used by various fishermen for fishing of non stocked forage fish mainly as a source of income. Carps are not caught by traps. A total of 4 types of trap were recorded in the Oxbow lakes during the period of study. The following are the description of all the traps that were seen to be operated in the six oxbow lakes studied. The traps are locally known as ramani, charo, arinda and ghuni. Bamboo splits, cane materials, metallic wire or rope are used to make the traps.

Ramani is a rectangular trap, broad at the base and narrow at the apex. It is provided with three entrances two of which are situated at the base of the front side, one at each corner and another is located in the middle portion of the rear side of the trap (fig ---16). The space between the 6bamboo splits ranges from 1.5 --2.5 cm.

Fisherman set the traps along the sides of the canals during monsoon. Besides, they also set the traps across the canal by making barriers with weeds and mud, locally called 'bana'. The trap is installed by keeping the front side having two trap entrances against the current.

Charo is also a rectangular trap but relatively small in size. There are two trap entrances running from the base to the apex, lying one behind the other. At the top of the trap there is an opening for collecting fish. The space between the splits varies from 1-1.5 cm.

The trap is set by facing the trap entrance along the current. It is generally used in the paddy field with flesh of snails as a bait which attracts the fish. The peak using period is during the ascending and descending level of water when appreciable current flows all over the khal to lakes.

Arinda is a box trap rectangular in shape and similar to charo. But its height is almost equal to its width. It is usually 45 cm long and 25 cm in height and breadth. It is provided with three trap entrances two of which are located on broad sides, and another door is located inside the middle portion of the trap. The doors of the trap extend from base to apex. There is an opening at the top of the trap for removing the fish from it. The space between the splits is about 0.8 cm. It is operated in shallow water areas where there is current flow. It is generally placed on the demarcation line of the two ridges made across the lakes with the vegetation by the fishermen. At a time one fishermen set 15-30 traps. The traps are either set in the evening and lifted in the morning or set in the morning and lifted in the evening.

Ghuni is a rectangular trap of variable size. It also known as khulson. The length, breadth and height range from 25-60cm, 9-20 cm and 25-40cm, respectively. The space between the bamboo splits ranges from 0.2-0.5 cm. There are 1-3 trap entrances on one side and 1-2 trap entrances on the opposite side. The mouth of the entrance extends from base to the apex. There is an opening on the top of the trap which is used for collecting fish. It is set either in stagnant or running shallow water. It is usually placed on the demarcation line of the two ridges. It is also used by setting in line on the artificially made ridges across the canal or lake. The trap is set in the evening and lifted in the morning for harvesting fish or vice versa.

### 3.1.2. Selectivity of gears :

In the course of the present study efforts were made to record the gears that were selectively used for fishing of different species. A total of 26 fishing gears were recorded in all the six oxbow lakes studied. A total of 18 gears were identified to be used for fishing different species of fish. The description of the gears , the species caught, their volume and the percentage have been mentioned in the following section.

### **3.1.2.1 . Kochal fishing :**

As has been said in the description section in the foregoing, kochal fishing was practiced for fishing the carps stock the method consisted of seine net, mainly operated for harvesting the silver carps and catla.

The practice was to initially operate the seine net for 7-10 days and by that time, the escapees, take refuge in the komors, set in nearby areas. At that stage the the fishermen stopped operating the seine net and started fishing in the komors by encircling those with drag nets.

In the present study, from katgora lakes under OLP-I the amounts of fish caught by komor fishing during 1997, 1998 and 1999 were recorded at 2.0, 2.4 and 2.5 tons respectively which were 9.25, 9.16 and 916 percent of the total catch of 30, 26.2 and 4.6 tons respectively. From Fatepur and Joydia lakes under the OLP-I management, the percentage of catch from kochal fishing were recorded at 0.22 and 0.11 respectively during the year 1999 (Table-6). Under OLP-II management adopted in case of Sasta, Nasti and Porapara baors, the percentage of catch under kochal fishing varied from 0.83 to 1 during the year 1997 -99. There were no significant komor fishing practice in these baors; only a few instances were there where water hyacinth was available to make an area suitable for encircling.

### **3.1.2.2 .Komor fishing :**

Drag netting or komor fishing is principally adopted as a device to catch the remaining fishes in the baor after the completion of kochal. The density of the fish population in the baor get reduced after kochal fishing ; the remaining fish after driven by the kochal operation take shelter in the brush parks set in the nearby areas. It has been seen that catla and silver carp are mainly caught by kochal fishing ; the comparatively bigger ones of catla and silver carps can escape the kochal and take shelter in the komors. Also, ruhu mrigal and common carps, who feed in the column and in the bottom areas can escape at large and hide in the brush parks. As a result of the harvest from komors, principally consist of bigger catla, and silver carps and varied sizes of ruhu, mrigal and common carps. It has been found that



under OLP-I, in Katgora, Fatepur and Joydia lakes maximum komor fishing was done during 1997, 1998 and 1999. Table-8 shows the picture of total catch from different fishing methods during 1997, 1998 and 1999. It is seen that from the lakes under OLP-I, i.e. Katgora, Fatepur and Joydia, the amount of catch ranged from 22.8 to 87.5 tons; the percentage of the catches stood at 0.53 and 0.79 respectively in 1997 and 1999.

The production figures from the lakes under OLP-II, was not very significant. Out of the three lakes komors were erected in two (Sasta and Porapara) because of availability of water hyacinth. A maximum production of 21 tons and 12 tons were achieved respectively in 1999 which was 17.34 percent and 11.7 percent of the total production of the year in the two lakes. The percentages of contribution of komor fishing in the total production in other two reporting years (1998, 1997) from the two lakes were 0.72, 0.65, 0.34 and 0.31 respectively.

### **3.1.2.3 . Vulki fishing :**

Vulki fishing is a supplementary device for fishing in komors. When a komor is encircled, the fishes inside look for any gap in the circle of the net. The fishermen at that stage, make special gap and set an otter shaped net in the gap. The otter shaped net has a valve in it that allows fishes to enter but not to retreat back from it. So in other words, the device is a trap. It was known that about 70- 80 percent of the fishes inside the komor is caught by the device within a few days of encirclement of the komor. During the investigation vulki fishing was only observed in Joydia under OLP-I. The percentages of production by the device in the lake in the year 1999, 1998 and 1997. were 0.14, 0.74 and 0.11 respectively. Vulki fishing was not practiced in the other two lakes under OLP-I also and not either in lakes under OLP-II ( Table-6).

### **3.1.2.4 . Chak fishing :**

It has been said in the foregoing that chak is a selective gear for fishing in areas that are comparatively shallower and with dense vegetation. These conditions do not allow fishing with kochal.



However, often the principal species caught by chak jal are rohu, mrigal and common carps. During the investigation chak fishing was only reported from katgora lake and the production figures were 4.2, 4.7 and 4.1 tons in the year 1999, 1998 and 1997 respectively. In 1998 a production of only 0.1 ton out of the total production of 35.5 tons was reported from Fatepur lakes (Table- 6).

### **3.1.2.5 : Angling (Sip borshi) :**

Angling is not the legal fishing method in the lakes. Fishermen do not use it. Some poachers use jhupa borshi and sip borshi. It is a selective gear, mainly catches the major stocked carps. The contributions of angling in the total production in the lakes are not significant. Table-6 shows that in the Katgora and Fatepur lakes 0.1 ton in each 1999 and 1998 was produced by angling ; in Joydia 0.2 tons and 0.1 tons were produced in 1999 and 1998.

### **3.1.2.6 . Gill net :**

It is not a legal fishing method. Fishers do not use gill net for harvesting of stocked carps. But some poachers use it at night. A very insignificant production was reported to be obtained by gill netting. In the lakes under OLP-I a production of 0.4 and 0.3 ton was from katgora in 1999 and 1998, 0.1 ton from Fatepur in 1998 and 0.5, 0.03 and 0.1 tons were from Joydia in 1999, 1998 and 1997 respectively.

## **3.2 . Catch composition :**

The stocked carp species were rohu, catla, mrigal, silver carp, grass carp, common carp and black carp. The stocking density followed for the carps under OLP-I was 1786-2660 /ha in OLP-II the density was higher at 2675-5450/ha. The species ratio followed for different species was 15,10,15,25,15 and 20% for silver carp, catla, grass carp, rohu, mrigal and common carp respectively.

### **3.2.1. Catch composition of stocked carps in different lakes :**

Although the baors are stocked every year with different species of Indian major carps and Chinese carps at some definite densities ; the recovery rates of the stocked fish often do not have relations with the stocking rates. The baors are semi-closed ; they have connections with the adjacent rivers/ waterways. Moreover, during high flood the narrow channels of the baors establish larger connection and as such often the fishes escape to the adjacent waterbodies. Similarly, sometimes, because of heavy floods, stocked fishes from the village ponds escape out from the ponds and enter the baor. Table-7.1 & 7.2 shows the overall picture of stocking densities and species of six different species in all the six baor under investigation. It is seen that there were broadly two levels of stocking densities adopted in the baors. In the baors under OLP-I (Katgora, Fatepur and Joydia), the stocking density varied between 1786 to 2660 per hectare. In the baors under OLP-II (Sasta, Nasti and Porapara) , a higher density at 2675-5450 /ha were adopted. The species ratio maintained either in the OLP-I or OLP-II lakes did not have any strict basis; the ratios were seen to vary among species in different lakes. The recovery picture in the lakes did not have any regular basis. The figures were found to vary between 20-30%. In Nasti baor, the recovery number exceeded than the stocked number, there were immigration of fish from village ponds because of heavy rainfall and overflowing of the village ponds.

#### **3.2.1.1 . Catch composition of stocked carps under different fishing methods :**

Percentages of species composition of different stocked carps caught by different fishing methods in all the six lakes have been shown in table-10. Also, the percentage composition of different species in the catch by the individual method have been shown in the same table.

Percentages of species caught by different methods in all the lakes shows that Komor fishing method was suitable for catching all species, except catla and silver carp. This method was followed by Kochal fishing and chak fishing method.

When the percentages were seen for the species caught by a particular method, it was seen that Kochal fishing method was effective to catch more silver carp(60%), followed catla (22%) and rohu (10%). Komor fishing method however, was found to be equally effective in catching all the different species. Chak fishing was found to be mainly suitable to catch rohu, grass carp and common carp (Table-8).

**Table - 6 : Harvesting records of stocked carps in the investigated oxbow lakes in 1997, 1998 & 1999**

(Figure in M.T)

| Fishing Technique/<br>Gear used. | OLP-I     |             |             |           |             |           |            |              |            | OLP-II       |             |             |              |              |              |              |              |              |
|----------------------------------|-----------|-------------|-------------|-----------|-------------|-----------|------------|--------------|------------|--------------|-------------|-------------|--------------|--------------|--------------|--------------|--------------|--------------|
|                                  | Katgora   |             |             | Fatepur   |             |           | Joydia     |              |            | Sasta        |             |             | Nasti        |              |              | Porapara     |              |              |
|                                  | 1999      | 98          | 97          | 1999      | 98          | 97        | 1999       | 98           | 97         | 1999         | 98          | 97          | 1999         | 98           | 97           | 1999         | 98           | 97           |
| Koichal Fishing (Seine netting)  | 2.5       | 2.4         | 2.0         | 6.4       | 5.7         | 6.0       | 12.5       | 10.1         | 12.0       | 100.1        | 90.0        | 85.5        | 118.0        | 113.3        | 120          | 90.5         | 110.2        | 100.5        |
| Komor fishing (Dragged netting)  | 22.8      | 18.7        | 15.5        | 23.5      | 25.8        | 24.0      | 82.0       | 70.5         | 87.5       | 21.0         | 7.1         | 6.0         | -            | -            | -            | 12.0         | 4.0          | 3.3          |
| Vallid fishing (Scoop netting)   | -         | -           | -           | -         | 3.7         | -         | 15.0       | 6.5          | 12.4       | -            | -           | -           | -            | -            | -            | -            | -            | -            |
| Chak fishing (Lift netting)      | 4.2       | 4.7         | 4.1         | -         | 0.1         | -         | -          | -            | -          | -            | -           | -           | -            | -            | -            | -            | -            | -            |
| Angling (Sip borshi & others)    | 0.1       | 0.1         | -           | 0.1       | 0.1         | -         | 0.2        | 0.1          | -          | -            | -           | -           | -            | -            | -            | -            | -            | -            |
| Gill net & others                | 0.4       | 0.3         | -           | -         | 0.1         | -         | 0.5        | 0.03         | 0.1        | -            | -           | -           | 0.2          | 0.2          | 0.1          | -            | -            | -            |
| <b>Total</b>                     | <b>30</b> | <b>26.2</b> | <b>21.6</b> | <b>30</b> | <b>35.5</b> | <b>30</b> | <b>110</b> | <b>87.23</b> | <b>110</b> | <b>121.1</b> | <b>97.1</b> | <b>91.5</b> | <b>118.2</b> | <b>113.5</b> | <b>120.1</b> | <b>102.5</b> | <b>114.2</b> | <b>103.8</b> |

