Flood Action Plan
FAP 3
North Central Regional Study

Supporting Report III
Fisheries

February 1993

Financed by:

Commission of the European Communities and
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Project ALA/90/03

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BCEOM, Compagnie Nationale du Rhone
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ACKNOWLEDGEMENTS

The co-operation of many individuals and organisations who provided data, publications and other reference material is gratefully acknowledged. Gratitude is extended to staff of the Department of Fisheries, particularly Messrs Liaquat Ali, R Bonik, Aziz and S Choudhury who kindly furnished much statistical information and patiently answered numerous queries. Thanks also go to staff of the North Central Regional Study and in particular to Mr. Q. J.Ahmed who, as Fisheries Specialist, assisted greatly in the collection of fisheries statistics and other information.

The Regional Water Resources Development Plan - Final Report consists of the following:-

Main Volume REGIONAL WATER RESOURCES DEVELOPMENT PLAN

Supporting Reports:-

SR I	LAND RESOURCES AND AGRICULTURE
SR II	WATER RESOURCES
SR III	FISHERIES
SR IV	HUMAN RESOURCES SOCIO-ECONOMICS AND INSTITUTIONS
SR V	ENVIRONMENT
SR VI	INFRASTRUCTURE AND EXISTING SCHEMES
SR VII	ENGINEERING
SR VIII	DEVELOPMENT OPTIONS
SR IX	PLANNING UNITS AND REGIONAL SCHEMES
SR X	ECONOMIC, AND MULTICRITERIA IMPACT ASSESSMENT

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NORTH CENTRAL REGIONAL WATER RESOURCES DEVELOPMENT PLAN
FAP-3
SUPPORTING REPORT-III, FISHERIES
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ABBREVIATIONS AND ACRONYMS

ADB	Asian Development Bank
BARC	Bangladesh Agricultural Research Council
BAU	Bangladesh Agricultural University
BB	Bangladesh Bank
BBS	Bangladesh Bureau of Statistics
BCAS	Bangladesh Centre for Advanced Studies
BFDC	Bangladesh Fisheries Development Corporation
BRAC	Bangladesh Rural Advancement Committee
BRRI	Bangladesh Rice Research Institute
BWDB	Bangladesh Water Development Board
CAS	Catch Assessment Survey
CIP	Chandpur Irrigation Project
CPCM	Coarse Pilot Computer Model
DANIDA	Danish International Development Agency
DOF	Department of Fisheries
FAO	Food & Agriculture Organisation of the United Nations
FAP	Flood Action Plan
FCD	Flood Control Drainage
FCDI	Flood Control Drainage & Irrigation
FPCO	Flood Plan Co-ordination Organisation
FRI	Fisheries Research Institute
FRSS	Fisheries Resources Survey System
GOB	Government of Bangladesh
HYV	High Yield Varieties
LGEB	Local Government Engineering Board
ME	Ministry of Education
MF	Ministry of Finance
MIWDFC	Ministry of Irrigation, Water Development & Flood Control
ML	Ministry of Land
MLGRDC	Ministry of Local Government, Rural Development & Co-operatives
MOFL	Ministry of Fisheries & Livestock
MP	Ministry of Planning
MPO	Master Plan Organisation
NCR	North Central Region
NFMP	New Fisheries Management Policy
NGO	Non-Government Organisation
ODA	Overseas Development Administration (UK)
PSO	Principal Scientific Officer
PU	Planning Unit
SPARRSO	Space Research and Remote Sensing Organisation
TFO	Thana Fisheries Officer
Tk	Taka
UNDP	United Nations Development Programme

CHAPTER 1
INTRODUCTION

1.1 Background

As part of the Phase 1 Reconnaissance Study, a brief description was given of the fish resources and fisheries in the western portion of the North Central Region (NCRS 1990). The present study is the first to provide a description and preliminary analysis of the fisheries sector of the whole NCR study area.

The principal objective of the fishery component of the NCRS was to carry out an evaluation of the fishery resources (both capture and culture) of the region and make an assessment of the impact of possible water development strategies on these resources. A further aim was to recommend mitigating measures to minimise any adverse impacts on fisheries and to identify priority fishery initiatives which may be incorporated into the regional development plan.

The terms of reference of the study are presented in Annex III-1. The study consisted of a six week assignment (September-November 1991) undertaken in Bangladesh by an expatriate fisheries specialist which supplemented a longer term assignment (May to November 1991 and February 1992) carried out by a local fisheries specialist.

Further information on fisheries is being collected in the North Central Region area by FAP 17 and FAP 3.1. This data will be utilised together with newly collected information when feasibility studies are carried out in the North Central Region. Recommendations have been made in the Terms of Reference for those subsequent studies that more quantitative data is required than has been available for this Regional (pre-feasibility level) study.

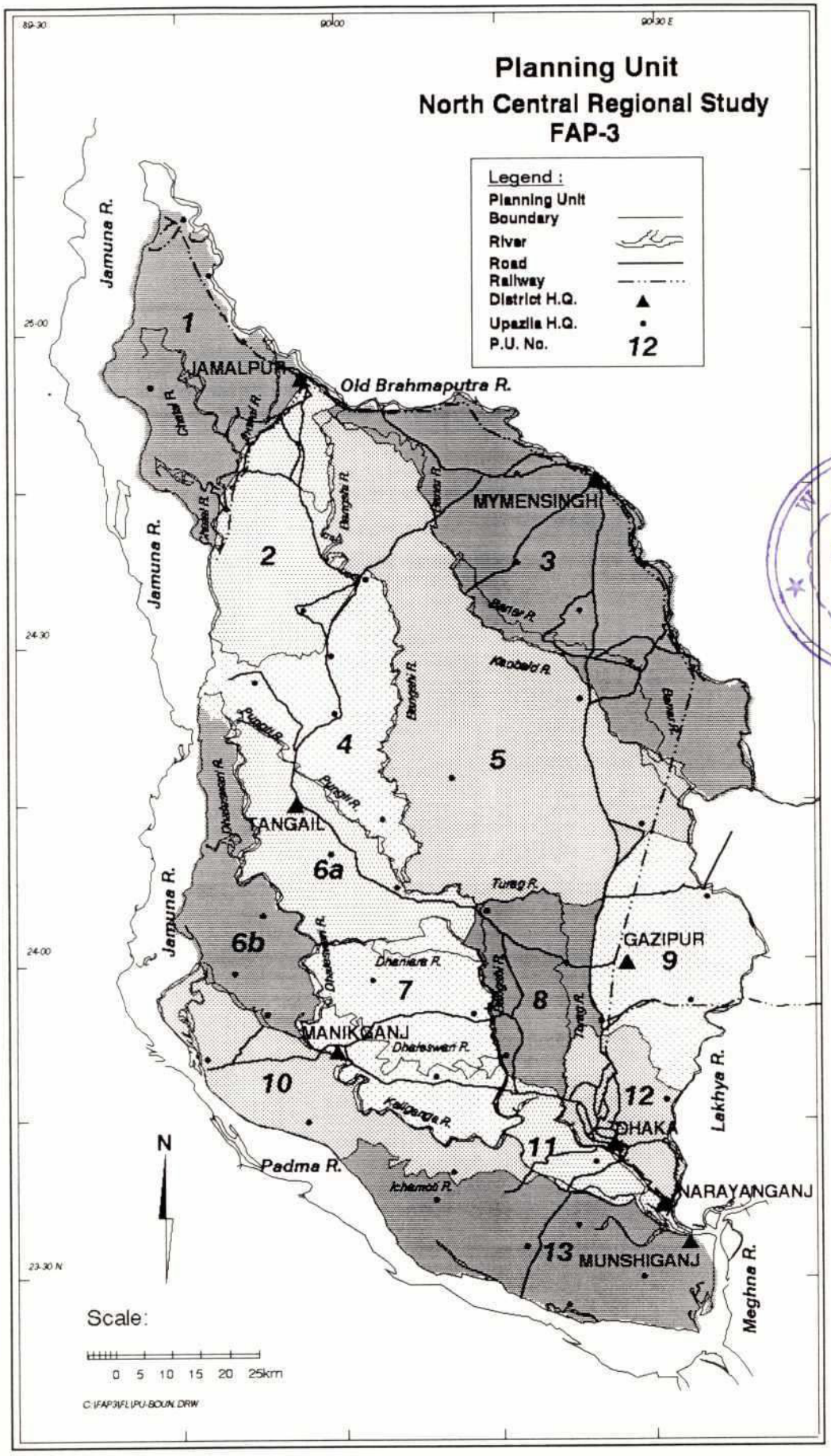
1.2 Guidelines

In carrying out this assessment of the fisheries resources within the NCR, attempts were made to follow, where possible, the general guidelines set out by the FPCO (FPCO 1991). However, the guidelines assume that accurate, comprehensive and detailed quantitative data are available or will be collected which relate to fish habitats, behaviour, biology, resource potential and to the socio-economic characteristics of the various fisheries which exist in the region. Unfortunately, this is not the case in the NCR. On the contrary, there is very little quantitative or even qualitative information concerning the fish resources of the NCR, apart from that provided by annual fisheries statistics published by the Department of Fisheries (DOF 1984-89). The quality of data provided by the latter is discussed in more detail in Section 2.1.

1.3 Visits

In view of the limited duration of the study, the approach adopted in the evaluation of the fisheries sector was based mainly on an analysis of the published statistics and information derived from other relevant literature. This entailed considerable time collecting and compiling information from various organisations, particularly from the Department of Fisheries (see Annex III-2). As a result, there was little time for field visits to each of the thirteen Planning Units of the NCR (Figure III-1.1) and therefore reliance had to be placed on visits to several of the PUs

Figure : III-1.1



(Nrs.3,4,6,7,8,10,11) made by the fishery specialist during a previous short-term study (FAP-17, Design Study) undertaken in August 1991. One field visit was, however, made during this NCRS to obtain further information on the beel areas around Mymensingh (PU3). In addition, a short aerial reconnaissance survey undertaken in October 1991 along the perimeter of the NCR study area provided a useful, rapid overview of the adjacent rivers and floodplain.