**Table - 7.1 : Catch and recovery percentages of stocked carps in the investigated oxbow lakes in the year 1999**

| Species     | Katgora(75)           |                                |                  | Fatepur(47)          |                                |                  | Jydia(189)             |                                |                  |
|-------------|-----------------------|--------------------------------|------------------|----------------------|--------------------------------|------------------|------------------------|--------------------------------|------------------|
|             | No. Stocked           | No. Recovered                  |                  | No. Stocked          | No. Recovered                  |                  | No. Stocked            | No. Recovered                  |                  |
|             | % of total species    | % individual sp. recovery      | % total recovery | % of total species   | % individual sp. recovery      | % total recovery | % of total species     | % individual sp. recovery      | % total recovery |
| Rui         | <u>18401</u><br>13.73 | <u>3607</u><br>19.6<br>12.41   |                  | <u>15000</u><br>12   | <u>1759</u><br>11.72<br>6.11   |                  | <u>33998</u><br>7.60   | <u>5104</u><br>15.01/4.59      |                  |
| Catla       | <u>15500</u><br>11.56 | <u>2165</u><br>14.43<br>7.45   |                  | <u>12000</u><br>9.6  | <u>1141</u><br>9.50<br>3.96    |                  | <u>46830</u><br>9.36   | <u>5105</u><br>10.90<br>4.59   |                  |
| Mirgel      | <u>15300</u><br>11.41 | <u>1446</u><br>9.45<br>4.91    |                  | <u>18000</u><br>14.4 | <u>1568</u><br>8.71<br>5.33    |                  | <u>55920</u><br>11.18  | <u>8296</u><br>14.83<br>7.46   |                  |
| Silver carp | <u>30700</u><br>22.91 | <u>18614</u><br>60.63<br>63.28 |                  | <u>45000</u><br>36   | <u>21188</u><br>47.08<br>72.03 |                  | <u>215377</u><br>43.07 | <u>68536</u><br>31.82<br>61.68 |                  |
| Grass carp  | <u>30100</u><br>21.07 | <u>1530</u><br>5.08<br>5.20    |                  | <u>24000</u><br>19.2 | <u>1796</u><br>7.48<br>6.10    |                  | <u>40047</u><br>8.00   | <u>8740</u><br>21.82<br>8.76   |                  |
| Common carp | <u>24000</u><br>16.8  | <u>1691</u><br>7.04<br>5.74    |                  | <u>11000</u><br>8.8  | <u>1301</u><br>11.82<br>4.42   |                  | <u>55010</u><br>11.00  | <u>8582</u><br>15.60<br>7.72   |                  |
| Total =     | 1,34,001              | 29,053                         |                  | 1,25,000             | 28,753                         |                  | 4,47,182               | 1,04,363                       |                  |
| Rate        | 1786/ha               | 20%                            |                  | 2660/ha              | 23%                            |                  | 2366/ha                | 23%                            |                  |

**Table - 7.2 : Catch and recovery percentages of stocked carps in investigated oxbow lakes in the year 1999**

| OLP- II     |                        |                             |                                               |                        |                              |                                               |                        |                       |                             |                                               |
|-------------|------------------------|-----------------------------|-----------------------------------------------|------------------------|------------------------------|-----------------------------------------------|------------------------|-----------------------|-----------------------------|-----------------------------------------------|
| Species     | Sasta(98)              |                             |                                               | Nasti(99)              |                              |                                               | Porapara (91)          |                       |                             |                                               |
|             | No. Stocked            | No. Recovered               | % individual sp. recovery<br>% total recovery | No. Stocked            | No. Recovered                | % individual sp. recovery<br>% total recovery | No. Stocked            | % of total<br>species | No. Recovered               | % individual sp. recovery<br>% total recovery |
| Rui         | <u>59391</u><br>11.87  | <u>24750</u><br>41.67/14.85 |                                               | <u>4800</u><br>2.4     | <u>27776</u><br>578.6/8.33   |                                               | <u>16188</u><br>17.23  |                       | <u>17884</u><br>20.74/12.51 |                                               |
| Catla       | <u>6663</u><br>1.332   | <u>7513</u><br>112.7/4.50   |                                               | -                      | <u>14053</u><br>/4.21        |                                               | <u>20920</u><br>4.18   |                       | <u>9640</u><br>46.08/6.74   |                                               |
| Mirgal      | <u>44669</u><br>18.93  | <u>23377</u><br>24.69/14.02 |                                               | -                      | <u>26155</u><br>7.84         |                                               | <u>96040</u><br>19.20  |                       | <u>13846</u><br>14.4/9.69   |                                               |
| Silver carp | <u>170636</u><br>34.12 | <u>86947</u><br>50.95/52.16 |                                               | <u>169956</u><br>84.97 | <u>214564</u><br>126.2/64.36 |                                               | <u>266819</u><br>53.36 |                       | <u>80020</u><br>64.03/56.03 |                                               |
| Grass carp  | -                      | <u>150</u><br>/09           |                                               | <u>495</u><br>0.247    | <u>5</u><br>1.00/0015        |                                               | <u>50</u><br>0.01      |                       | <u>744</u><br>1488/0.52     |                                               |
| Common ca   | <u>15195</u><br>3.039  | <u>8899</u><br>58.5/5.33    |                                               | <u>1326</u><br>.663    | <u>2342</u><br>176.6/702     |                                               | <u>26005</u><br>5.20   |                       | <u>7358</u><br>28.29/5.15   |                                               |
| Total =     | <u>3,46,554</u>        | <u>1,51,636</u>             |                                               | <u>1,76,577</u>        | <u>2,84,896</u>              |                                               | <u>4,96,022</u>        |                       | <u>1,29,492</u>             |                                               |
| Rate        | <u>3536/ha</u>         | <u>44%</u>                  |                                               | <u>2675/ ha</u>        | <u>61%</u>                   |                                               | <u>5450/ ha</u>        |                       | <u>26%</u>                  |                                               |

**Table - 8 : Percentage catch of different species in different fishing methods**

| Species     | Fishing Methods |                                                |               |                                                |              |                                                | Total |
|-------------|-----------------|------------------------------------------------|---------------|------------------------------------------------|--------------|------------------------------------------------|-------|
|             | Kochal fishing  |                                                | Komor fishing |                                                | Chak fishing |                                                |       |
|             | No.             | % over different methods/<br>Individual method | No.           | % over different methods/<br>Individual method | No.          | % over different methods/<br>Individual method |       |
| Rui         | 187             | $\frac{10.34}{11.01}$                          | 1260          | $\frac{20.224}{74.42}$                         | 246          | $\frac{42.36}{14.53}$                          | 1693  |
| Catla       | 406             | $\frac{22.45}{36.19}$                          | 716           | $\frac{11.68}{63.81}$                          | -            | -                                              | 1122  |
| Mrigal      | 105             | $\frac{5.8}{10.14}$                            | 815           | $\frac{13.08}{78.74}$                          | 115          | $\frac{19.79}{11.11}$                          | 1035  |
| Silver carp | 1085            | $\frac{60.01}{36.53}$                          | 1885          | $\frac{30.25}{63.47}$                          | -            | -                                              | 2970  |
| Grass carp  | 15              | $\frac{0.82}{4.92}$                            | 220           | $\frac{3.53}{72.13}$                           | 70           | $\frac{12.04}{22.95}$                          | 305   |
| Common carp | 10              | $\frac{.55}{0.67}$                             | 1330          | $\frac{21.34}{89.26}$                          | 150          | $\frac{25.81}{10.7}$                           | 1490  |
| Black carp  | -               | -                                              | 4             | 100                                            | -            | -                                              | 4     |
|             | 1808            |                                                | 6230          |                                                | 581          |                                                |       |

### 3.2.2 . Non- stocked fish in oxbow lakes :

There are listed fishermen who catch the forage fishes from the lakes. They fish in a group or individually throughout the year. Information on the catch of the forage fishes was obtained by collecting data from the forage fishermen. The daily catch was calculated by dividing the weight of the sampled catch by the number of fishers sampled multiplied by the total number of fishers engaged in fishing on that day.

$$\text{Daily catch} = \frac{\text{Weight of the sampled catch}}{\text{No. of fishers sampled}} \times \text{No. of fishers engaged in fishing on that day}$$

$$\text{Monthly catch} = \frac{\text{Daily sampled catch}}{\text{Wt of the estimated total sample}} \times \text{No. of fishing days}$$

Estimates of the forage fishes were also made from the records available with the lake fishing teams.

The non stocked forage fishes caught in the baors were broadly divided into three categories viz ; Clupeids, Miscellaneous with other species. Other than Clupeids and prawn, efforts have been made to the composition of the groups with regard to different gears used and also with their contribution in the total production in comparison to stocked carps.

#### 3.2.2.1 : Catch composition of non stocked forage fish caught by seine net and cast net

For harvesting of nonstocked forage fish, fishers generally used one type of seine net like the net they use in Kochal fishing. This netting is mainly done for fishing the clupeid groups of fish for example Chapila (*Gadusia chapila*) & khoira. This net is locally called Ghono jal or Maya jal (0.5 – 1.5 inch mesh size). This is a more or less selective gear and the fishermen use them to catch the target species.

In the present study 11 different species of forage fish were caught by this net. Among the catch major species were Chapila (40.1%), Chela (*Salmostoma bacaila*) (11.42%), and kachki (*Corica soborna*) (16%) (Table-9).



The fishermen also used lift net for fishing some species of forage fishes. The lift net they use is called Vesal jal. By this net 16 different species were found to be caught. The species caught by lift net were Taki (*Channa punctatus*) (19.93%), shoal (*Channa striatus*) (6.0%), chanda (*Chandana*) (8.74%), Baim (*Mastacembelus spp*) (14.16%), kachki (*Corica soborna*) (5.68%) and foli (*Notopterus notopterus*) (5.68%). This net is non selective (Table-9)

Cast nets with different mesh sizes were found to be used in this study. Cast net that is allegedly used by the poachers for catching carps were of comparatively larger mesh sizes; it was not possible to record the catch of these nets. The cast net that is used for fishing of small size forage fish includes 20 species of fish. Among them the dominant species was found to be Kachki (*Corica soborna*) (40%). Besides this, the other species were chapila (11.80%), Mola (*Amblypharyngodon mola*) (11.08%), small chingri (*Palaeomon spp*) (4.44%), Maya (6.20%)(Table-9). This net was also a selective gear.

### **3.2.2.2 . Catch composition of nonstocked forage fish Caught by gill net:**

Three types of gill net were recorded in the study. Fishermen used these gears as selective gears to catch target species. Among these punti jal was found to catch mainly punti and maya jal was found to catch maya fish. Fansh jal or current jal with larger mesh size was generally found to be used by poacher for carp fishing.

The ratios of species caught by the punti jal were 31.95% punti, 29.7% chapila, 6.00% Maya and 4.53% of chanda (Table-10).

Six different species were recorded to be caught by Maya jal. They were Maya 67.22%, chela 22.77% and Mola 3.60%. Other species were also found to be caught with Maya jal but those were not significant (Table-10).

### **3.2.2.3 . Catch composition of nonstocked forage fish caught by traps:**

In all the six Oxbow lakes the traps were not found to be significantly used. This is because the lakes were mostly closed. There are some canals and khals that have connections with the nearby waters. These canals and khals usually become active during release of water from the lakes during rainy season, or even, sometimes water from outside enters the lakes; the traps of various types are then put in the entrance for catching different forage fish species.

Ramani is more or less a selective gear with larger mesh was found to catch 6 different species. Among them , Taki, (*Channa punctatus*) shoal (*C. striatus*) and Bele (*Glossogobius giuris*) were found significantly.

Charo is also used by the fishers for fishing the same type of species. This is also a selective gear. But Arinda with smaller mesh size is not a selective gear. Twenty one different small size species of fish are caught by this gear. This is not specially significant for any definite type of species.

Gihuni trap is also used by some fishers. It is also a non selective gear. Twenty different species of fish are found to be caught by this trap.

### **3.2.2.4 . Volume of catch of nonstocked forage fishes and their contribution in the total production in the lakes:**

The present study was conducted during the period from April –June 1999. Six lakes were selected; 3 were of from OLP-I which were under direct management of the Directorate of Fisheries and 3 were under OLP-II which were managed by the beneficiaries themselves. Estimated catch (kg) and yield (kg/ha/month) of non-stocked forage fish of the lakes Katgora, Fatepur, Joydia, Sastar, Nasti and Porapara from April-June 1999 are presented in Table-15. a graphically in frame I Haque 1997 showed that when the catches of the stocked carps is recorded at higher, the catch of the nonstocked forage fishes goes lower and vice-versa.

In the present study it was found that during the month of April 1999, the catch of the nonstocked fish was recorded at high but in June it was low because in June the catch of the stocked carp was higher.

In the year 1999 the annual yield of non-stocked forage fish was recorded at 87 Kg, 118.98 Kg, 64.7 kg, 124 kg, 18.74 kg and 222.5 kg at Katgora, Fatepur, Joydia, Sastar, Nasti and Porapara lakes respectively.

Over the usual 10 months fishing period the non-stocked forage fish contributed 17.90%, 15.71%, 10.0%, 8.45%, 10.36% and 16.50% of the total yield of Katgora, Fatepur, Joydia, Sastar, Nasti and Porapara lakes respectively. Haque(1997) recorded the contribution of the forage fishes in the total production of Bukbhara and Kannadah lakes at 57% and 42% respectively.

Total yield (kg / ha / month) and percentage contribution of forage fish in the total production of the lakes are shown in the table-15. Chapila, a clupeid migratory non stocked forage fish contributed as high as 71.72%, 61.55%, 56.68%, 74.23%, 65.33% and 56.63% in the total carp production in Katgora, Fatepur, Joydia Sasta, Nasti and Porapara lake in the year 1999. Although clupeid fish catch in oxbow lakes is largely seasonal.