Significant use was made of information from the District (DFOs) and Thana Field Offices (TFOs). These visits have been detailed in SR VI.

1.4 Reporting

This Preliminary Supporting Report, first describes the methodologies employed and then presents descriptions and analyses of various fisheries at the regional level together with an assessment of general constraints on fisheries development in the area and prospects for future development in the absence of any water development interventions.

Each Planning Unit is then examined individually in terms of its existing fish resources and fisheries. Assessments are made, quantitatively where possible, of the impacts of various water development options on these resources. Within each PU, consideration is also given to the identification of priority fishery initiatives which may be incorporated into the regional development plan.

CHAPTER 2
METHODOLOGY

2.1 General

This chapter sets out the methodology used to utilise the presently available information. It comments on the limitations to the accuracy of the data available, and indicates the method used to apply this data to the planning regions (Planning Units) used in the Regional Study.

The impact assessment of potential regional schemes, as proposed in the Regional Water Resources Development Plan is discussed in Chapter 7.

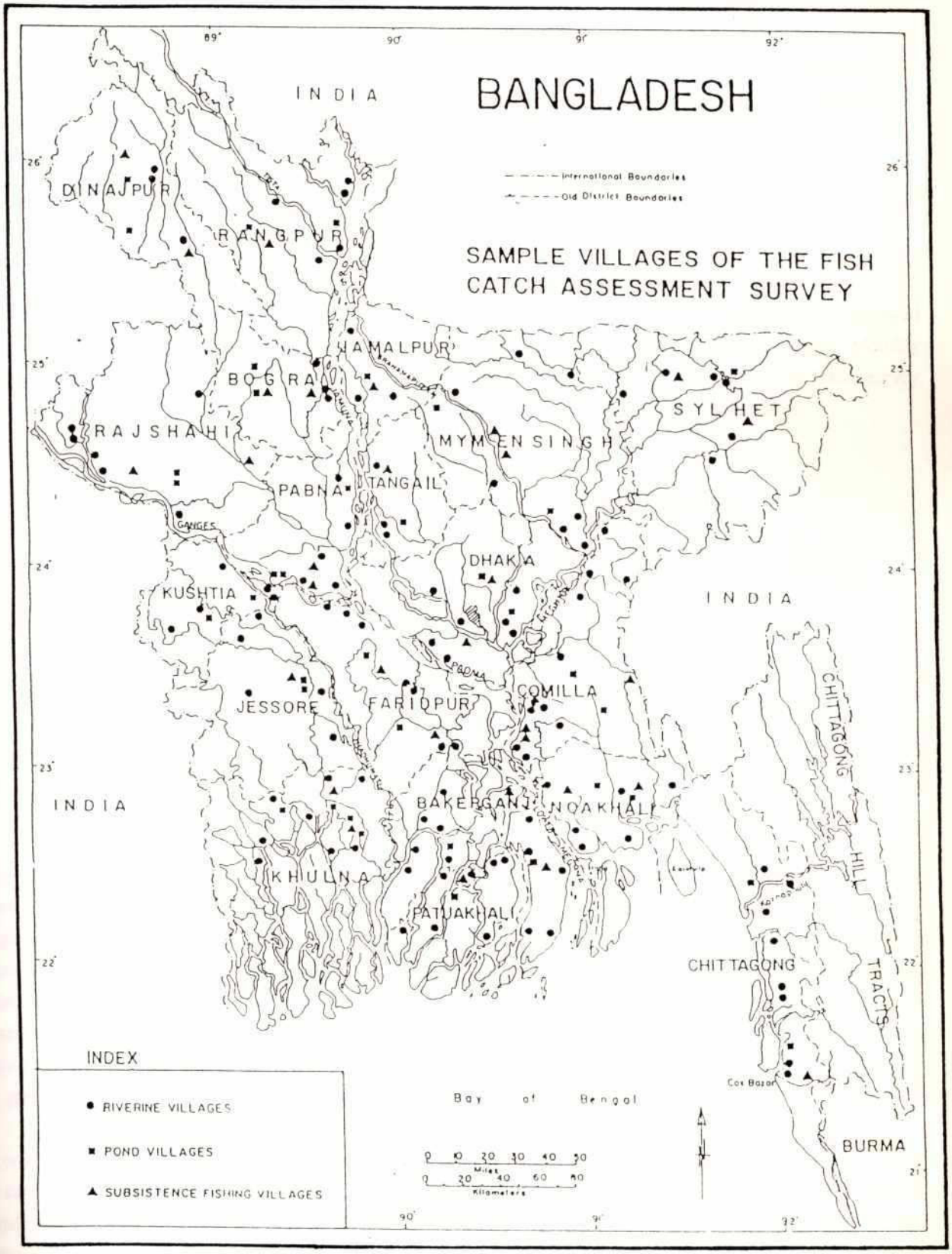
2.2 Fisheries Catch Statistics and Water Area Statistics

The first national statistical system for the collection of fisheries data in Bangladesh, known as the Fisheries Resources Survey System (FRSS), was introduced in 1980 with financial and technical assistance from FAO/UNDP. The main objective of the programme was to provide sufficient data upon which to base fisheries planning, development and management policies. The first set of statistics generated by the new system was published for the year 1983/1984 by the Department of Fisheries (DOF) and thereafter annually (DOF 1984-89). It is recognised by DOF that the FRSS is in need of improvement, particularly in terms of increasing the sample size of its various components and strengthening the supervision of field staff to ensure good quality data. However, DOF has recently reported that, because of its limited manpower and financial resources, it has been unable to provide the necessary improvements (DOF 1990).

Even though the quality of the FRSS statistics remains uncertain, they represent the only source of national fisheries information and as such have been used widely by national and international organisations as a basis for fisheries assessment, planning and development (MOFL 1990, MPO 1985, World Bank 1991). In the present study, the FRSS statistics have also been used to provide a quantitative assessment of the fisheries resources of the NCR. The FRSS provides data on capture and culture fisheries and sub-divides the former on the basis of different types of water bodies. Those which are relevant to the NCR comprise rivers, beels and floodlands (floodplain). Catch statistics relating to the capture fisheries of rivers, beels and floodplain for the period 1983 to 1989 are published for each one of the former administrative districts of Bangladesh together with data on the production of different categories of fish ponds, i.e. cultured, culturable and derelict.

As part of the FRSS, the Bangladesh Space Research and Remote Sensing Organisation (SPARRSO) was commissioned to collect data on water bodies using satellite imagery, aerial photographs and ground-truth surveys and to estimate the total area of water bodies usable for fish production. For survey purposes, water bodies were divided into small and large bodies. Small water bodies were defined as ponds, tanks, ditches, etc., having an area less than 25 hectares. The term "pond" was used in the survey for all categories of water bodies,natural, partly excavated or wholly artificial reservoirs charged by stream, rainwater, floodwater or all three and used for irrigation, fisheries and domestic purposes. Large water bodies comprised areas greater than 25 hectares and included rivers, canals, old river beds and beels (SPARRSO 1984). For fisheries purposes, areas of beels, rivers and other large water bodies were presented separately for each former district(DOF 1986). Information on numbers and areas of ponds was presented at the level of thana (SPARRSO 1984, DOF 1986).

Figure: III-2.1



Source : DOF 1986

Four former districts covered the NCR: Dhaka, Jamalpur, Mymensingh and Tangail. All but Tangail also comprised areas outside the NCR which, in the case of Mymensingh district, was substantial (Figure III-2.1). Therefore, to utilise district data in the assessment of fisheries of the NCR, the first step was to exclude those data relating to areas outside the NCR and then to adjust the remaining data to individual Planning Units. The manner in which adjustments were made varied according to the type of water body (fishery) to which the published data referred. The methods employed to make the adjustments are outlined below with comments, where appropriate, on some of the weaknesses of the statistical collection system.

2.2 Adjustments of Data of Planning Units

2.2.1 River Fisheries

The statistical collection system was based on an initial frame (census) survey carried out in 1980/1981, followed by regular catch assessment surveys of selected villages visited by FRSS officers on two days per month. Monthly data were compiled and pooled to provide annual catch statistics. Rivers selected for study during the frame survey were divided into three categories depending on size: principal, major and minor rivers (Table 2.1).

TABLE 2.1
Rivers of the NCR Sampled by the FRSS Frame Survey, 1980-1981

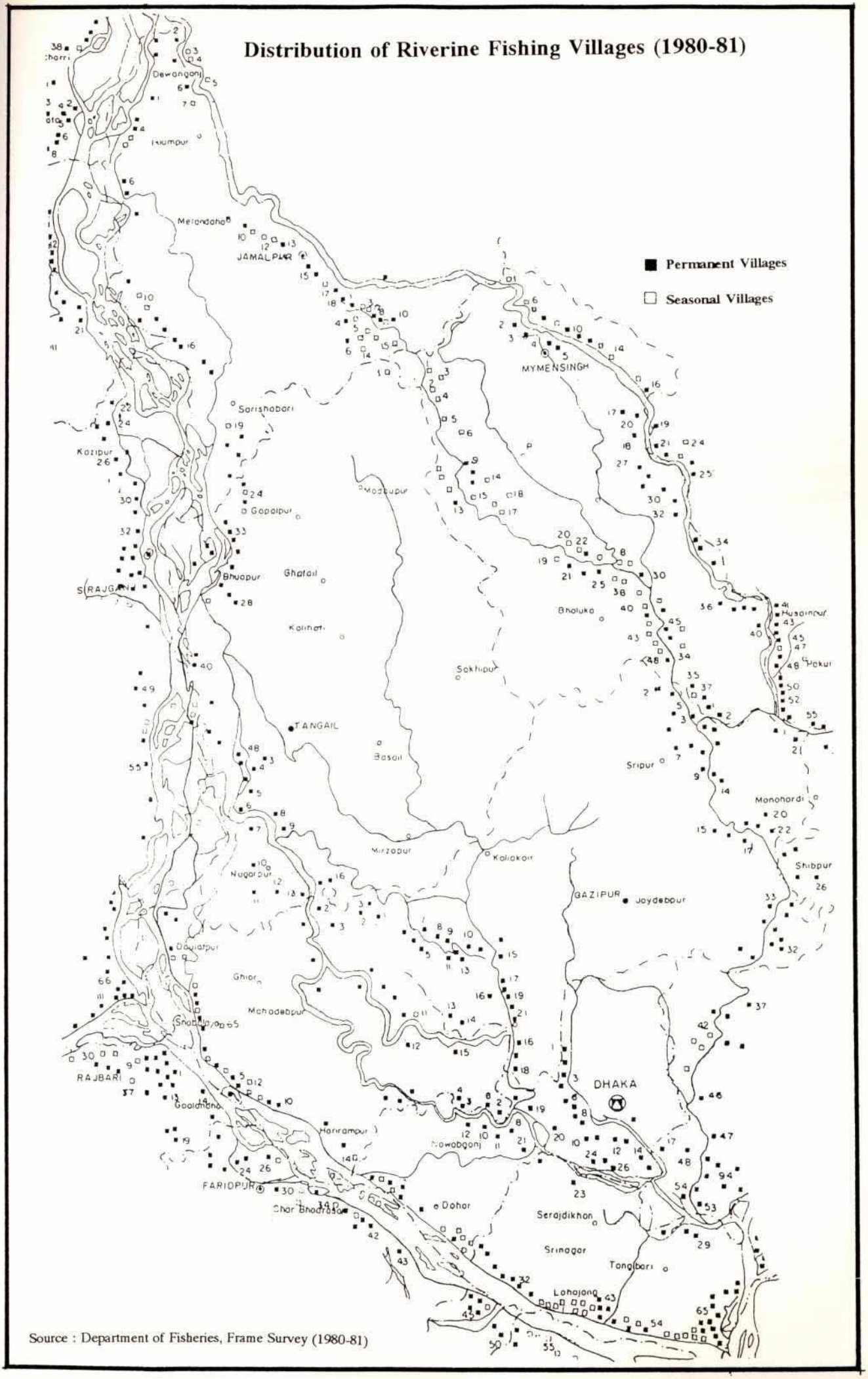
Rivers		
Principal	Major	Minor
Jamuna Lower Padma	Old Brahmaputra Lakhya Dhaleswari	Banar Bangshi Buriganga Kaliganga

Source : CS 1992

Many smaller river systems were not included in the frame survey but were incorporated into the sampling programme of the floodplain component of the FRSS. On each selected river, all fishing villages located within about 10km of its banks were visited and the total numbers of boats in each village were recorded (Figure III 2.2 and Annexes 3,4,5). Within each former district, four villages were selected for study by catch assessment surveys: two on principal rivers and one each on major and minor rivers or two each if there was no principal river in the district (Figure III 2.1). At each village, details of total catch, catch composition by species or species groups, catch rate per gear type and total number of different gears were recorded.

To convert total catch from selected villages to district level, a multiplication factor is applied which is based on the ratio of total numbers of boats in the district to that in the selected villages. Thus, to convert district catch data to individual PUs in the NCR, the appropriate conversion factor was calculated by dividing the total boat number in those villages recorded in the frame survey for each PU by the total number of boats in the district. An example is given below:

Figure III.2.2



Source : Department of Fisheries, Frame Survey (1980-81)

e.g.	-	Total number of boats in district A	= 500
	-	Total number of boats in sampled villages	= 60
	-	Total annual catch of sampled villages	= 150t
	-	Therefore, total annual catch for district A = 500/60 x 150	= 1250t
	-	Assume, total number of boats in villages of PU A	= 190
	-	Therefore, total annual catch in PU A = 190/500 x 1250	= 475t

Within the last two years, the number of FRSS survey officers has been increased so that riverine fishing villages in each new district can now be sampled. Unfortunately catch statistics for these districts have not yet been published. Despite the recent increase in sampling effort, the overall sample size remains low compared with the size of the riverine fishery.

A more serious weakness of the FRSS estimation of riverine catches stems from the absence of updated frame surveys or supplementary frame surveys upon which annual catch assessment surveys should be based. No survey has been undertaken since the first in 1980/1981. It seems likely, particularly in view of the disastrous floods of 1988, that major changes have occurred in the distribution and possibly number of boats within the NCR. Such changes would have a significant effect on estimates of annual catches at district or lower level, e.g. Planning Unit or within a single river system.

A further weakness in the FRSS system results from the absence of census data on the total number of different types of gears used in each district or on each river system. The only available measure of fishing effort must therefore be derived from boat number and this is not very meaningful in a multispecies, multigear riverine fishery.

2.2.2 Beel Fisheries

The total catch from beels in each former district is estimated by applying the catch per unit area from one sampled beel to the total area of beels in each district estimated by SPARRSO in 1984. In recent years the results from remote sensing have improved considerably in terms of the degree of resolution achieved. Currently there is a number of SPOT images of the NCR from which detailed quantitative estimates of the number, distribution and area of beels could be obtained. This analysis is time consuming and could not be undertaken at Pre-feasibility level, estimates of beel area in each Planning Unit have therefore been based on information obtained through the Local Government Engineering Board (LGEB), which has compiled data on the number and area of beels in each thana. The quality of these data remains uncertain and, in the many thanas, the information is incomplete. For each Planning Unit, the number and area of beels were calculated on the basis of the proportional areas of those thanas contained within its boundaries.

2.2.3 Floodplain Subsistence Fisheries

The FRSS catch assessment survey of floodplain subsistence fisheries is based on the selection of only one subsistence fishing village in each of the four former districts covering the NCR. At each selected village, the proportion of households engaged in fishing activities is calculated from a total of 100 households selected at random. The average catch per household is estimated on a monthly basis for 15 households. The proportion of fishing households is multiplied by the total number of households in the district to obtain an estimate of the total number of subsistence fishing households in each district. This is then multiplied by the average annual catch per household to obtain an estimate of total catch of the floodplain subsistence fishery in each district.

Clearly, there are considerable difficulties in obtaining reliable estimates of annual catches from the floodplain fisheries. These are typically scattered over vast areas where much of the catch is taken for immediate home consumption and where very few fish landing stations exist. However, a major weakness of the FRSS methodology results from the extremely low sample size of only one village per district compared with the enormous number of people (and households) engaged in subsistence fishing.

A further problem results from the use by FRSS of the total number of households (urban and rural) in each district to derive total catch estimates, rather than using only the total number of rural households (as indicated by the Bangladesh Bureau of Statistics). Thus, in districts where large urban populations exist, e.g. Dhaka, a significant overestimate of total floodplain subsistence catch would occur. This overestimate is counterbalanced to some extent by an underestimate of rural household numbers caused by the use of only one set of data obtained by FRSS from the 1981 population census and by the omission of the effects of subsequent population growth, which averages around 2% per annum in the rural areas of the NCR.

In the present study, the published data on floodplain catches were adjusted by considering only the total number of rural households and ignoring data from urban centres. First, the proportion of fishing households was estimated from the ratio of numbers of fishing households (given in DOF catch statistics) to the total number of households in each district. The proportion of fishing households was then multiplied by the number of rural households in each thana, to obtain the total fishing households per thana. The latter was then multiplied by the average annual catch rate per household (from DOF catch statistics) to obtain the total annual catch per thana, which was then converted to catch per PU by taking into account proportional areas of each thana in each PU. The above analysis does not take into account population growth over the last decade, therefore values of floodplain catches are probably underestimates.

2.2.4 Culture Fisheries

The survey by SPARRSO, carried out in 1983/1984 using infra-red aerial photography and ground surveys in 40 thanas, resulted in a detailed quantitative description of the distribution, number and area of ponds. The results of the surveys were then extrapolated for the whole of Bangladesh, and data on numbers and areas of ponds were presented for each thana and district. Information on pond production was obtained by FRSS in one sample village in each former district (Figure III-2.1). Estimates of total pond production in each district were obtained by multiplying values of pond production per unit area by the total area of each pond type (cultured, culturable and derelict).

The total number and area of ponds in each thana were converted to Planning Unit areas by taking into account the percentage area of thanas in each PU. The approach assumes an even distribution of ponds within each thana but this is probably not the case in thanas where there are significant spacial differences in population densities, geographical features, soil types or groundwater supplies. In the absence of more detailed information on the distribution of ponds within each thana, this source of bias was unavoidable. Estimates of total pond production within each Planning Unit were based on productivity rates derived from district data.

It should be noted that the smallest pond area detected by infra-red aerial photography used by SPARRSO was 0.032 hectares and that while the results of the ground truth survey indicated that most ponds were between 0.03-0.13 hectares, more recent surveys carried out in the Mymensingh area (PU3) as part of the Aquaculture Extension Project revealed more than twice the number of ponds identified originally by SPARRSO. Many of the ponds were small and probably went undetected by aerial photography.

CHAPTER 3
FISHERIES-RELATED INSTITUTIONS AND PROJECTS

3.1 Government Organisations

Fisheries management, development and administration is primarily the responsibility of the Ministry of Fisheries and Livestock (MOFL) which operates through three executive agencies.

a) Department of Fisheries (DOF)
b) Bangladesh Fisheries Development Corporation (BFDC)
c) Fisheries Research Institute (FRI)

3.1.1. Department of Fisheries

The Department of Fisheries is the principal executing agency for fisheries development. Currently (1991-1992) DOF is implementing four development projects within the NCR of which three also receive donor support:

a) Aquaculture Extension Project in Mymensingh District. Supported by DANIDA. Active area: Planning Unit 3. Main objective is to provide an aquaculture extension service to encourage the expansion of small-scale fish farming in the district.
b) Second Aquaculture Development Project. Supported by ADB. Active area: Planning Units 2, 4, 5, 6, 7, 8, 10,11,13.
Main objective is to encourage the expansion of small-scale fish farming.
c) Integrated Fisheries Development Project. Active area: Planning Units 5, 8, 9, 13.
Main objective is to encourage the expansion and spread of small-scale fish farming.
d) Implementation of the New Fisheries Management Policy (NFMP).
The main objective is to improve the long-term sustainability of open water capture fisheries through the introduction of a more effective management system which is designed to serve the interests of fishermen rather than entrepreneurs and leaseholders (see Chapters 5 and 6).