Bio-diversity of nonstocked forage fish in the six studied lakes has been presented in the Appendix Table-19 and the total number of species recorded were 36. Although Haque (1999) provided some information about the number of nonstocked forage fish species but that also has some limitations. However it has been showed that the percentage contribution of the forage fishes in the total production in the lakes is different than it is known in the case of flood plain fisheries production.

The seasonal variation of the catch of stocked carps and the non –stocked forage fish are probably due to the differences in the fishing effort than their actual natural abundance. In oxbow lakes, fishing of stocked carps generally takes place between October to June and fishing remains closed during July – September. A more clear picture of the yield of non – stocked forage fish and the stocked carp may be obtained if data for a complete one year cycle can be collected. In terms of number of species that are available in Oxbow lakes, open waters and flood plains are comparable to them.

The total number of species recorded were 60 in culture based fisheries (oxbow lakes), 56 in open waters and 48 in flood plains. Hossain et al (1997) recorded 43 fish species from two flood plains (Chanda & BSKB). Freshwater fish of Bangladesh is however, diverse. Rahaman (1999) reported 260 freshwater species from flood plains, lakes and rivers of Bangladesh. The variation in terms of number of dominant species are not so distinct between flood plains, open waters and oxbow lakes.

**Table – 9 : Catch composition of forage fishes caught by seine net, lift net, cast net**

| Species       | Percentage composition of catch of different nets |       |          |       |          |       |
|---------------|---------------------------------------------------|-------|----------|-------|----------|-------|
|               | Seine net                                         |       | lift net |       | Cast net |       |
|               | No.                                               | %     | No.      | %     | No.      | %     |
| Punti         | 15                                                | .36   | -        | -     | 55       | 2.41  |
| Chapila       | 2005                                              | 40.1  | -        | -     | 270      | 10.80 |
| Chanda        | 10                                                | 0.2   | -        | 8.74  | 71       | 2.84  |
| Kholisha      | 88                                                | 1.76  | 50       | 4.3   | 55       | 2.41  |
| Kakila        | 89                                                | 1.77  | -        | -     | 20       | 0.80  |
| Taki -        | -                                                 | -     | 205      | 19.93 | 5        | 0.20  |
| Shoal -       | -                                                 | -     | 75       | 6.0   | 7        | 0.28  |
| Gozar -       | -                                                 | -     | 21       | 1.61  | 1        | .04   |
| Chela         | 578                                               | 11.42 | -        | -     | 26       | 11.08 |
| Mola          | 207                                               | 4.14  | -        | -     | 277      | 6.20  |
| Maya          | 155                                               | 3.1   | -        | -     | 155      | 2.8   |
| Kanpona       | 95                                                | 1.9   | -        | -     | 70       | 2.84  |
| Kazoli        | 75                                                | 1.5   | -        | 14.16 | 71       | 1.04  |
| Baim          | -                                                 | -     | 177      | 6.0   | 26       | 0.8   |
| Tarabaim      | -                                                 | -     | 75       | -     | 20       | 40.04 |
| Kachki        | 800                                               | 16    | -        | 5.61  | 1001     | 1.00  |
| Tengra        | -                                                 | -     | 65       | -     | 25       | 0.2   |
| Foli          | -                                                 | -     | -        | 5.68  | 5        | -     |
| Shing         | -                                                 | -     | 78       | 2.08  | -        | -     |
| Magur         | -                                                 | -     | 26       | 1.68  | -        | -     |
| Ghutum        | -                                                 | -     | 21       | 3.60  | -        | -     |
| Bele          | -                                                 | -     | 45       | -     | -        | -     |
| Air           | -                                                 | -     | -        | 3.2   | -        | -     |
| Tepa          | -                                                 | -     | 40       | -     | 10       | 0.4   |
| Boal          | -                                                 | -     | -        | -     | -        | -     |
| Small Chingri | -                                                 | -     | 155      | -     | 111      | 4.44  |
|               | -                                                 | -     |          | -     |          | -     |
| Vhedda        | -                                                 | -     | 10       | -     | -        | -     |
| Pabda         | -                                                 | -     | 7        | -     | -        | -     |
|               | 4110                                              |       | 1143     | -     | 2281     |       |

**Table-10: Catch composition of forage fishes caught by different types of gill net**

| Species       | Percentage composition of catch of different gill nets. |      |          |      |           |       |
|---------------|---------------------------------------------------------|------|----------|------|-----------|-------|
|               | Punti Jal                                               |      | Maya Jal |      | Fansh jal |       |
|               | No.                                                     | %    | No.      | %    | No.       | %     |
| Punti         | 1065                                                    | 3.95 | -        | -    | -         | -     |
| Chapila       | 990                                                     | 29.7 | -        | -    | -         | -     |
| Chanda        | 151                                                     | 4.53 | 27       | 2.97 | -         | -     |
| Kholisha      | 75                                                      | 2.25 | 20       | 2.25 | -         | -     |
| Kakila        | 28                                                      | 0.84 | 5        | .5   | -         | -     |
| Taki          | -                                                       | -    | -        | -    | -         | -     |
| Shoal         | -                                                       | -    | -        | -    | -         | -     |
| Gozar         | -                                                       | -    | -        | -    | -         | -     |
| Chela         | 90                                                      | 2.7  | 207      | -    | -         | -     |
| Mola          | 95                                                      | 2.85 | 32       | -    | -         | -     |
| Maya          | 200                                                     | 6.00 | 597      | -    | -         | -     |
| Kanpona       | 102                                                     | 3.06 | -        | -    | -         | -     |
| Kazoli        | 758                                                     | 2.25 | -        | -    | -         | -     |
| Baim          | -                                                       | -    | -        | -    | -         | -     |
| Tarabaim      | -                                                       | -    | -        | -    | -         | -     |
| Kachki        | -                                                       | -    | -        | -    | -         | -     |
| Tengra        | -                                                       | -    | -        | -    | -         | -     |
| Foli          | -                                                       | -    | -        | -    | -         | -     |
| Shing         | -                                                       | -    | -        | -    | -         | -     |
| Magur         | -                                                       | -    | -        | -    | -         | -     |
| Ghutum        | -                                                       | -    | -        | -    | -         | -     |
| Bele          | -                                                       | -    | -        | -    | -         | -     |
| Air           | -                                                       | -    | -        | -    | -         | -     |
| Tepa          | -                                                       | -    | -        | -    | -         | -     |
| Boal          | -                                                       | -    | -        | -    | -         | -     |
| Small Chingri | -                                                       | -    | -        | -    | -         | -     |
| Veda          | -                                                       | -    | -        | -    | -         | -     |
| Pabda         | -                                                       | -    | -        | -    | -         | -     |
| Rui           | -                                                       | -    | -        | -    | 5         | 15.6  |
| Catla         | -                                                       | -    | -        | -    | 15        | 46.8  |
| Mrigel        | -                                                       | -    | -        | -    | -         | -     |
| Silver carp   | -                                                       | -    | -        | -    | 7         | 21.84 |
| Grass carp    | -                                                       | -    | -        | -    | 5         | 15.6  |
| Common carp   | -                                                       | -    | -        | -    | -         | -     |
| Total         | 2871                                                    | -    | 888      | -    | -         | -     |

**Table -11 : Catch composition of forage fishes caught by different types of traps**

| Species       | Percentage composition of catch of different traps |       |       |       |        |       |       |       |
|---------------|----------------------------------------------------|-------|-------|-------|--------|-------|-------|-------|
|               | Ramani                                             |       | Charo |       | Arinda |       | Ghuni |       |
|               | No.                                                | %     | No.   | %     | No.    | %     | No.   | %     |
| Punti         | -                                                  |       | -     |       | 20     | 7.4   | 17    | 7.14  |
| Chapila       | -                                                  |       | -     |       | 35     | 12.95 | 30    | 12.60 |
| Chanda        | -                                                  |       | -     |       | 15     | 5.55  | 11    | 4.62  |
| Kholisha      | -                                                  |       | -     |       | 10     | 3.7   | 9     | 3.78  |
| Kakila        | -                                                  |       | -     |       | 5      | 1.85  | 4     | 1.68  |
| Taki          | 27                                                 | 51.84 | 20    | 46.57 | 5      | 1.85  | 3     | 1.26  |
| Shoal         | 8                                                  | 15.36 | 5     | 11.6  | 2      | .74   | 2     | .84   |
| Gozar         | 2                                                  | 3.84  | 1     | 2.32  | 1      | .37   | -     | 1.68  |
| Chela         | -                                                  |       | -     |       | 7      | 2.59  | 4     | 1.26  |
| Mola          | -                                                  |       | -     |       | 5      | 1.85  | 3     | 5.04  |
| Maya          | -                                                  |       | -     |       | 10     | 3.70  | 12    | 5.46  |
| Kanpona       | -                                                  |       | -     |       | 15     | 5.55  | 13    | 7.98  |
| Kazoli        | -                                                  |       | -     |       | 17     | 6.29  | 19    | 9.24  |
| Baim          | -                                                  |       | -     |       | 20     | 7.40  | 22    | 8.82  |
| Tarabaim      | -                                                  |       | -     |       | 25     | 9.25  | 21    | -     |
| Kachki        | -                                                  |       | -     |       | -      | -     | -     | 7.56  |
| Tengra        | 2                                                  | 3.84  | 5     | 11.6  | 20     | 7.40  | 18    | -     |
| Foli          | -                                                  |       | -     |       | -      | -     | -     | -     |
| Shing         | -                                                  |       | -     |       | -      | -     | -     | -     |
| Magur         | -                                                  |       | -     |       | -      | -     | -     | 2.94  |
| Ghutun        | -                                                  |       | -     |       | 5      | 1.85  | 7     | -     |
| Bele          | 10                                                 | 19.2  | 9     | 20.88 | -      | -     | -     | -     |
| Air           | -                                                  |       | 1     | 2.32  | -      | -     | -     | 1.68  |
| Tepa          | -                                                  |       | -     |       | 5      | 1.85  | 4     | -     |
| Boal          | -                                                  |       | -     |       | -      | -     | -     | 13.02 |
| Small Chingri | -                                                  |       | -     |       | 35     | 12.95 | 31    | 1.68  |
| Veda          | 3                                                  | 5.76  | 2     | 4.64  | 5      | 1.75  | 4     | .84   |
| Pabda         | -                                                  |       | -     |       | 3      | 1.11  | 2     | -     |
| Total         | 52                                                 |       | 34    |       | 265    |       | 236   |       |

**Table – 12 : Yield (kg/ha/month) and percentage contribution to the total yield (% weight) of non- stocked forage fish groups in the investigated baors from April-June 1999**

| Fish group                          | Katgora OLP-I       |                               | Fatepur OLP-I     |                               | Joydia OLP-I       |                               | Sastar OLP-II      |                               | Nasti OLP-II       |                               | Porapara           |                               |
|-------------------------------------|---------------------|-------------------------------|-------------------|-------------------------------|--------------------|-------------------------------|--------------------|-------------------------------|--------------------|-------------------------------|--------------------|-------------------------------|
|                                     | Yield (kg/ha/month) | % contribution to total yield | Yield kg/ha/month | % contribution to total yield | Yield(kg/ha/month) | % contribution to total yield | Yield(kg/ha/month) | % contribution to total yield | Yield(kg/ha/month) | % contribution to total yield | Yield(kg/ha/month) | % contribution to total yield |
| Chupeids                            | 5.20                | 71.72                         | 6.10              | 61.55                         | 3.05               | 56.68                         | 7.06               | 74.23                         | 12.25              | 65.33                         | 10.5               | 56.63                         |
| Miscellaneous and all other species | 1.05                | 14.48                         | 2.51              | 25.32                         | 1.34               | 24.86                         | 1.35               | 14.19                         | 4.24               | 22.62                         | 6.0                | 32.36                         |
| Prawn                               | 1.00                | 13.79                         | 1.30              | 13.11                         | 1.00               | 18.55                         | 1.10               | 11.56                         | 2.25               | 12.00                         | 2.04               | 11.00                         |
| Sub total                           | 7.25                |                               | 9.91              |                               | 5.39               |                               | 9.51               |                               | 18.74              |                               | 18.54              |                               |

\*\* Miscellaneous fish group includes gars, gobies, goramies, perches, half beaks, puffer fish, & feather backs.