[Active area: throughout the NCR]

3.1.2 Bangladesh Fisheries Development Corporation

The BFDC is an autonomous organisation engaged in improving the fishing industry of Bangladesh. It was established primarily to develop marine fisheries and has been responsible for the establishment of ice plants, fish landing centres and a net-making factory. In the NCR it is involved only in the marketing of fish but, compared to the private sector, the amount of fish marketed by BFDC is small (about 2% nationally)

[Active area: throughout the NCR]

3.1.3 Fisheries Research Institute

The FRI was created in 1984 largely as a result of reorganisation, extending previously existing institutions to improve the implementation of the fisheries research programme. The FRI headquarters are located in Mymensingh on land adjacent to the Bangladesh Agricultural University (BAU). The FRI headquarters also provide a base for one of three research stations, the Freshwater Research Station which is involved principally with research in aquaculture. The FRI also provides collaboration with the Aquaculture Extension Project (DANIDA).

[Active area: Planning Unit 3]

3.1.4 Other Government Organisations

Many other government organisations participate to varying degrees in the fisheries sector, the most important of which are listed below. Unless otherwise stated, all are active throughout the NCR.

a) **Bangladesh Bank (BB):** The BB is the central agency for channelling institutional credit through the nationalised banks.

b) **Ministry of Agriculture:** The Bangladesh Agricultural Research Council (BARC) is responsible for co-ordinating all national agricultural (including fisheries) research. Research carried out by the Bangladesh Rice Research Institute (BRRI) on deep water rice/fish pen culture in Tangail district (PU 6) is one example of a research programme under the overall co-ordination of BARC.

c) **Ministry of Education (ME):** The BAU, Mymensingh, has a Faculty of Fisheries which offers courses to B.Sc. and M.Sc. levels. Substantial ODA assistance is to be provided in the near future for the improvement of laboratory facilities and training in water quality (mainly in ponds) and fish nutrition and disease. The University of Dhaka also offers courses in fisheries. The Ministry may offer traiing courses on Fisheries, with an extension programme in the country.

[Active area: PU 3 and 12]

d) **Ministry of Finance (MF):** The MF release all funds under the fisheries revenue and development budgets.

e) **Ministry of Irrigation,Water Development and Flood Control (MIWDFC):** The Ministry, through the agency of the Bangladesh Water Development Board (BWDB), has already undertaken numerous small and large-scale flood control and irrigation projects in the NCR, most of which have adversely affected fish populations and have altered long established aquatic ecosystems; but many of which have created water reservoirs to facilitate culture fishery which may act as compensatory measures for the loss of fisheries.

f) **Ministry of Land (ML):** All public water bodies, including rivers and beels except those in forest reserves, are under the control of this Ministry. The fishing rights on water bodies greater than 20 acres are leased by auction to the highest bidder to generate government revenue. These fisheries, known as jalmahals, may comprise stretches of rivers, individual beels or groups of beels. Since 1986 the ML has gradually transferred the management of a number of jalmahals to DOF under the New Fisheries Management Policy.

g) **Ministry of Local Government, Rural Development and Co-operatives (MLGRDC):** This agency is responsible for the control of those water bodies with areas less than 20 acres.

h) **Ministry of Planning (MP):** In collaboration with MOFH/DOF, the Planning Commission of MP is responsible for the planning of all fisheries development activities, which include all projects within the national five year development programme.

3.2 Non-Government Organisations (NGOs)

Of the many NGOs which operate in Bangladesh, a number are involved in the fisheries sector. The majority of these are concerned solely with the development of small-scale aquaculture through the provision of credit facilities, usually to the poorest section of the rural community, together with extension services and training.
Some of the most important NGOs are the Grameen Bank, PROSHIKA, CARITAS and the Bangladesh Rural Advancement Committee (BRAC). Those NGOs involved in fisheries activities in North Central Region are listed in Table 3.1. The list is by no means exhaustive but it does provide an indication of the extent of these activities in the region. Further information on NGOs is given in SR X.2.Annex 2.

3.3 Flood Action Plan Activities

There are a number of the other FAP projects being carried out in the North Central Region which are concerned with the control of floodwaters in localised areas and which therefore will have an impact on fisheries of the region.

3.3.1 Directly Related FAP Activities

a) **FAP 3.1 Jamalpur Priority Project:** Pre-feasibility study of embankment strengthening and reconstruction, introduction of hydraulic structures associated with controlled flooding and drainage, and compartmentalisation.

[Active area: PU 1]

TABLE 3.1
List of NGO (Fisheries) in the NCR Area

PU	Name & Address of the NGOs (Organisations)	Area of Operations	Programme
3	Anneshi Chakra 22/B,C.K.Ghose Road Mymensingh Sadar	Mymensingh Sadar (2 unions)	Programme started in 1988. Pond re-excavation and fingerling distribution.
3	CARITAS, Mymensingh 95/B, Brahmapalli Road Bagmara, Mymensingh Sadar	Muktagacha Thana Kalibari & Kakinti Vill.	Leasing for the Target groups provides credit and arrange training for the largest members, 1 trained worker & 3 field workers problems identified Require training on scientific method of fish farming.
3	Naya Action Foundation Trisal, Mymensingh	Fish Culture, Credit Team, DANIDA	
12	CARITAS, Dhaka, Bangladesh 2,Outer Circular Road, Shantibagh, Dhaka	Dhaka District, Kulaura, Sirajdikhan, Tangail, Madhupur	Programme started in 1980. Programme includes pond leasing. Pond excavation for fish cultivation. Provides credit to target fish farmers. Provides technical assistance to groups undertaking fish fry production to fish growers, operates five hatcheries.
1	Samaj Progoti Sangstha Melandaha, Madarganj, Jamalpur	Madarganj Thana (5 unions)	Pond leasing for fish cultivation.
2	Unnayan Sangha Noyapara College Road, Jamalpur Sadar, Jamalpur		
7	Barongkola Sabuj Sangha Barongkola, Sadar Thana, Manikganj	Manikganj Sadar	Programme started in 1984, fingerling collection and nursing.
10	Terosree Bittoheen Samity Terosree, Ghoir Thana, Manikganj	Ghior Thana (1 union)	Programme started in 1984, fingerling collection and nursing.
10	BRF Torun Sangha Baniajuri, Ghior Thana, Manikganj	Baniajuri Ghior Thana	Pond leasing for fish cultivation.
7	Somaj-O-Jati Gathan Shailan, Dhamrai Thana, Savar	Dhamrai	

b) **FAP 8A Greater Dhaka Protection Project:** Pre-feasibility study to prepare a Master Plan for flood control and storm water drainage for the Greater Dhaka Protection Project covering 860km^2.
[Active Area: PU 12 and Boundary Rivers]

c) **FAP 8B Dhaka Integrated Town Protection Project:** Pre-feasibility study of high priority works for immediate investment. The works are for the protection of 260km^2 of the Greater Dhaka area. This area is immediately bounded by the rivers Turag, Buriganga, Lakhya and Tongi khal.
[Active area: PU 12]

d) **FAP 20 Compartmentalisation Pilot Project:** Pilot project to develop and test methods of flood control and drainage in protected areas in order to provide criteria and guidelines for the planning, implementation and management of the FAP projects.
[Active area: Tangail PU 6]

3.3.2 Other Related FAP Activities

a) **FAP 1 Brahmaputra Right Embankment Strengthening:** Investigation of the Brahmaputra/Jamuna River to examine its morphology, behaviour and causes of embankment failure and to design remedial measures to strengthen the embankment. Although this study lies just outside the North Central Region, any changes in the morphology and hydraulic conditions in the river which may result from this study may have a direct impact on the shared riverine fisheries.
[Active area: PU 1,2,4,6,10]

b) **FAP 12 FCDI Agricultural Review:** A review of the performance of existing FCD/I projects, especially their agricultural, economic, social and environmental impacts with the aim of providing guidelines on economic and social analysis for regional and feasibility studies. Two of the seventeen FCD/I projects selected for investigation lie within the NCR.
[Active area: PU 2 Katakhali khan, PU 6 Silimpur-Karatia Bridge and Regulator]

c) **FAP 17 Fisheries Study and Pilot Project:** A study and pilot project to assess the likely impacts of the Action Plan on floodplain fisheries and fishing communities, to identify ways of minimising negative impacts, of developing fisheries resources and to produce guidelines for planning Action Plan projects.
[Active area:selection of study areas within the NCR has yet to be finalised but FAP 20, Tangail (PU 6) already selected.]

3.4 Other Relevant Activities

In addition to the activities undertaken under the FAP,there are several other programmes ongoing in the NCR which may have significant impact on aquatic resources and the fisheries they support. Most of these have been documented previously in the Interim Report (NCRS 1991) and therefore need not be repeated here. However, mention should be made in particular of the Jamuna Multipurpose Bridge which could result in serious adverse consequences for the fish resources and fishing communities of Tangail district.

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Jamuna Multipurpose Bridge

The project involves a proposal to construct a bridge across the Jamuna river between Bhuapur and Serajganj to enhance the country's economy by increasing passenger and freight traffic, providing a power interconnector and, potentially, natural gas and telecommunication link between the northwestern and eastern part of Bangladesh. Construction works may necessitate closure of the northern intake of the Dhaleswari river. Clearly, this proposal would have a devastating impact on the local river and floodplain fisheries. Environmental impact assessments have already been undertaken to examine the effect of this project on the fisheries and environment in general. However, a report on these studies is not yet available.

[Active area: PU 4 and 6]

CHAPTER 4
WATER RESOURCES OF THE NORTH CENTRAL REGION

4.1. The River System

The NCR is bounded by two of the three most important rivers in Bangladesh: the Jamuna to the west and the Padma to the south. The smaller system of the Old Brahmaputra river forms the northern and north eastern boundary. The river is joined by several other secondary rivers draining Mymensingh district to form the eastern boundary along the Lakhya river which discharges into the Meghna system just south of Dhaka (Figure III-1.1). A prominent feature of the region is a central area of relatively higher ground, known as the Madhupur Tract, which divides major river catchments to the east and west. The rivers generally drain in a south or south easterly direction towards Dhaka beyond which they eventually discharge into the river Meghna.