**Table – 13 : Stocked and nonstocked fish of the investigated baors 1999**

|                                                    | Katgora                          |                         | Fatepur           |                         | Joydia              |                         | Sastar              |                         | Nasti               |                         | Porapara            |                         | Remarks |
|----------------------------------------------------|----------------------------------|-------------------------|-------------------|-------------------------|---------------------|-------------------------|---------------------|-------------------------|---------------------|-------------------------|---------------------|-------------------------|---------|
|                                                    | Recorded and estimated catch(kg) | % contribution of total | Yield kg/ha/month | % contribution of total | Yield (kg/ha/month) | % contribution of total | Yield (kg/ha/month) | % contribution of total | Yield (kg/ha/month) | % contribution of total | Yield (kg/ha/month) | % contribution of total |         |
| Harvested and recorded stocked carps, prodn. kg/ha | 30,000                           | 82.09                   | 30,000            | 84.28                   | 110,000             | 89.99                   | 121,100             | 91.54                   | 118,200             | 98.96                   | 102500              | 83.49                   |         |
| Estimated nonstocked forage                        | 6544.8                           | 17.90                   | 5592.5            | 15.71                   | 12235               | 10.00                   | 11,190              | 8.45                    | 1237.5              | 10.36                   | 20254.5             | 16.50                   |         |
| Fish prodn kg/ha                                   | 87                               |                         | 118.98            |                         | 64.7                |                         | 124                 |                         | 18.74               |                         | 222.5               |                         |         |
| Total                                              | 36,544.8                         |                         | 35,592.5          |                         | 122235              |                         | 132,290             |                         | 119,437.5           |                         | 122754.5            |                         |         |

**Table -14: Estimated catch (kg) and yield (kg/ha) of non-stocked forage fish in the investigated baors during April-June'1999**

| Name of Baor | Fish groups             | Estimated catch (kg) in month |         |        | Yield (kg/ha) |       |       |
|--------------|-------------------------|-------------------------------|---------|--------|---------------|-------|-------|
|              |                         | April                         | May     | June   | April         | May   | June  |
| KATGORA      | Non stocked forage fish |                               |         |        |               |       |       |
|              | Clupeids                | 390                           | 500.0   | 250    |               |       |       |
|              | All others              | 153.75                        | 250.0   | 160.0  |               |       |       |
|              | Total                   | 543.75                        | 750.0   | 410.0  | 7.25          | 10.0  | 5.46  |
| FATEPUR      | Clupeids                | 286.7                         | 312.90  | 205.5  |               |       |       |
|              | All others              | 132.07                        | 150.50  | 130.6  |               |       |       |
|              | Total                   | 418.77                        | 463.4   | 346.1  | 8.91          | 9.85  | 7.36  |
| JOYDIA       | Clupeids                | 576.49                        | 518.5   | 449.5  |               |       |       |
|              | All others              | 442.26                        | 312.4   | 120.5  |               |       |       |
|              | Total                   | 1018.75                       | 830.9   | 570.0  | 5.39          | 4.39  | 3.01  |
| SASTAR       | Clupeids                | 691.88                        | 550.7   | 490.5  |               |       |       |
|              | All others              | 240.10                        | 301.5   | 325.5  |               |       |       |
|              | Total                   | 931.98                        | 852.2   | 816    | 9.51          | 8.69  | 3.01  |
| NASTI        | Clupeids                | 808.5                         | 850.5   | 749.1  |               |       |       |
|              | All others              | 428.34                        | 403.8   | 330.2  |               |       |       |
|              | Total                   | 1236.84                       | 1254.3  | 1079.3 | 18.74         | 19.00 | 16.35 |
| PORAPARA     | Clupeids                | 955.5                         | 880.5   | 758.5  |               |       |       |
|              | All others              | 731.64                        | 560.34  | 330.4  |               |       |       |
|              | Total                   | 1687.14                       | 1440.84 | 1088.9 | 18.54         | 15.83 | 11.96 |

### **3.3 . Co-management : A novel concept in oxbow lake management:**

Among the 500-600 Oxbow lakes which are located at the South West region of the country (Jessore, Jhenaidah, Kushtia, Magura, Faridpur) districts the DOF took only 6 oxbow lakes for improved management programme under a project called Oxbow Lakes Project (OLP-I).

The First Oxbow Lakes Project partly financed by the World Bank (IDA), was initiated in 1980 and finished in 1986. It included 6 lakes covering 1,063 ha water area. This time the objective of the project was to improve the fisheries management practices and to increase production of fish through stocking, and restocking of selected species. DOF had provided all the inputs for fish culture in the 6 lakes. One DOF officer was deputed to take charge of each lake as the lake manager, assisted by a small number of staff. The manager needed the approval of higher DOF authorities for implementation of the lake production plan.

The project had involved the traditional fishermen of the locality for harvesting of the fish only. The number of fishermen involved in each lake depended on the size of the lake, and was determined by the principle of registering one fishermen per ha of lake water. These fishermen were divided into small teams known as "Kochal" teams after the local name of the net types that were used for fishing in the lakes. The fishermen received 40% of the share of the catch for their labour. The fishermen also had used their all fishing gears, nets, boats and all other expenses for installation of the komor i.e. the brush shelters. The lake management also had employed the guards, generally from the locals, in an attempt to control poaching.

In OLP-I average fish production had increased to 400-500 kg/ha (from stocking rate of 1800 fingerling /ha) .The highest achievement being 950 kg/ha in the largest lake Baluhar.

The management programme adopted was a co-management in nature, since the DOF had involved the beneficiary groups i.e. the real fishermen in harvesting.

However, the fishermen had very little scope to infiltrate their ideas and experiences in the whole process of the management; the major responsibility in the management details retained with the project authority i.e. the DOF officer.

Depending upon the experience gathered from this project, the DOF had planned and executed another project called Oxbow lakes small scale fishermen project in the same region of the country. The project was planned to be carried out in 30 lakes, however, 23 lakes were finally obtained from the MOL. The baors are essentially the centers of integrated economic activities of the area based on the use of the baor water during the dry season. The rural population of the areas around the baors are mainly small farmers, landless farm labour, fishermen and small traders. But almost all of them were limited in low income pattern mainly due to exploitative social structure, lack of education and technical know-how and lack of access to credit. The project was designed to augment the production of fish from the lakes with an understanding that it would implement the spirit of the New fisheries Management policy (NIMP), where fishing rights will go directly to individual or groups of fishermen and landless people. In this way, the income generated will go directly to the producers and catchers.

The involvement of the fishermen population in the fishery and ancillary operations in the first oxbow lakes project was limited. The OLP-II was then an improvement in the oxbow lakes management process where the fishermen groups—the marginal and landless farmers were involved in a more decision making process for managing the lakes.

The approach was to form fishermen groups who would receive annual licenses from the government by paying the lease value, operate the lakes with the technical support of the project and who would be responsible for maintaining the lakes. The fishermen groups were the keystone of the project, who were prepared to invest in the productive purpose of the lakes since they had fought for long time against exploitation. Self-help was the key concept. It is needed to mention that the fishermen were identified mainly from traditionally skilled fishers and landless agriculture labourers for whom the fishing was second profession.

The fishermen groups under the lake fishing team through their management effort had contributed significantly to increase the average production from the 23 lakes. The average production obtained was 613 kg/ha/ year. However, out of the 23 lakes subjected in the project, production of carp from 10 lakes exceeded the rate of 700kg/ha/year; in 3 lakes the production obtained was even more than 1000kg/ha/year and in one lake- Nasti the yield was registered at 1821kg/ha/year.

The total revenue earned from the lake production come out as a turning point; the per hectare income stood at Tk 22,751 and Tk 11082 per fishermen. The fishermen community was composed of Hindu traditional fishermen, while Muslims were newcomers who began to adopt this profession in the absence of an alternative means of livelihood.

The external institutional arrangements at different levels of GOB and NGO had links with the lake fishery. They had provided the fishing rights to the fishermen and secured such rights to the licensed fishermen.

BRAC was entrusted with the task of selecting the members from the community around the lakes and organized them in forming the groups.

Ministry of land was holding charge of the water bodies.

Department of fisheries under MOF was the implementing agency. And the Thana/ District fisheries officer had played the field level role in this management. The role of different organizations was for the development of fishermen. Fishermen themselves also tried for changing their lot. NGO & Government, fishermen & Government, fishermen and NGO, fishermen & stakeholders and fishermen themselves had positive interactions. Generally competition between BRAC and DOF continued unabated. The fishermen found BRAC as a true well wisher when they had problems with DOF in getting renewal of licenses and also for other legal help. Again the TFO become useful when BRAC tried to realise the credit. One BRAC study reported about the improvement in living standard of the sample LFT households of 10 lakes between 1993 and 1995. Table 20....shows a picture of improvement in there economic conditions.

### **3.3.1. Organization and institutions involved :**

**IFAD :** International Fund for Agricultural Development was involved for development of Aquaculture sector giving loan support. Infrastructure development and credit support to fishermen is also provided by IFAD.

**MOL :** Ministry of land was responsible for handing over the right of the waterbody to the Ministry of Fisheries and Livestock.

**MOFL :** The Ministry of Fisheries and livestock obtained the ownership of the waterbody from the MOL for better management for ultimate upliftment of the fishermen.

**DOF :** The Department of Fisheries was responsible for taking up development projects and act as the facilitation for negotiating with different related national and international organization.

**DFO :** District Fisheries Officer under the guidance of DOF and was responsible for co-ordination among NGOs, Fishermen and Local Administrations which was necessary for security of tenure.

**TFO :** Thana Fisheries Officer worked under direct guidance of DFO and DOF. Technical supports for fishermen were given by TFO. From the GOB Administration all sorts of co-operations, co-ordinations are provided by the TFO.

**BRAC :** It is a non government organization named as Bangladesh Rural Advancement Committee was responsible for assisting the DFO to implement the project activities.

**AM :** Area Manager from BRAC was responsible for group formation, organize fishermen into a team, for credit support to them and recovery of the same.

**FISHERMEN/ BENEFICIARIES :** All sorts of activities were for their upliftment. They also tried for upgrading their socio- economic condition. They, with their experience, labour, boat, net, and komor caught fish and co-operated the concerned bodies.

### 3.3.0.2 : ORGANIZATION AND INSTITUTIONS INVOLVED

#### IFAD

(ESTABLISHMENT AND INFRASTRUCTURE DEVELOPMENT)

|                                                       |                                                                                                   |
|-------------------------------------------------------|---------------------------------------------------------------------------------------------------|
| Ministry of land (Handover the ownership of the lake) | Ministry of Fisheries & livestock (Obtains ownership of the lakes in favour of the beneficiaries) |
|-------------------------------------------------------|---------------------------------------------------------------------------------------------------|

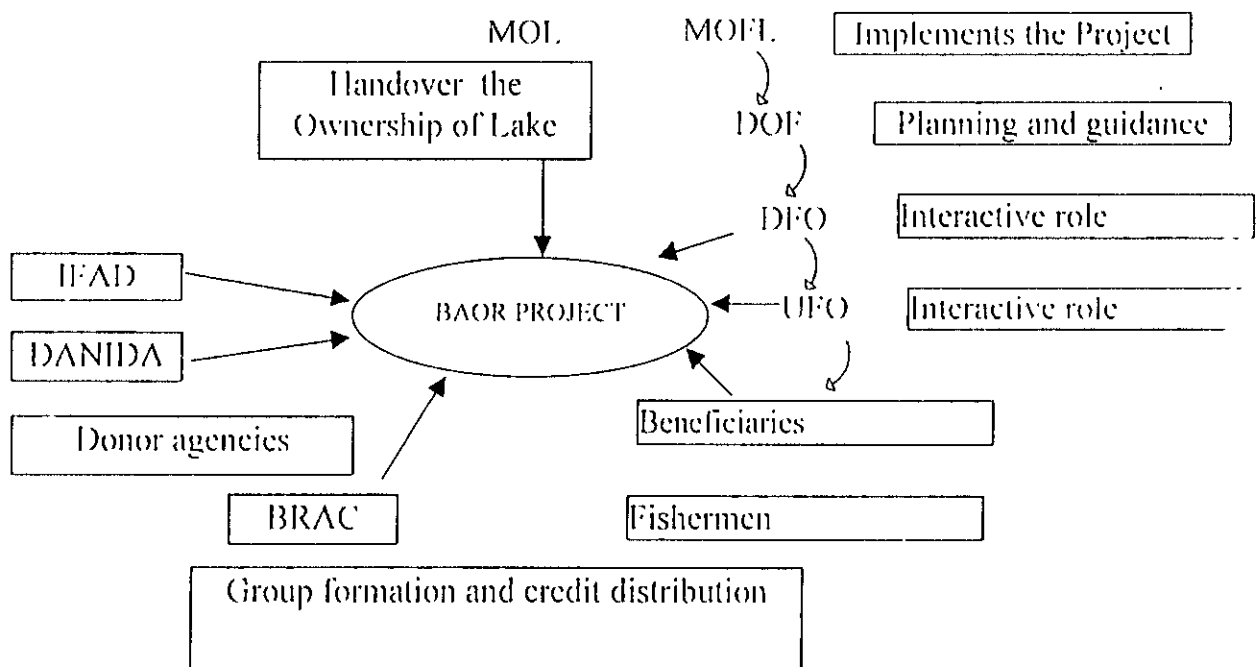


Diagram shows the agency and group involved in co-management practices in the Oxbow lakes.

**Table - 15 : Changes of socio economic conditions of fishermen in some indicators of well- being of LFT households**

| Year | Land owned         |                    | Mean monthly hh income in (Tk/hh) | Expenditure (Tk/ person/ month) | Fish consumption (g/ person/ month) | Flood space sqft/ person |
|------|--------------------|--------------------|-----------------------------------|---------------------------------|-------------------------------------|--------------------------|
|      | Less than 0.5 acre | More than 1.0 acre |                                   |                                 |                                     |                          |
| 1993 | 74.1               | 10.6               | 1288                              | 284                             | 720                                 | 41                       |
| 1995 | 69.9               | 13.8               | 1396                              | 344                             | 996                                 | 67                       |

Table shows that the proportion of LFT households enjoying certain facilities for better living increased between the two years under reference.