4.2 Flooding

With the onset of the monsoon, the rising waters of the Jamuna and Padma rivers spill over into secondary rivers and on to the floodplain. At about the same time localised rainfall flooding occurs which, together with river floodwaters, form a number of floodplain systems consisting of a network of small rivers, flooded depressions (beels), canals (khals), ditches and paddies. The distribution and number of the various types of water bodies are determined not only by natural variations in hydrological, geomorphological and climatic characteristics of the region but also by human activities and interventions. These include the construction of embankments to provide flood protection, road and rail links, and the development of agriculture, in particular rice cultivation.

A notable feature of the freshwaters of the region is their extremely dynamic nature, a factor which renders their assessment and management so challenging. Temporal and spatial variations in water quantities, areal distributions, depths, velocities and retention times constitute the basic physical environment which, together with an equally wide array of complex and variable chemical and biological inter-relationships, form an integrated system to which fish populations have become inextricably linked and adapted.

For planning purposes the NCR was originally divided (NCRS 1990) into four major zones based on differences in the origin and severity of flooding (Figure III-4.1). Zone "A" is characterised by flooding mainly from Jamuna and Padma rivers; zone "B" is influenced by flooding from both the main rivers and local rainfall; zone "C" is influenced by regional rivers and local rainfall; and zone "D" is characterised by relative freedom from flooding. Heavy flooding in the western and south western areas is determined largely by the Jamuna and Padma rivers. Regional rivers in these areas are mostly distributaries, the flows of which although considerable during the monsoon are greatly reduced in the dry season.

A generalised pattern of spatial variation in flood depths within the NCR is shown in Figure III-4.2. This figure should be regarded as indicative only, since there are numerous localised variations superimposed on the overall pattern.

Figure : III.4.1

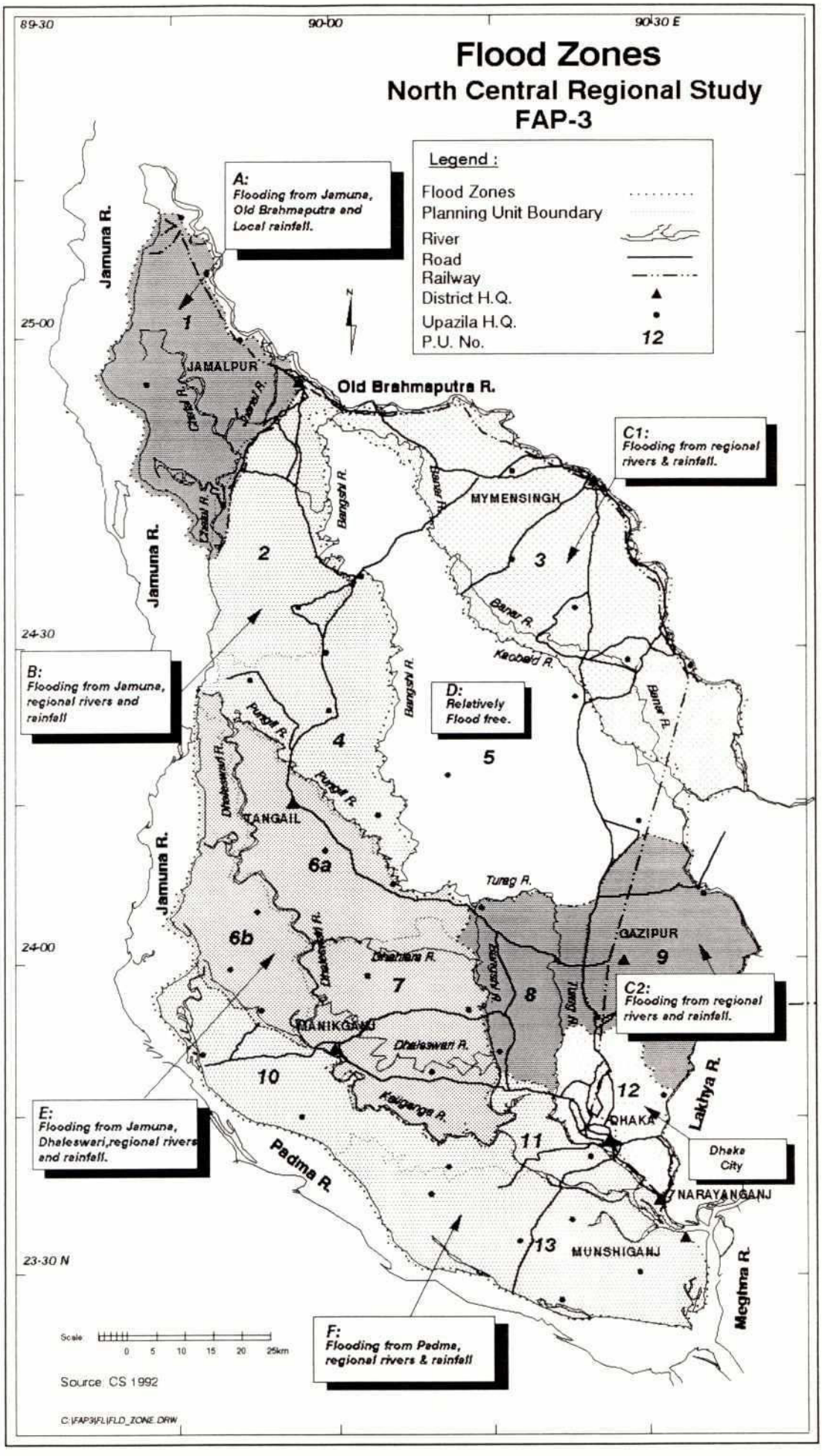
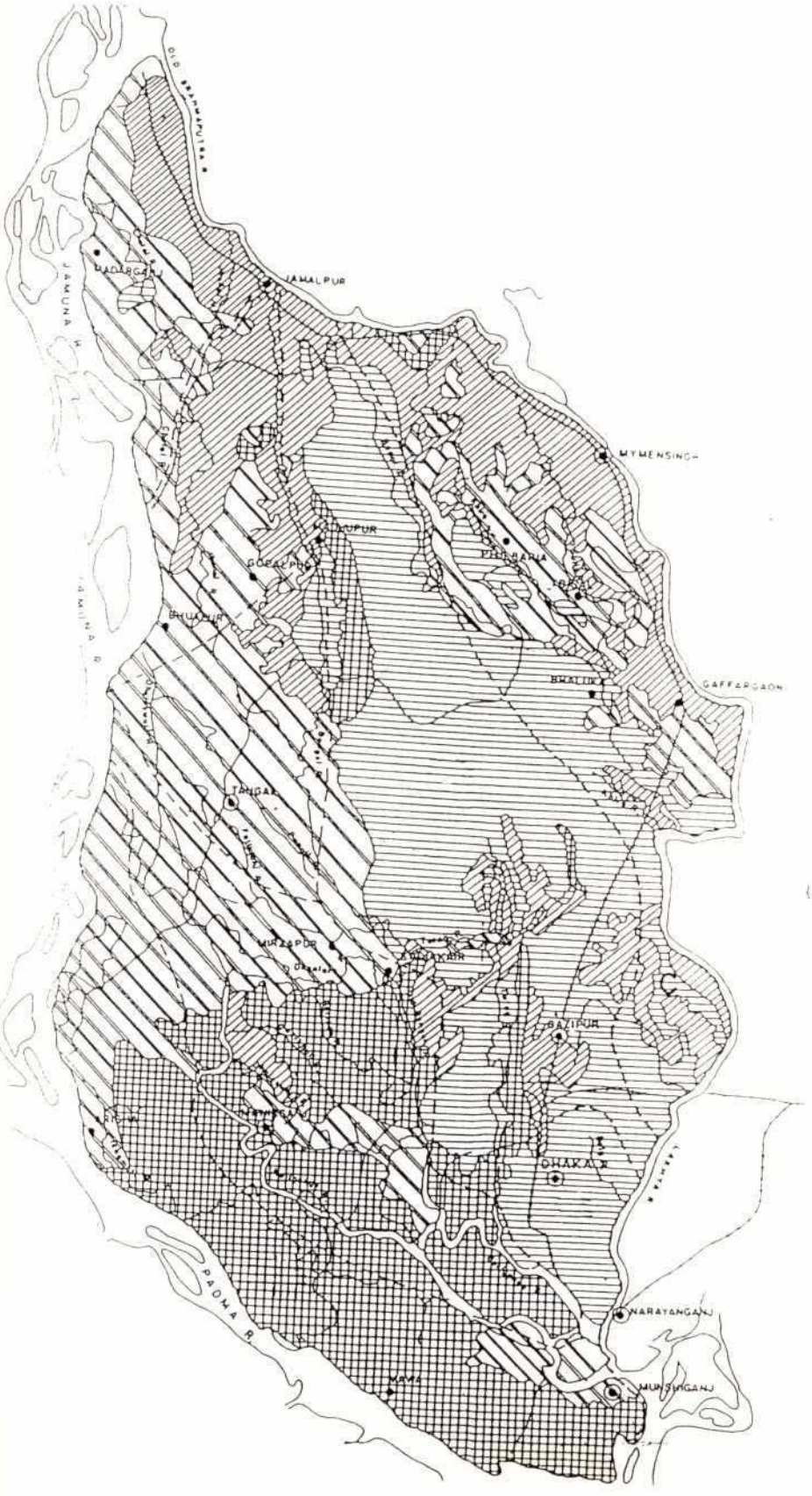
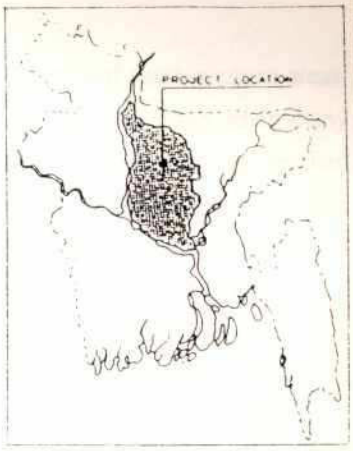


Figure III.4.2

Regional Distribution of Dominant Flood Phases





Location Map

N

Flood Phases

FLOODING

F0 < 30 cm

F1 31 - 90 cm

F2 91 - 180 cm

F3 180 - 270 cm

(characteristic flooding depths)

District Headquarters

Upazila Headquarters

Source: Master Plan Organisation

4.3 Changing Patterns

Siltation of river beds has been reported as a major problem by fishermen of the western and south-western areas, leading to a loss of fish habitat and an increase in vulnerability to overfishing during very low flows when many rivers are reduced to isolated pools. In the Old Brahmaputra river, siltation at the mouth of the river has also resulted in very low dry season flows. Similarly on the main Padma river the construction of the Farakka Barrage in India has resulted in low dry season flows downstream, which have been blamed for a reduction in fish catches by local fishermen in the North Central Region.

Rivers such as the Bangshi and Banar draining the Madhupur Tract are subject to flash floods and high suspended sediment loads caused by excessive rainfall during the monsoon. Flooding of these and similar, largely rain-feed, rivers is generally caused by lack of conveyance capacity or impeded drainage caused by infrastructural development.

4.4 Aquatic Habitats

The areas of different types of aquatic habitats found in the NCR have been estimated (see Table 4.1).

TABLE 4.1

Estimated Areas (km^2) of Different Aquatic Habitats in the NCR

Habitat	NCR		Bangladesh Area (Km^2)	NCR area as % of Bangladesh
	Areas (km^2)	Length (km)		
Rivers				
Principal	277	302	2172	13%
Others	215	1817	2626	8%
Beels	116	--	1142	10%
Floodplain	5927	--	28328	21%
Ponds	89	--	1469	6%

Source:
1. Area of principal rivers (Jamuna and Padma) obtained from DOF, 1986; Area of other major rivers in the NCR assuming ratio of 11.85 ha/km of river the 700 major rivers of Bangladesh, with a reported length of 22, 155km (BBS 1990), covering a dry season area of 2626km^2 (DOF 1986).
2. Lengths of other rivers estimated by NCR hydrological section (see Annexes 6 and 7).
3. Beel area estimated from LGEB data (see Annexes 8, 9, 10.
4. Floodplain area based on the total area of land in the category F_1-F_3 (see Annex 11 for further details).
5. Pond area derived from Department of Fisheries, Fisheries Information Bulletin Vol. 3 No. 1, 1986 (see Annex 12 and 13 for further details).

The total area of beels within the NCR was estimated from data collected almost 10 years ago using methods which apparently have not been documented (Annexes 8,9,10). As mentioned previously (Chapter 2), more accurate and up-to-date quantitative information on the distribution, number and areas of beels within the NCR could not be located during the present study. In view of the importance of perennial beels, not only as sites of commercial fisheries but also as natural reservoirs of many floodplain fish species during the dry season, high priority should be placed on the instigation of a survey to determine their distribution, number and size within the NCR. The survey must also include the more numerous seasonal beels which are invariably the first to disappear under FCD/I projects.

Despite the existence of remote sensing systems, which are capable of monitoring inter-annual and seasonal changes in the extent of floodwaters in Bangladesh, this type of information is not yet available for the North Central Region. In the absence of such data, an approximate estimate of floodplain area in the NCR shown in Table 4.1 was based on the classification system of cultivated land used by the Soil Resources Department Unit and MPO as follows:

F_0 = Highland with no inundation or inundation less than 30 cm.
F_1 = Medium highland, shallowly inundated from 30 - 90 cm.
F_2 = Medium lowland, inundated from 90 - 180 cm.
F_3 = Lowland, flooded from 180 - 360 cm.

The area of land lying within the range F_1 to F_3, i.e. flooding to greater than 30cm in a normal year, was used as a measure of flood plain area which can be considered useful for the purpose of fish production within the NCR. The disadvantage of this system is that it is based primarily on patterns of crop suitability and not on empirical determination of water depth across the floodplain. The percentage areas of land in each of the above categories are presented for each Planning Unit in Annex 11. The estimates were based on F_1 - F_3 categories in each thana, which were then converted to individual PUs on the basis of the proportional areas of thanas within each PU.

The estimated total area of ponds in the NCR was based on thana data (Annex 12) which were converted to PUs (Annex 13) using the methods outlined in Chapter 2. The estimate in Table 4.1 refers to ponds of all types, i.e. cultured, culturable and derelict.

CHAPTER 5
REGIONAL FISHERIES

5.1 Background

5.1.1 Capture Fisheries

Very little effort has been focused on capture fisheries research in Bangladesh, especially on systematic, long-term and large-scale research programmes. These are required to generate accurate and detailed background information upon which rational fisheries development and management policies can be based. It is not surprising therefore, given this lack of information, that the general biology, movement, population dynamics and current status of even the most commercially important fish stocks are still poorly understood. Today, in the face of considerable modification to natural river flow regimes by various artificial flood control interventions, there is increasing awareness of the urgent need for a greater understanding of aquatic ecosystems and of the fish resources which they support.

Some 260 species of indigenous fish and several species of indigenous prawn inhabit the different components of inland freshwater and brackish waters of Bangladesh (Rahman 1989). Together, these species provide an invaluable human food resource which is self-sustaining as long as the natural ecological regime is not disrupted, and as long as the populations are not fished beyond their biological limit. The life cycles of most species, including their migrations, breeding, feeding and growth are inextricably linked with the sequence of annual flooding. The monsoon floods interconnect the various components of the aquatic system (the rivers, tributaries, beels, canals, ditches and floodlands) to produce an integrated biological production system at the time of fish and prawn breeding increasing both the number and biomass. Within this system, the inundated floodplain plays a particularly significant role in providing nutrient and food-rich nursery/feeding grounds for the hatchlings, fry and juveniles of fish and prawn species. These breed not only on the floodplains themselves but also in the rivers and estuaries.

The situation on the Padma and Jamuna rivers appears typical of other floodplain river systems. As the floodwaters rise and water levels, discharge rates and water velocities increase,many species of fish are stimulated to commence an upstream longitudinal migration which is invariably associated with spawning. As the floodwaters spill over the floodplain, most fish conduct lateral migrations into these areas, not only to spawn but to take advantage of the abundant food supply. Since this period in the life cycle is characteristically one of rapid growth for most species, the general productivity of the floodplain can be correlated with seasonally inundated area (Welcomme 1977 & 1979). The nutrient richness of floodplain areas can usually be attributed to the vast quantities of decaying terrestrial vegetation, drowned terrestrial insects and nutrients, both particulate and dissolved, transported by the floodwaters themselves. The increase in nutrient levels in turn stimulates rapid and substantial increases in phytoplankton and zooplankton populations which provide young fish and fry with an abundant food supply.

As the floodwaters recede fish migrate off the floodplain, usually adults first, followed by enormous numbers of juveniles. The timing of the flood recession varies spatially in the NCR, but normally it occurs between October and December. At this time, fish concentrate in channels and tributaries leading back to the main river and thus become extremely vulnerable to fishing activities, which intensify considerably. As the floodwaters continue to retreat, isolated beels remain on the floodplain, some of which eventually dry up completely while others remain as permanent reservoirs of fish populations until the arrival of floodwaters the following monsoon. Once the floodwaters have receded completely, under natural conditions most adult and juvenile fish would have returned to the main rivers. However, a proportion of the population often becomes accidentally trapped in isolated shallow waters destined to dry up, while a limited number of species are adapted to survive in the bottom muds of these seasonal water bodies. Most migratory species trapped under these conditions are destined to be eliminated by fishing, natural predation or desiccation. In Bangladesh (including the NCR), because of the high human population, it seems likely that most fish in this situation succumb to fishing pressure. This is not necessarily damaging to floodplain fish stocks since under natural conditions these fish, principally juveniles, would other wise have been taken by predators including fish, birds and mammals. In contrast, fisheries based on spawning migrations of adults can be very damaging.

A classic example is provided by the case of *Labeo altivelis* from central and southern Africa. From Lake Mweru (Zambia/Zaire) this fish undertook an annual spawning migration up the main feeder river, the Luapula. In the 1940's this fish accounted for the bulk of the commercial catch from the lake and river. However, with the advent of modern nylon gill nets, drift netting along the lower reaches of the Luapula eliminated this important fishery within the space of five years and since then the stock has shown no sign of recovery (Scullion 1985).

In Bangladesh there is one species of fish of great commercial importance, whose behaviour does not conform to the general pattern described above. This is the anadromous clupeid, *Hilsa ilisha*, which migrates from the Bay of Bengal into many upstream rivers to breed (Pillay 1963). Spawning takes place in river channels and the eggs drift down to the estuary to complete development in the sea. There is some evidence that in India *Hilsa* may exist in two populations, one which is more inclined to migrate and the other more sedimentary and more likely to remain in estuaries (Pillay 1963). This may make *Hilsa* more resilient to the potential disturbance of freshwater riverine areas by flood control processes. However, *Hilsa* stocks have been depleted in India due to upstream impoundments, river flow regulation and increased siltation due to upstream erosion (Welcomme 1979). There is recent evidence that in Bangladesh *Hilsa* stocks are overfished in the lower Padma and Meghna rivers (BCAS 1989).

Other groups of fish of commercial importance are the major carps which comprise three cyprinid species, catla *Catla catla*, rui *Labeo rohita* and mrigal *Cirrhinus mrigala*. These species apparently share the same spawning grounds, nursery grounds for larvae and fry; and feeding grounds for juveniles and adults. Although there are numerous important carp fry collection centres along the Jamuna and Padma rivers, it is believed that spawning occurs in distant upstream locations outside Bangladesh in the Letha Range and Assam Hills, bordering the Brahmaputra river, and in the vicinity of the Farakka barrage on the Ganges of India (Tsai 1985 & 1986). It has been reported that spawning may occur in the Old Brahmaputra near Mymensingh but this has yet to be confirmed (Azadi 1985). Throughout India major carps migrate only locally, with little upstream movement and mainly laterally on to the floodplain (Jhingham 1968, Khan 1975). Between May and July, drifting carp fry are swept downstream and on to the floodplain of the NCR where they grow to maturity for about two years, before returning to the Jamuna/Brahmaputra river to spawn.