**Table -16 : Changes in facilities to the lft households between 1993 and 1995 (in percentage)**

| Year | Literacy rate | Ring slab sanitary latrine | Electricity facility | Roof material (Tin & Tiles) | Tube-well water for drinking |
|------|---------------|----------------------------|----------------------|-----------------------------|------------------------------|
| 1993 | 49.5          | 3.2                        | 2.1                  | 46.3                        | 98.4                         |
| 1995 | 65.5          | 20.1                       | 13.0                 | 54.8                        | 98.9                         |

Change shows in the table above. May be attributed to the influence of other programs of BRAC in the area. For example, it was found that literacy rate has gone up to 65.5% in 1995 from 49.5 in 1993. However unlike literacy the indicators reported in the table are generally slow to respond to mere availability of facilities around from the operation of any agency. Furthermore, the study confirmed that LFT households enjoyed a better position than other comparable groups in the locality.



**Table -17 : Price of fish in respect of fish Catching time (value/ kg)**

| Name of month     | Jan | Feb | Mar | Apr | May | Jun | July | Aug | Sept | Oct | Nov | Dec |
|-------------------|-----|-----|-----|-----|-----|-----|------|-----|------|-----|-----|-----|
| Price of fish /kg | 45  | 45  | 40  | 40  | 45  | 50  | 60   | 55  | 50   | 45  | 45  | 45  |

Table shows that average rate of fish per kg was high during the month of June to September. But it was low in the rest months.. So, fishermen should select the culture period from October to April . Then they can start fishing largely. Before only to move and for thinning some fishing may done during November, December, January.

**Table – 18 : Culture period**

| Name of month                                 | Jan  | Feb  | Mar  | Apr  | May  | Jun  | July | Aug  | Sept | Oct  | Nov  | Dec  |
|-----------------------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|
| Average Growth of individual fish wt. in (kg) | .250 | .350 | .550 | .650 | .800 | 1.00 | .075 | .100 | .150 | .200 | .250 | .250 |

Table shows the culture period and fish growth. As in the June Market price remains high (Table-18) and the growth of individual fish (average) attains 1 kg (highest in a definite time). That is why culture period should continue up to June every year.

**Table - 19 : Scientific name and local name of the fish species recorded in the oxbow lakes caught by different gears.**

| Sl.No. | Local Name      | Scientific name                                               | Size range | Remarks                |
|--------|-----------------|---------------------------------------------------------------|------------|------------------------|
| 1.     | Rui             | <i>Labeo rohita</i>                                           | 60-100 cm. | Indian may or carp     |
| 2.     | Catla           | <i>Catla catla</i>                                            | 50-90 cm   | Indian may or carp     |
| 3.     | Mrigal          | <i>Cirrhina mrigala</i>                                       | 60-120 cm  | Indian may or carp     |
| 4.     | Calbasu         | <i>Labeo calbasu</i>                                          | 60-80 cm   | Indian may or carp     |
| 5.     | Silver carp     | <i>Hypophthalmichthys molitrix</i>                            | 70-100 cm  | Exotic carp            |
| 6.     | Grass carp      | <i>Ctenopharyngodon idella</i>                                | 100-150 cm | Exotic carp            |
| 7.     | Common carp     | <i>Cyprinus carpio</i>                                        | 60-70      | Exotic carp            |
| 8.     | Black carp      | <i>Mylopharyngodon piceus</i>                                 | 150-300 cm | Exotic carp            |
| 9.     | Punti           | <i>Puntius spp</i>                                            | 10-13 cm   | Indigenous forage fish |
| 10.    | Chapila/Khoira  | <i>Gochisia Chapra</i>                                        | 18-20 cm   | Indigenous forage fish |
| 11.    | Chanka          | <i>Channa sp</i>                                              | 7-8 cm     | Indigenous forage fish |
| 12.    | Kholisha        | <i>Colisa fasciatus</i>                                       | 9-10 cm    | Indigenous forage fish |
| 13.    | Kakila          | <i>Xenentodon concilia</i>                                    | 20-26 cm   | Indigenous forage fish |
| 14.    | Taki            | <i>Channa punctatus</i>                                       | 20-24 cm   | Indigenous forage fish |
| 15.    | Shoal           | <i>Channa striatus</i>                                        | 50-90 cm   | Indigenous forage fish |
| 16.    | Gozar           | <i>Channa maculata</i>                                        | 60-120 cm  | Indigenous forage fish |
| 17.    | Chela           | <i>Silmonistoma hexolepis</i>                                 | 12-14 cm   | Indigenous forage fish |
| 18.    | Mola/Maya       | <i>Amblypharyngodon mola</i>                                  | 12-15 cm   | Indigenous forage fish |
| 19.    | Kaspara/Dankora | <i>Aplocheilichthys parichthys</i>                            | 5-6.0 cm   | Indigenous forage fish |
| 20.    | Kazoli          | <i>Ailichthys punctata</i>                                    | 6-8.0      | Indigenous forage fish |
| 21.    | Baim            | <i>Mastomembelus punctatus</i>                                | 13-13.5    | Indigenous forage fish |
| 22.    | Tara Baim       | <i>Macrognathus aculeatus</i><br><i>Mastomembelus armatus</i> | 20-24 cm   | Indigenous forage fish |
| 23.    | Kachki          | <i>Coriaca sobornai</i>                                       | 3-3.5 cm   | Indigenous forage fish |
| 24.    | Tengra          | <i>Mystus tengra</i>                                          | 5-6.5 cm   | Indigenous forage fish |
| 25.    | Foli            | <i>Notopterus notopterus</i>                                  | 35-45 cm   | Indigenous forage fish |
| 26.    | Shing           | <i>Heteropneustes fossilis</i>                                | 25-27.5 cm | Indigenous forage fish |
| 27.    | Magur           | <i>Clarias batrachus</i>                                      | 30-32 cm   | Indigenous forage fish |
| 28.    | Ghutun          | <i>Lepidocyphalus guntur</i>                                  | 9-9.5 cm   | Indigenous forage fish |
| 29.    | Bele            | <i>Glossogobius aureus</i>                                    | 20-29 cm   | Indigenous forage fish |
| 30.    | Air             | <i>Mystus aor</i>                                             | 50-94 cm   | Indigenous forage fish |
| 31.    | Small chingri   | <i>Palaeomon spp</i>                                          |            | Indigenous forage fish |
| 32.    | Tepu            | <i>Tetraodon lineatus</i>                                     | 12-13.1 cm | Indigenous forage fish |
| 33.    | Baxal           | <i>Wallago attu</i>                                           | 100-186 cm | Indigenous forage fish |
| 34.    | Voda            | <i>Nandus nandus</i>                                          | 17-18 cm   | Indigenous forage fish |
| 35.    | Pabda           | <i>Ompok pabda</i>                                            | 10-20 cm   | Indigenous forage fish |
| 36.    | Koi             | <i>Amurba testudineus</i>                                     |            | Indigenous forage fish |

## 4.0 . Summary and conclusion :

Fisheries sector plays an important role in the poverty alleviation of the poor people as well as food and protein supply for the country. In this sector fish produced from the inland water resources is about 40%. Oxbow lakes fish covers a large portion of inland fish production. Oxbow lakes are the dead portion of the river, mainly situated in the South West part of the country. There are about 500-600 Oxbow lakes covering an area of 5488 hectares. Since 1900 the lakes had been taken by the Government and leased out. Since 1980 among these lakes only 6 were taken by the Government for better and improved management. And a project was undertaken to facilitate the infrastructure development of the lakes, supported by the World Bank. The Oxbow lake project was implemented by the Directorate of Fisheries with the help of listed fishermen who stocked fish fingerling and managed the lakes with 60:40 sharing system. But as there was some lapses, DOF again implemented another project for better management of the lakes. Second phase project enlisted 23 lakes. DOF (GOB), NGO (BRAC) and Fishermen (beneficiaries) were the co-partners of the management. Second phase project was supported by IFAD. There were differences in between this two management. In 1st phase GOB i.e. DOF directly managed the lakes. And in 2nd phase beneficiaries directly managed the lakes. Among these lakes 3 from 1st phase and 3 from 2nd phase were selected for the present study. At the lake site, personal interview of the fishermen and concerned people were taken. Fish harvesting were seen and observed. Catch composition of the fish species were recorded. Liberated and unliberated fish and their availability were recorded. Species composition were tried to record and their contribution to the total yield was recorded and the management and co-relation were observed. The records from the project office were taken for necessary help.

It is seen that there are four categories of fishing gears used for harvesting of fish in the oxbow lakes such as fishing nets, fishing traps, hooks and line and wounding gears. Fishermen used these gears for fishing of various fish from the oxbow lakes. These four categories of fishing gears had 26 sub types which were recorded. Among them 26 gears, 18 were useful gears such as seine net, lift net, brush park, gill net, cast net and push net. Seine net and brush park were found to be most effective. About 80-90% of fishes were harvested by seine net.

During harvesting period the fishermen used seine net of various mesh sizes in different lakes. Among the studied six lakes, Katgora, Shasta, Nasti and Porapara were found to be harvested by seine netting mainly. There were no brush park shelters. But Fatepur and Joydia had some brush park shelters though, it was seen that production of fish did not depend on brush park shelters. But traditionally it was being done. Lift net was found to be used in Katgora and Fatepur as there were availability of sub merged vegetation. Rohu, Mrigel and Common Carp were the main species for this fishing gear. Except these gears, regular fishermen did not harvest fish by dipnet, falling net, gill net, hooks, spears and by traps. These were used by other fishermen or even sometimes by the pouchers. Fishing was done normally in two-three times a year. Komor fishing was followed by seine netting. In such type of largers water bodies seine netting was found to be more effective fishing method.

However, fish which was caught by seine net or brush park was found to vary in number, sizes and ratio. It was found that stocking density. Species composition were same for all the lakes and as such there were no consideration even to stock grass carps in the lakes with relation to the of vegetation or not. In some lakes silver carp had been found as functional species. It covers the maximum yield. Though stocking design was there but harvesting picture showed that the ratio of fish species did not have synchronization with stocking. Available record showed that catch ratios varied from year to year in the same

lake and from lake to lake. It was also found that catch composition varied with various fishing methods. Seine netting was largely effective for silver carp whereas Komor fishing covered all species.. Chak fishing covers only Rohu, Mrigal and Common Carps.

Though oxbow lakes fisheries has now become a culture based fisheries management but non stocked fish was produced there every year in large quantity. In this study, it was seen that the species composition of non stocked forage fish and their availability and contribution to total yield was mentionable. Non stocked fishes were mainly harvested by gill nets and falling nets. Clupeids fishes were mainly caught by falling net. The percentage contribution of non stocked forage fishes was varied from 8.5% to 17.90%. It has been seen that the production of non stocked fish and availability were depended directly on stocking of scheduled fish. If major carp stocking was relatively lower than non stocked forage fish production was higher. The production of fish in the lakes has been seen to be related with number of people involved in the lake management. The management of the lake depended mainly on the united effort of the people. Thus a community based co-management was established there. A better management and production was achieved when the beneficiaries directly involved in management. GO, NGO and beneficiaries managed system had worked well.

To increase the fish production, mesh size of seine net should be more specified i.e mesh size should be adjustable to catch only market size fish. Re-stocking of fish species after harvesting should be ensured so that a balanced stocking density and fishes of various year classes would be there for whole of the year; even year to year. Stocking design should be separate for each lake. Where submerged vegetation is available grass carp stocking should be done at optimum level. Fishermen groups should be made well aware about technological, biological, and managerial basis of management. For that the group member should be more trained.

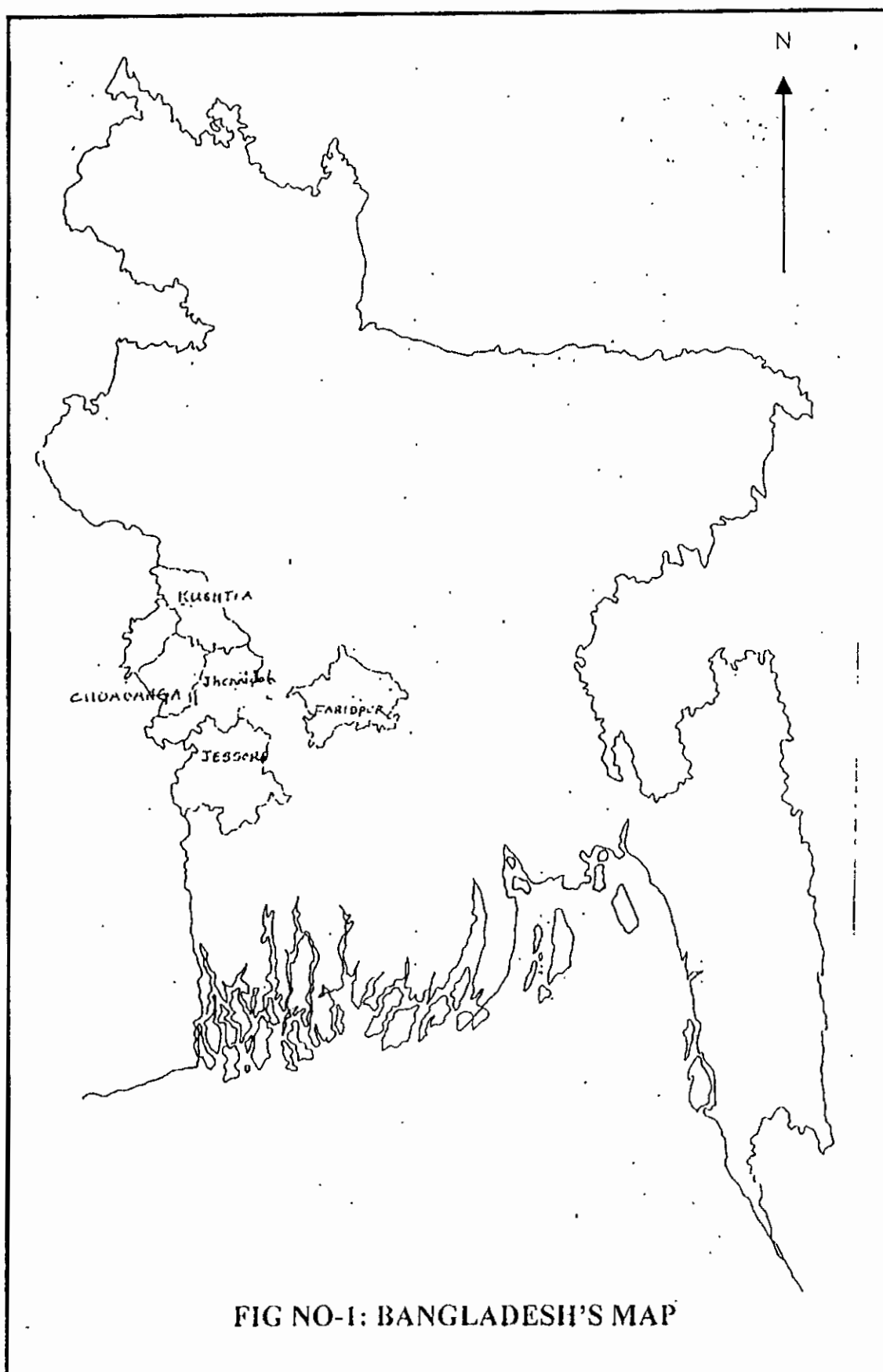


FIG NO-1: BANGLADESH'S MAP



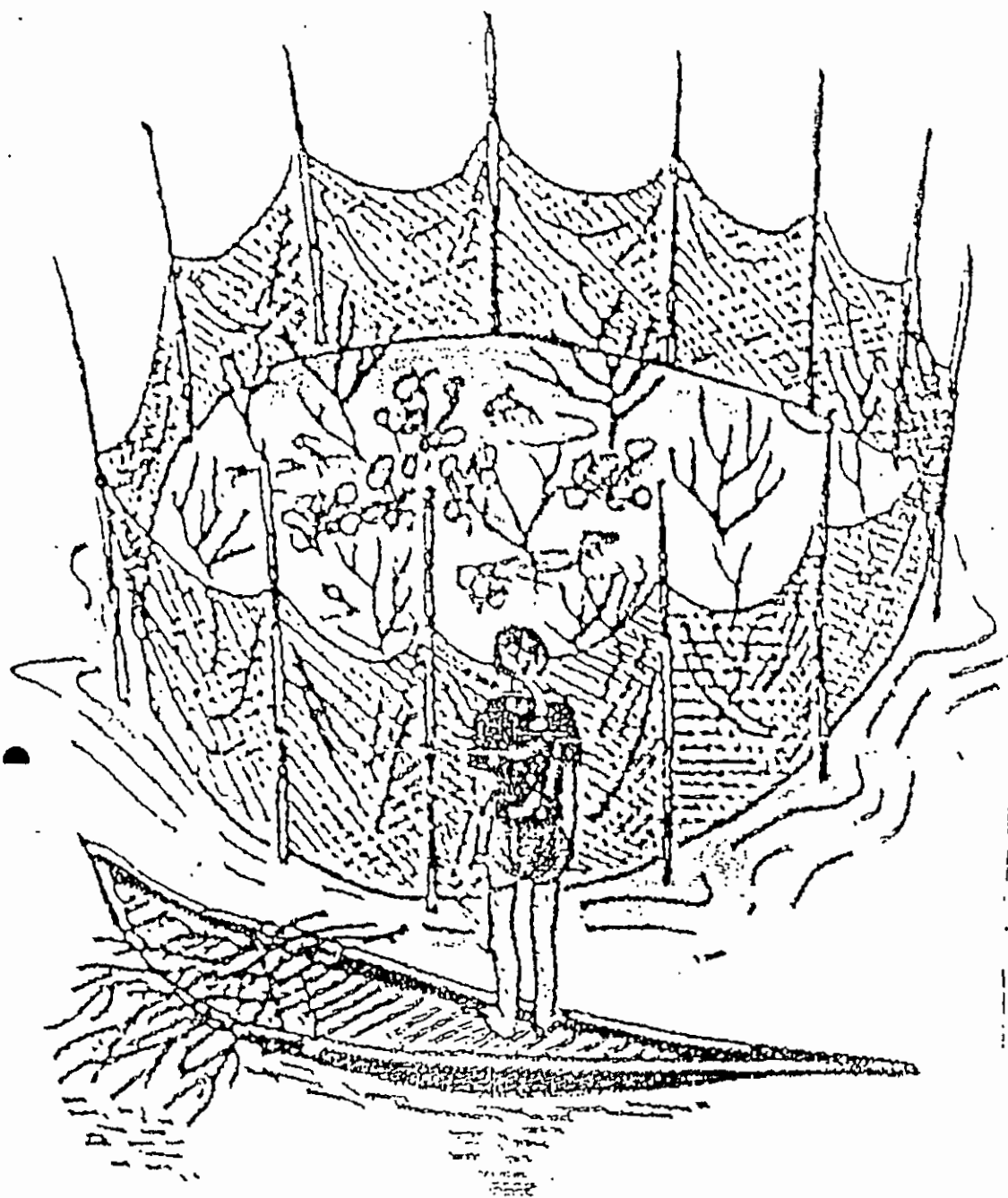


FIG NO-5: SKETCH OF KOMOR FISHING



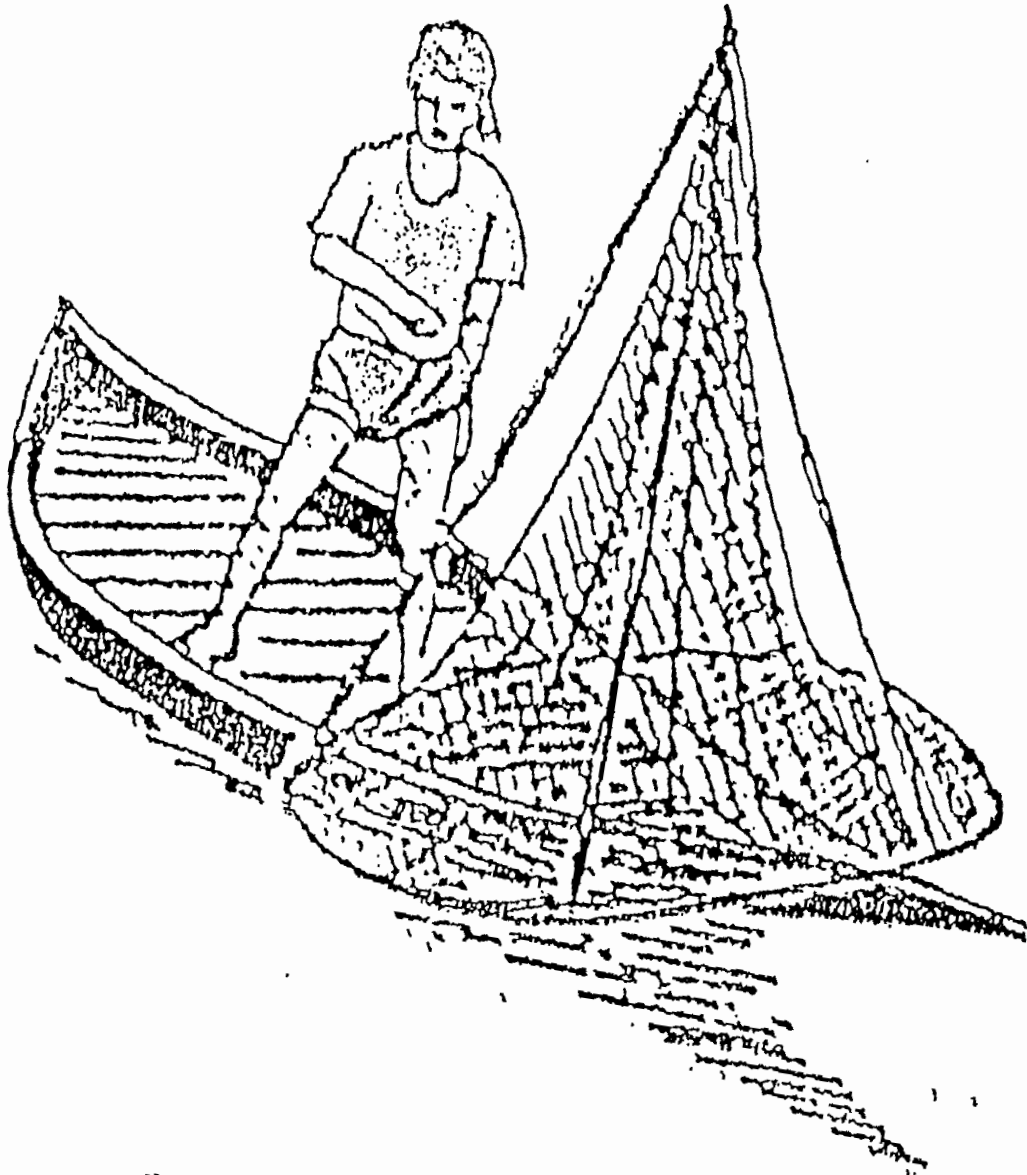


FIG NO-6: SKETCH OF CHAK FISHING

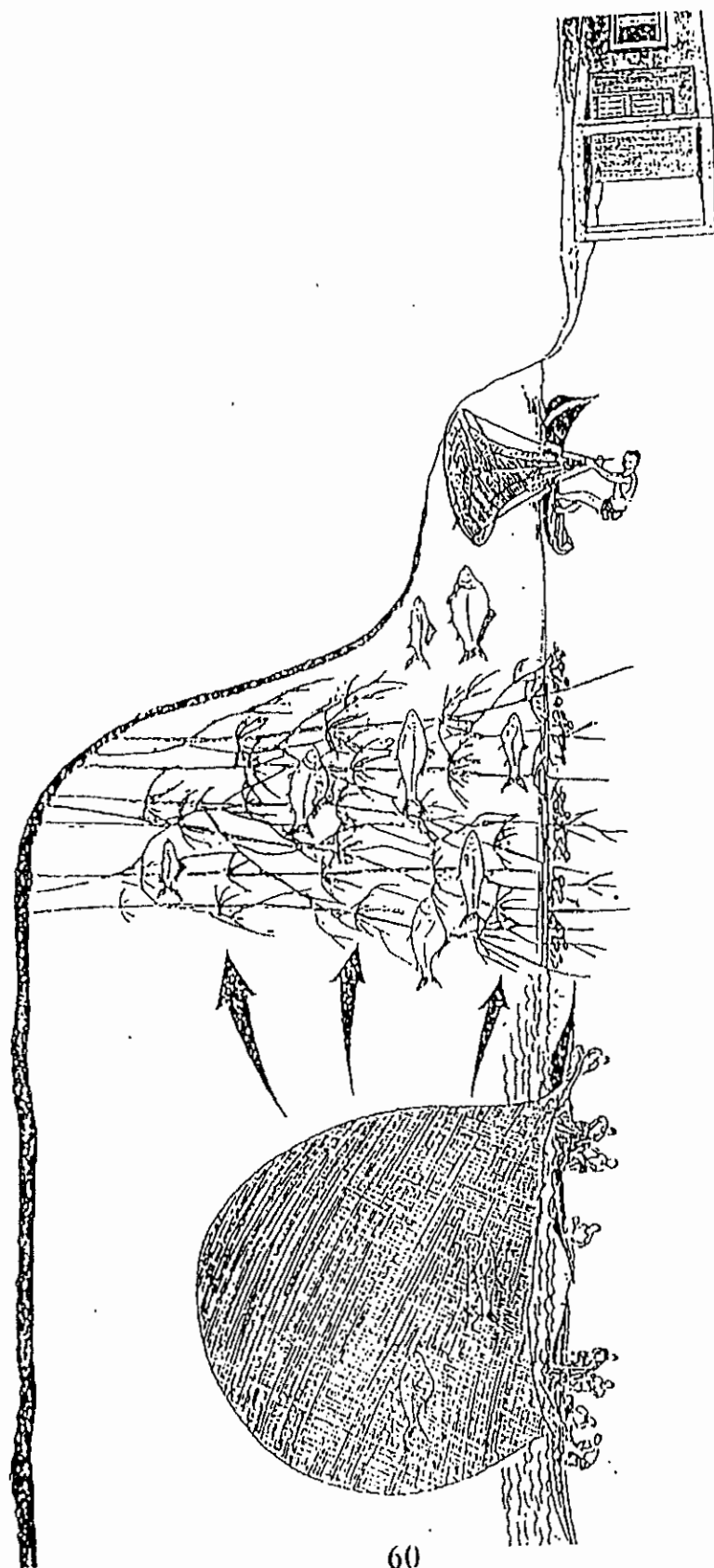


FIG NO-7: SKETCH OF KOTCHAL AND CHAK FISHING.