Another species believed to undertake extensive longitudinal spawning migrations is the anadromous riverine catfish, *Pangasius pangasius*. It has been reported that this species spawns in mid-channel areas of the Jamuna river in shallow waters around muddy islands (David 1963). The eggs and fry are then swept rapidly downstream towards the sea on strong mid-water currents. Several other species, commonly found in the catches of the NCR, are reported to move laterally on to floodplains without undertaking extensive longitudinal migrations. These include the catfish, *Clarias batrachus*, and *Heteropneustes fossilis*, snakeheads, *Channa* spp. and the climbing perch, *Anabas testudineus* (Welcomme 1985). These are fish which habitually remain in permanent water bodies such as beels throughout the dry season and are adapted to prevailing low dissolved oxygen levels by the development of a variety of ancillary air-breathing organs. A few species, e.g. *Channa* spp. (snakeheads), are able to withstand complete drying out by burrowing into the bottom muds during the dry season.

5.1.2 Culture Fisheries

The division between capture and culture fisheries is not well defined in Bangladesh. Rather, there is a gradation from totally unmanaged open water capture fisheries, through those where open water fish populations (major carp) are enhanced by the stocking of fingerlings by DOF, to closed water systems comprising properly constructed ponds, which are deliberately stocked and managed for fish culture. The most valued fish in demand for culture are the major carps. However, because of the relatively long periods needed for adequate growth, faster growing exotic species such as chinese carps have become increasingly popular. The latter are not particularly favoured fish for consumption but their fast growth and high yields available through polyculture have made them an attractive proposition (Bennett 1991). A typical polyculture system is based on silver carp, common carp and at least two of the major carps, mrigal and rui. Another major carp, catla, is also a highly favoured table fish but it is less good for pond stocking, as the fingerlings are expensive and the fish are traditionally grown for a two year period.

A major proportion of carp fry used to supply fish farmers of the region comes from natural sources. Important carp spawn/fry collection centres occur along the Padma and Jamuna rivers and also along secondary systems of the Old Brahmaputra and Dhaleswari (Tsai 1985). In recent years, however, the private sector has made much progress in establishing a number of successful carp fry hatcheries in the region in addition to those managed by the DOF in Mymensingh and Dhaka.

5.2 Fishing Methods

The considerable number of fish species inhabiting a wide range of aquatic habitats in the rivers and floodplains of Bangladesh has led to the development by local fishermen of a diverse array of fishing gears and methods with which to exploit these fish stocks. Only one detailed account of gears used in Bangladesh was located during the present study (Ahmed 1956). This account described 116 different nets, 26 traps and an assortment of spears, etc.

Although the number of gears is large, differences between them are often minor, sometimes merely in terms of mesh size or in the arrangement of floats and sinkers on head and bottom lines. The composition of gears employed varies seasonally, depending on the flow regime, and also spatially between districts and aquatic habitats. Local names of gears also vary between districts and one gear may have several different names. Some gears are designed to capture one particular species of fish, e.g. chandijal (drift net) for *Hilsa*, while others are less discriminate and capture fish of all kinds and sizes, e.g. small-meshed seines. Gears also vary considerably in terms of size and cost, ranging from

very large drift and seine nets normally operated by terms of professional fishermen on main rivers to small gear such as cast nets, push nets, hooks and lines used by individual subsistence or part-time fishermen.

A list of some of the most common gears used in the North Central Region is given in Table 5.1. The list is based on field observations (CS, August 1991) and on previous reports on riverine fisheries in the region (BCAS 1989). The list is by no means exhaustive but does provide an indication of the high diversity of fishing methods used in the study area.

On the Jamuna and Padma rivers gill nets predominate, especially surface-set drift nets (chandi and dora jal) which target *Hilsa*. This nets are set using planked wooden boats such as chandi nauka and kosha nauka. Gill nets, such as pice/pine jal are set in deeper, slower flowing areas of rivers, where they target major carps and the catfish, pangash.

Clap nets are very common near the confluence of the Jamuna and Padma, just south of Aricha. These nets are used to catch *Hilsa* by day and night from smaller, often sail-powered, wooden craft known as kosha nauka. Seine nets of various lengths and mesh sizes are used on the rivers; large seines such as gulti capture mainly *Hilsa* while smaller seines, e.g. shateen ber, catch small miscellaneous fish species and shrimps.

Stationary gears are also used on main rivers, usually during low flows of the dry season. These gears include kathas (brush shelters) fixed to the river bed in pools where they attract carps, catfish (aor, tengra) and some species of shrimp which are captured using seine nets (BCAS 1989). Fixed engines (gara jal) are also common the Padma. They consist of joined sections of gill nets, ranging in mesh size from 5mm to 100mm, some stretched from bank to bank completely blocking the channel although temporary gaps are made to allow passage of vessels. These nets are illegal since they indiscriminately catch fish of all types and size, including both adults and juveniles. Despite a legal ban they are still widely used.

TABLE 5.1

Fishing Gears used in Different Habitats in the NCR

Gear		Habit		
		River	Beel	Floodplain
Gill nets:				
Chandijal	(drift net)	*		
Dora jal	(drift net)	*		
Lengta		*		
Pice/Pine jal		*		
Ragini jal		*		
Current jal		*	*	*
Chatka jal		*	*	*
Koi jal			*	*
Seine/drag nets:				
Mosharee ber		*	*	*
Dasom ber		*		
Moi jal		*	*	*
Ber jal		*	*	*
Gulti jal		*		
Kona ber		*	*	
Shateen ber		*		
Clap net:				
Kharki jal		*		
Shanglijal		*		
Cast nets:	Jhaki jal		*	*
Push nets:	Bhael jal			*
Lift nets:	Veshal	*	*	*
Katha:	Dal jal	*	*	*
Fixed engine:	Gara jal	*		
Barricades:	Gara	*		*
Hook & line:	Barsi	*	*	*
Longline		*		
Baskets	Various types		*	*
Spears				*

Note : * denotes gear used

Source : Ahmed 1956; BCAS 1989; CS 1992.

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Fishing methods employed in beels and other areas of the floodplain are characterised by the use of small-scale gears such as cast nets, push nets, basket traps, hooks and line, and spears. However, some of the larger, more expensive gears are found such as seine/drag nets (ber jal, moi jal) and lift nets used in canals,large ditches and beels. Most nets used on the floodplain are of very small mesh size (2-15mm) and are capable of capturing the smallest species and juveniles of larger species. The distributions of different types of gears on the floodplain are determined principally by the nature of the habitat - whether vegetated or open water and by water depth. Small individually operated gears such as push nets, cast nets, spears and hooks and lines are generally used in shallow waters of paddies or from the banks of ditches, ponds and beels. Cast nets, drag nets (moi jal) and hooks and lines are also operated from small (3-7m) dugout canoes called donga. In deeper open waters, large seines and fixed gill nets predominate. The widespread use of the illegal, small meshed monofilament gill net, known locally as current jal, is reported to cause damage to stocks by the indiscriminate capture of juvenile fish (BCAS 1989, Ali 1991).

5.3 Socio-economic Aspects

5.3.1 Capture Fisheries

A distinction is usually drawn between professional full-time fishermen and those who operate on a part-time subsistence basis. Given the broad spectrum of fishing activities, this division is rather arbitrary but is retained in the present discussion for the sake of convenience. Formerly, professional fishermen were low caste Hindu and full-time fishing was regarded (and is still today) as a very low status occupation. In recent years, many landless unemployed Muslims have been forced to set aside traditional inhibitions and have taken up full-time fishing. Despite this change in the social structure of professional fishing communities, today they still remain one of the poorest groups in rural Bangladesh, seldom owning much land or household assets (BCAS 1989).

Professional fishing is invariably carried out only by men or boys; women do not usually participate in fishing operations but they do play an important role in other fisheries-related activities such as the construction and repair of nets. In contrast, part-time subsistence fishing is carried out by men, women and children. It is a near-universal activity in the rural life of Bangladesh, undertaken by Hindu and Muslim households alike.

Subsistence fishing is carried out in seasonally flooded areas of open access; these include ditches, small canals, tributaries and flooded paddies. The catch mainly consists of a variety of small, miscellaneous species of low commercial value. Despite the low commercial value, a considerable proportion of the rural population depends on this fishery for much of its dietary intake of animal protein. This group of miscellaneous fish species therefore represents a key resource of the rural poor.

Jalmahals

Professional fishing is usually carried out in officially demarcated fisheries known as jalmahals. All large public water bodies, including rivers, beels, haors and baors, are owned by the government through its Ministry of Land and are divided into separate jalmahals which are leased through an auction system to generate government revenue. In Bangladesh there are about 10,000 jalmahals, of which about 440 are found in the North Central Region. In the case of a riverine or seasonal beel fishery, the term of the lease is for one year only whereas permanent beels may be leased for a term of three years. The lease holders (ijaradar) are normally rich and influential people in the local rural communities. Once the lease has been issued, the holder takes full control of the fishery and treats it as his private

property. In order to maximise income and profit, the lease holder may sub-lease to others or charge rent prescribed by him to as many fishermen as possible, who in turn harvest as much fish as possible within the given period of the lease. The principle aim of all concerned in this system is one of short-term income generation without regard for the long-term effects on fish resources. It is therefore not surprising that problems of overfishing and the use of damaging or illegal fishing methods are widely reported in many jalmahals (Ali 1991). In order to improve the management of open-water capture fisheries, the Ministry of Fisheries and Livestock (MOFL) initiated a New Fisheries Management Policy (NFMP) from 1986-87. Under the new system, the management of jalmahals is gradually being transferred from the Ministry of Land to MOFL. So far about 300 jalmahals have been handed over to the Department of Fisheries.