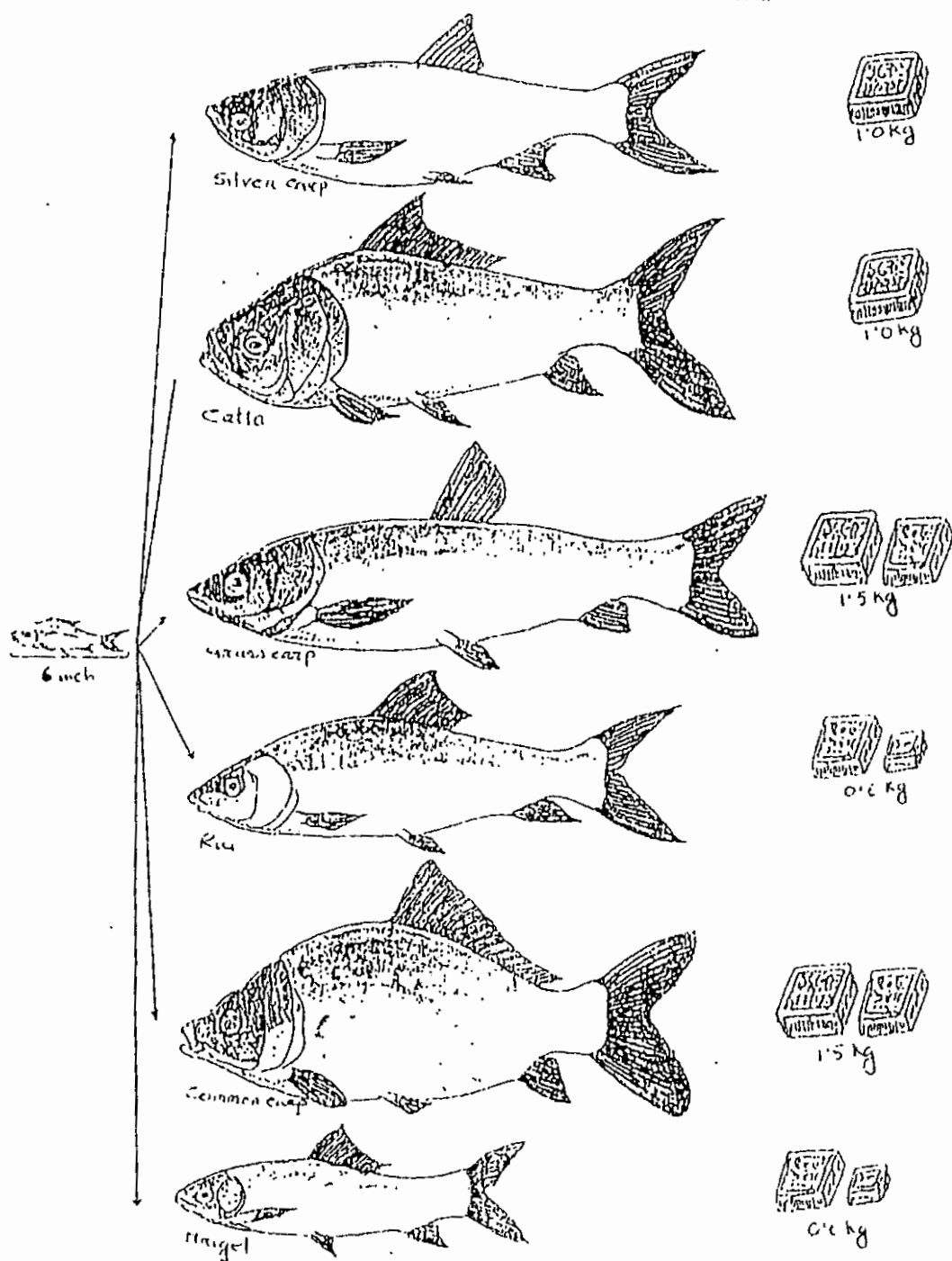


FIG NO-8: PICTURE OF MARKET SIZE FISH

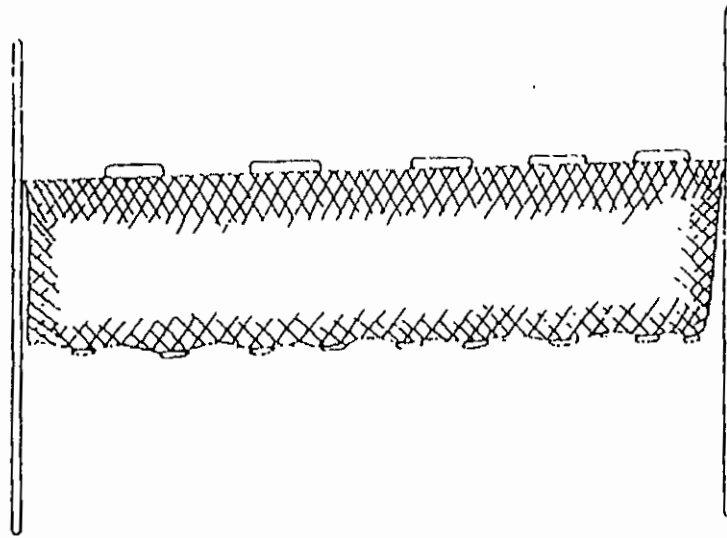


FIG NO-9: SKETCH OF GILL NET (PUNTI AND FANSII JAL)

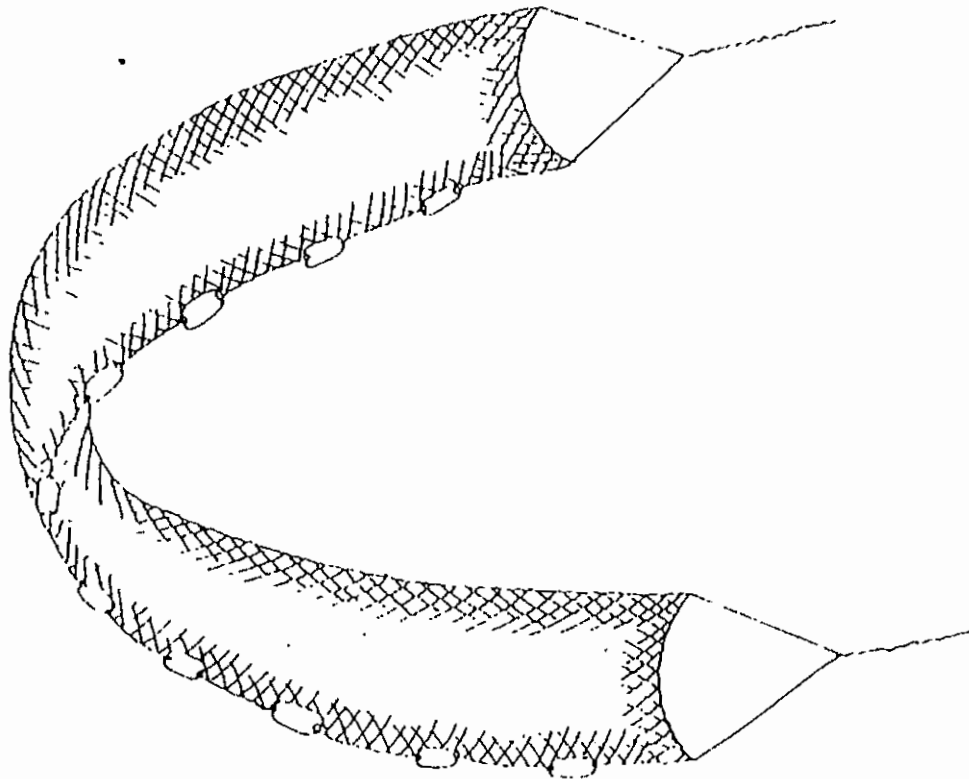


FIG NO-10: SKETCH OF SEINE NET

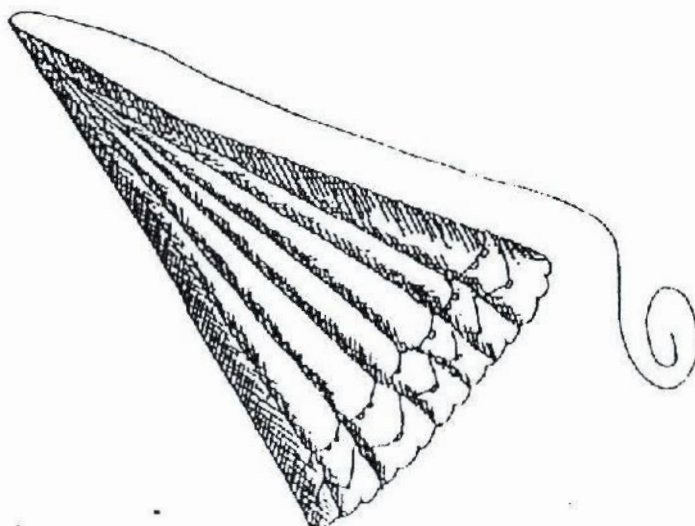


FIG NO-11: SKETCH OF FALLING NET (CAST NET/ KHEPLA JAL.)

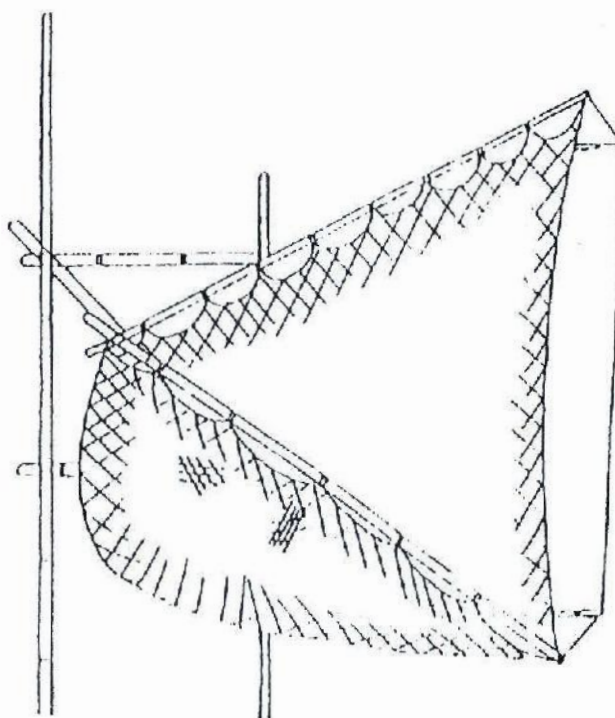


FIG NO-12: SKETCH OF DIP NET (LIFT NET / KHORA JAL.)

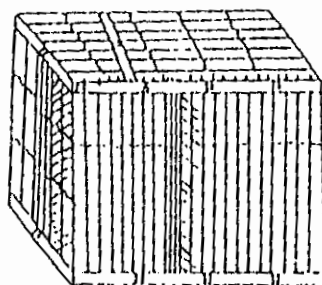


FIG NO-13: SKETCH OF CHARO (BOX TRAP)

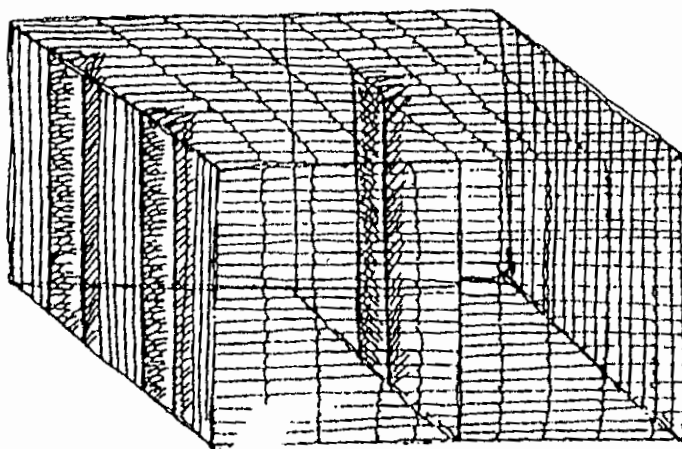


FIG NO- 14: SKETCH OF ARINDA (BOX TRAP)

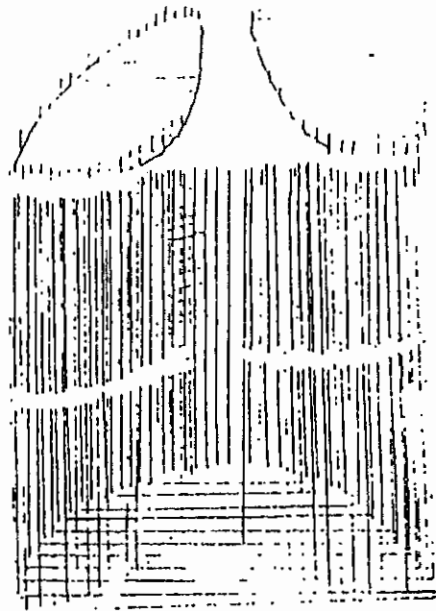


FIG NO-15: SKETCH OF KHADOM (BOX TRAP)

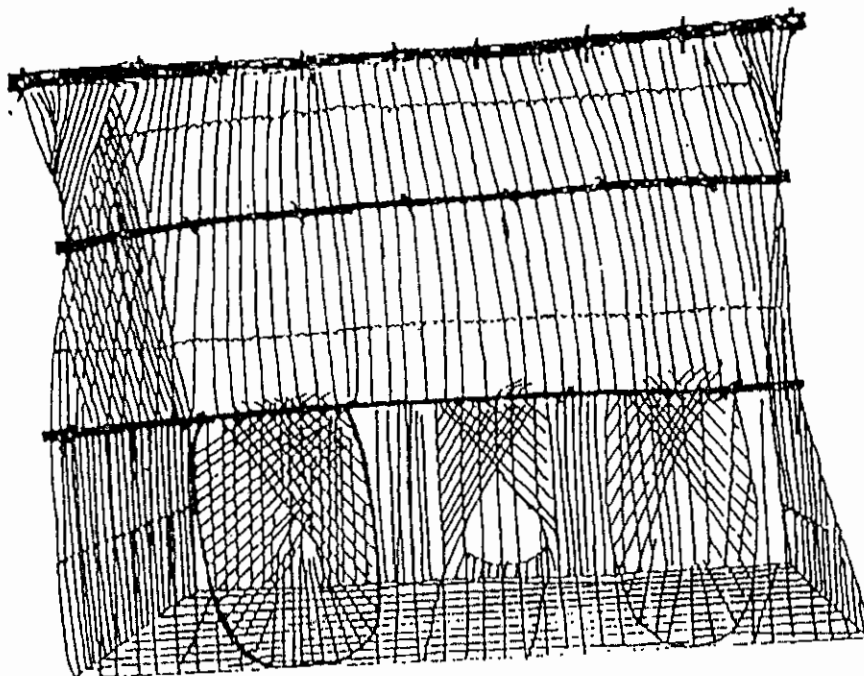


FIG NO-16: SKETCH OF RAMANI (BOX TRAP)

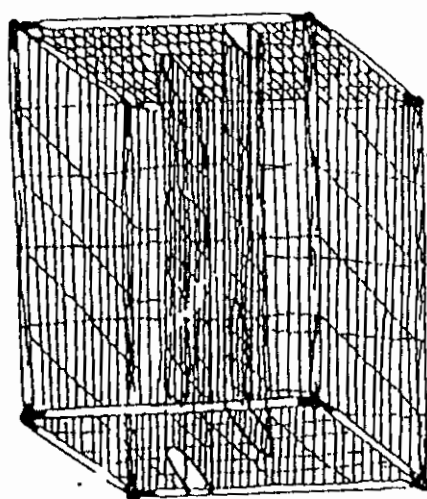


FIG NO-17: SKETCH OF TUBO (BOX TRAP)

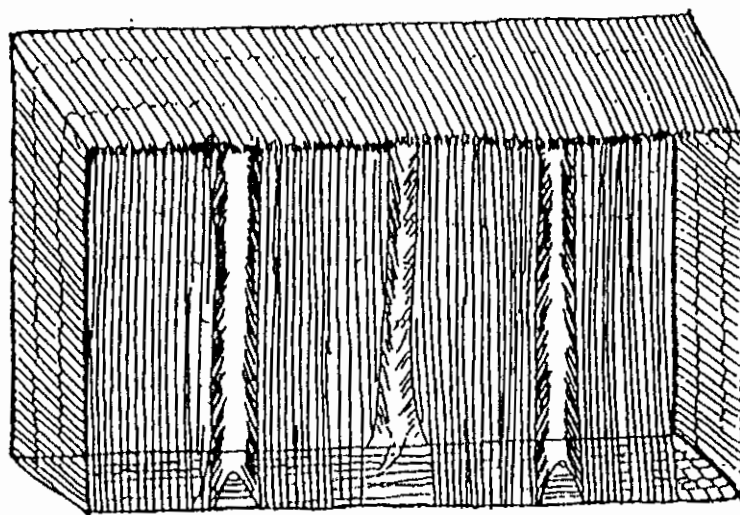


FIG NO-18: SKETCH OF GHIUNI (BOX TRAP)



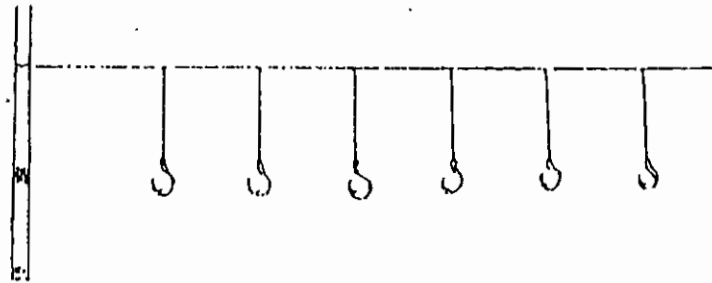


FIG NO-19: SKETCH OF DHAWN BORSHI (LONG LINE)

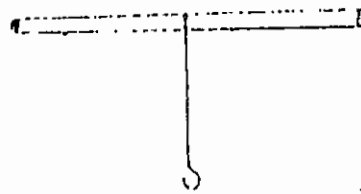


FIG NO-20: SKETCH OF NOL BORSHI/DHAP BORSHI

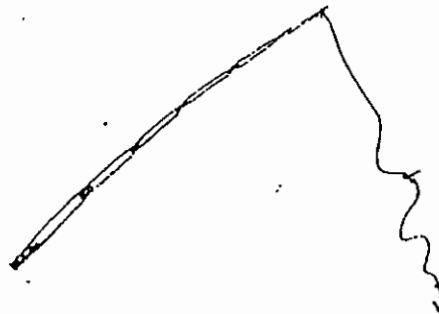


FIG NO-21: SKETCH OF SIP BORSHI

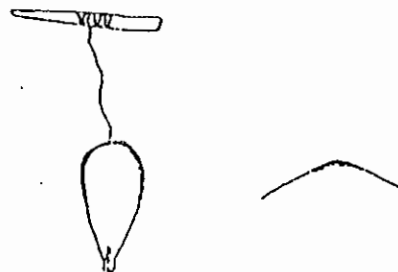


FIG NO-22: SKETCH OF CHASRA (BAMBOO MADE HOOK)



FIG NO-23: SKETCH OF KOACH (SPEAR/HARPOON)

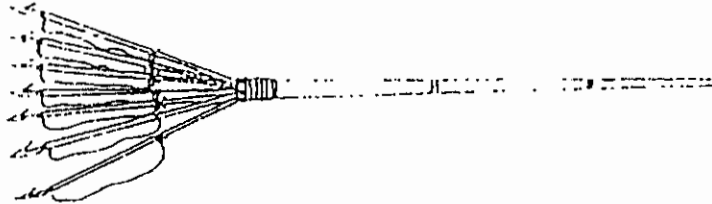


FIG NO-24: SKETCH OF JUTI (SPEAR/HARPOON)

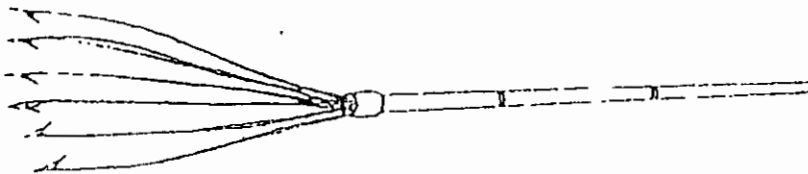


FIG NO-25: SKETCH OF JHUPI (SPEAR/HARPOON)

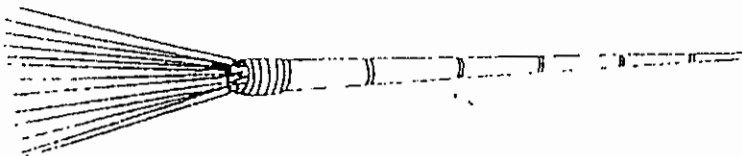


FIG NO-26: SKETCH OF FULKUCHI (SPEAR/HARPOON)

## ABBREVIATION

MOL= MINISTRY OF LAND

MOFL= MINISTRY OF FISHERIES AND LIVESTOCK

DOF= DEPARTMENT OF FISHERIES

IFAD= INTERNATIONAL FUND FOR AGRICULTURAL DEVELOPMENT

GOB= GOVERNMENT OF BANGLADESH

BRAC= BANGLADESH RURAL ADVANCEMENT COMMITTEE

BM= BAOR MANAGER

WB= WORLD BANK

OLP= OXBOW LAKES PROJECT

LFT= LAKE FISHING TEAM

TFO= THANA FISHERIES OFFICER

AM= AREA MANAGER

AHO= ASSISTANT HATCHERY OFFICER

FA= FIELD ASSISTANT

LMG= LAKE MANAGEMENT GROUP

### Data Collection sheet - 1

Name of Baor ..... Month ..... Year.....

[illegible]

## Oxbow lakes information sheet

Name of Baor : ..... Code : ..... Date : .....

[illegible]

## APPENDIX - 3

### Data Collection sheet - 2

Collection No .....

Locality ..... Date .....

Name of baor/lakes ..... Area of baor .....

1. Name of the gear / fishing technique .....
2. Type of fishing: kochal..... seine.....  
Kamor .....  
Chak fishing ..... Gill .....  
Lift ..... Cast .....  
Other ( specify) .....
3. Specification of net: Shape .....  
Length ..... Width .....  
Mesh ..... material used .....
4. Type of I look and line .....  
Multiple ..... Single .....  
Length of line ..... Depth of I look line .....
5. Type of bamboo trap .....  
Shape ..... Width ..... Mesh .....
6. Type of lift Net .....  
Length ..... Width ..... Mesh .....
7. Fishing method .....  
Manpower utilized .....
8. Operation procedure (in brief) .....

## REFERENCES

- Apu N.A, S. Rahman, DevNathon, J.D. Balarin, 1997 Mechanism for Security of Tenure in a common property regime, Oxbow lakes small scale fishermen project Matshay Bhaban, Arabpur, Jessore.
- Ahmed, N. 1954 Fishing gears of East Pakistan, Pak J. Sci (3), 195-20. PP.
- Ahmed N. 1954, Fishing Crafts of East Pakistan Proc. Indo pacific Fish Council. IPFC/C 54/TECH 20, 1-9 pp.
- Abstract of community Based fisheries management 1997, Department of fisheries, Govt of Bangladesh, Matshaya Bhaban, Ramna, Dhaka-1000.
- Brief on Department of fisheries and fisheries sector of Bangladesh, 1997, 19 pp Ahmed, N (Edited), Department of Fisheries, Government of Bangladesh, Matshaya Bhaban, Dhaka.
- Baseline Survey : Final Report 1991-1993 Oxbow lakes small scale Fishermen project, BCAS, 620 Road 10A (New) Dhanmondi, Dhaka, 1209.
- Brief on Department of Fisheries, Bangladesh, 2001. Ahmed N. (ed) Department of Fisheries, Matshaya Bhaban, Dhaka 1000.
- Baor Biological Studies 1994-1995. Studies and Research Report No- 16.152 PP. Department of Fisheries.
- Baor Production Technology manual 1994. Department of Fisheries DANIDA Technical Assistance, Bangladesh Rural Advancement Committee, OLP-II, Matshaya Bhaban, Arabpur, Jessore. 27 pp.
- Biological studies of oxbow lakes 1989-1997. Oxbow lakes small scale fishermen project, Matshaya Bhaban, Arabpur, Jessore
- Baor Atlas. 1989- 1997. Oxbow lakes small scale fishermen project, Matshaya Bhaban, Arabpur, Jessore.



- Dilruba, A. A. Hossain and S. Mostafa, 1997. Impact of the Oxbow Lakes Project II on Participant households. BRAC Research and Evaluation Division, BRAC Centre, 56, Mohakhali, Dhaka 1212.
- Doha, S. 1965. Fresh water fishes of Pakistan. Present status and measures for Development Production, crafts and Gears, Pak. J. Sci. 17 (2): 105-110.
- Economic Analysis of financial Report of lake fishing Team Report No-19. 1989-79. Final report VII. Oxbow lakes small scale fishermen project, Matshaya Bhaban, Arabpur, Jessore.
- Final Report, ENIMOF Project, 1989 Bangladesh Center for Advanced studies (BCAS) Department of Fisheries, Ministry of Fisheries and livestock, Govt of Bangladesh. 228 PP.
- Fish week, 2001 (Published in Bengali) Department of fisheries, MOFL, Govt of Bangladesh, Matshaya Bhaban, Ramna, Dhaka. 1000. 1-7 pp
- Fish Culture by the management of landless poor fishermen (In Bengali) 1995. Oxbow lakes project -II, Matshaya Bhaban, Arabpur, Jessore. 1-18
- Fisheries special study Report 1993. North East regional water management Project FAP-16 CIDA, Dhaka.
- Fisheries and socio-Economic studies in the Oxbow lakes. 1989-1997. Oxbow lakes small scale fishermen project, Matshaya Bhaban, Arabpur, Jessore.
- Fisheries co-management in oxbow Lakes in Bangladesh 1989-1997. Oxbow lakes small scale fishermen project. Matshaya Baban, Arabpur, Jessore.
- Haque, A. 1997 Impact of carp stocking on yield & species diversity of non stocked indigenous fish of Oxbow lake, A Ph.D study. Abstract Report on National work shop of policy for sustainable inland Fisheries Management. Department of Fisheries, Matshya Bhaban, Ramna, Dhaka.
- Legal studies of fishers groups, security of Tenure and lease Fee in Oxbow lakes in Bangladesh 1989-97. Oxbow lakes small scale fishermen project, Matshaya Bhaban, Arbapur, Jessore.