Although following a full-time occupation, professional fisherman can suffer seasonal under-employment. Therefore, most try to retain a degree of flexibility in the choice of fishing grounds exploited at different times of the year and in the selection of fishing gears needed on these different waters. Those fishermen owning seine or drag nets can also supplement their income by hiring out their services to fish farmers for the harvesting of fish ponds.

5.3.2 Culture Fisheries

In general, professional fishermen in Bangladesh are neither involved in nor interested in aquaculture, which they regard as an agricultural pursuit. Most aquaculture in the NCR is carried out on a small-scale, in ponds of only a few hundred square metres in area which are usually located close to village households. Very simple, low-cost technologies are employed in the management of these ponds with many remaining totally unmanaged, receiving no stocking other than that provided naturally during floods. There are very few large-scale commercial fish farms in the NCR. Further details of the constraints and potential for aquaculture development in the region are discussed later in this report (Chapter 6).

5.4 Marketing

5.4.1 Fish Markets

Traditional fish marketing systems have evolved over the centuries in Bangladesh. In contrast to actual fishing activities which have in the past been carried out by Hindus, fish trading has generally been undertaken by Muslims. Mobile fish assemblers, known locally as mohajans, visit fishermen on their fishing grounds to collect fish. The mohajans often provides credit facilities early in the season on condition that fishermen deliver their catch to him. Mohajans occasionally engage local agents (dadals) on a commission basis for the collection and purchase of fish from fishermen. In the case of river fisheries, mohajans also carry ice to the fishing grounds to preserve the fish they purchase.

Mohajans transport fish to nearby markets and sell the catch to local retailers (nikaries), wholesalers (paikers) and distributors (beparis) through commission agents known as aratdars. The aratdars sell fish by public auction to the highest bidder for which they receive a commission of between 3% to 6% of the sale value. Fish may then be transported by beparis to markets in other districts or thanas where it is sold again through aratdars to local retailers or wholesalers who may, in turn, transport their purchased fish to smaller rural markets for final sale to consumers.

There are many variations of the general pattern of marketing described above. In many cases the number of links in the system are reduced in some way. For example, fishermen may personally transport their catch to local markets, thus bypassing fish traders operating on the fishing grounds. However, fishermen will only do this if it is cost effective, when catches or market prices are high. Normally, fishermen prefer to sell on site so that more time can be spent fishing or preparing for fishing. Quite often paikers (wholesalers) also act as assemblers on fishing grounds. On the fisheries of the Padma and Jamuna rivers, fish assemblers generally operate from their own boats, both day and night, to purchase fish from several different fishing units.

In the North Central Region, fish are sold in the markets of most thana towns (NCRS 1990). More important retail and wholesale fish markets occur in all district headquarter towns, from where fish are either sent to secondary markets of smaller towns and to the larger markets of Dhaka, or sold directly to consumers. Little information was obtained in this study on the quantities of fish distributed through the regional marketing system. However the results of a more detailed, longer-term study (BCAS 1989) revealed that of the total amount of fish caught in the river Padma and assembled in the district fish market of Manikganj, a high proportion (80%) was transported for sale in Dhaka. This pattern is probably representative of the commercial fish catches passing through the urban district centres of the NCR. It seems likely, however, that a much lower proportion of the catch from the subsistence fisheries, comprising small miscellaneous species, is transported to Dhaka. More detailed marketing studies are required to clarify this situation in the NCR.

5.4.2 Fish Prices

Information on fish prices was collected by project personnel between June and July 1991, as part of a broader investigation directed mainly at the agricultural sector of the NCR. This information was supplemented by data collected during field visits related to a separate study in the region (FAP 17 Design Study Team, August 1991). Prices of fish vary depending on area, market, season, species and size. In general, higher prices are obtained for larger species such as major carps and catfish compared with small miscellaneous species (Table 5.4.1). Prices also decrease substantially during periods of high catches. This usually occurs at the end of the monsoon, when floodwaters recede and fishing activities increase in the remaining shallow waters of the floodplain.

TABLE 5.4.1

Average Fish Prices obtained by Fishermen in the NCR (June-August 1991)

Habitat	Main Species Group	Price	
		Average (Tk/kg)	Range (Tk/kg)
River	Hilsa, catfish	40	25-65
Beel	Carp,catfish and miscellaneous spp.	30	15-50
Floodplain	Miscellaneous spp.	25	15-40
Pond	Major & exotic carps	40	25-45

Source : CS 1991

5.5 Fish Resources-Capture Fisheries

5.5.1 Total catch

Annual fish catches from rivers, beels and floodplain have been estimated (see Chapter 2) separately from published data relating to the former districts of Dhaka, Jamalpur, Mymensingh and Tangail (Annex 14). For the most recent year in which published data were available (1988-89), estimates have been made of the catch from each type of aquatic habitat in the NCR and their relative contribution to the total inland fish catch from respective habitats nationwide (Table 5.5.1).

Data in Table 5.5.1 indicate that the fisheries of the North Central Region make a relatively small contribution to the total freshwater capture fisheries of Bangladesh. This is in contrast to the published catch statistics from the four former districts covering the NCR which suggest a considerably higher contribution (19% in 1988/89) to the national catch (Annex 14). The disparity can be explained by the fact that much of the catch from former districts originated from areas outside the NCR, to the north and east of the Old Brahmaputra and Lakhya rivers.

Within the NCR, estimates of annual catch were made for the period 1983 to 1989 for each type of aquatic habitat (Table 5.5.2). The data reveal that the greatest contribution to total annual catches was from floodplains (44-56%) followed by rivers (27-41%) then beels (15-17%). Beel catches are probably underestimated since data on the number and area of beels were lacking in several thanas of the NCR. Floodplain catches should also be regarded as minimal estimates, since population growth rate during the previous decade was not taken into account in the estimation method (see Chapter 2). Regarding riverine catches, there is some corroboration of catch estimates on the River Padma from an independent study carried out by BCAS in 1988/89 (BCAS 1989). This study reported a total annual catch of 402 tonnes from the Padma-Jamuna jalmahal which covers about half the length of the Lower Padma compared with 902 tonnes reported by DOF for the same period for the whole of the Lower Padma in Dhaka District. Thus, in terms of catch per unit length of river, there is remarkably close agreement between the two estimates.

TABLE 5.5.1

Annual Catch from Different Aquatic Habitats in the NCR (1988-1989)

Habitat	NCR (tonnes)	Total Bangladesh (tonnes)	% of Total in Bangladesh (%)
River[1] :			
Principal	2599	75,428	3.4
Others	4623	105,712	4.4
Total	7222	181,140	4.0
Beel	4501	47,019	9.6
Floodplain	14866	186,126	8.0
Total	**26580**	**414,285**	**6.4**

Note 1 : Principal and other rivers as defined by DOF: Principal = Jamuna and Padma in the NCR

Source : DOF 1988-89

TABLE 5.5.2

Annual Variation in Fish Catch (tonnes) (1983-1989)

Habitat	Year											
	1983-84		1984-85		1985-86		1986-87		1987-88		1988-89	
	(tonnes)	%	(tonnes)	%	(tonnes)	%	(tonnes)	%	(tonnes)	%	(tonnes)	%
River[1]:-Principal	4285	14	2730	9	2887	11	3553	12	2431	9	2559	10
Others	5822	19	8868	29	6392	25	8149	29	7411	27	4623	17
Total	**10107**	**34**	**11598**	**38**	**9279**	**36**	**11702**	**41**	**9842**	**36**	**7222**	**27**
Beel	5221	17	4522	15	4435	17	4321	15	4160	15	4501	17
Floodplain	14876	49	14390	47	12036	47	12520	44	13453	49	14866	56
Total	**30204**		**30510**		**25750**		**28543**		**27455**		**26589**	

Note : 1. Principal and other rivers as defined by DOF: Principal = Jamuna nd Padma rivers.

2. See Annex III.14 for more details

Source: DOF 1983-84

Although the time series of available catch data is relatively short, several general trends are apparent (Figure III.5.1). The total yield from the capture fisheries decreased by 12% between 1983 and 1989. The greatest reduction in catch (39%) was recorded in the Jamuna and Padma rivers whilst catches from secondary rivers fluctuated more widely showing no clear trend. A sharp decrease in catch from these smaller rivers was observed between 1987/88 and 1988/89 (Table 5.5.2) but this may have been related to the exceptionally high flows hindering fishing during 1988 rather than to a serious decline in fish abundance. Catch statistics for 1989/90, when available, will indicate whether this decrease is indeed a temporary fluctuation.

The catch from beels decreased by 14% between 1983 and 1989 but, surprisingly, floodplain catches increased from a minimum of about 12,000 tonnes recorded in 1985/88 to 14,900 tonnes in 1988/89 which equals the previous levels of 1983/84 (Figure III.5.1). This pattern is in contrast to the national trend which shows a progressive decline in floodplain catches of about 7% between 1983 and 1989 (Annex 14).

Average annual catch rates per household also declined nationally from 23kg to 17kg during the same period whereas in the Mymensingh and Tangail districts of the NCR catch rates apparently increased from 12kg to 15kg and 19kg respectively (Annex 15). These data should be treated with caution since fishermen from Tangail districts consistently reported a substantial reduction rather than an increase in floodplain catches over recent years.

5.5.2 Seasonal Variation in Fish Yields

Analyses of monthly catch statistics from rivers, beels and floodplains revealed marked seasonal changes which varied between habitats (Figure III.5.2 and Annexes 16,17):

- In the **principal rivers**, Jamuna and Padma, peak catches occurred during the dry season (Feb-April) when low flows permitted the use of a wider range of gears, especially large seine nets, and concentrated fish into progressively smaller areas in which they become increasingly vulnerable to fishing.

- A similar pattern is seen on the smaller, **secondary rivers** but here peak catches occurred earlier in the year (October-February) which coincided with the recession of floodwaters and the rapid emigration of both adult and juvenile fish from the floodplain.

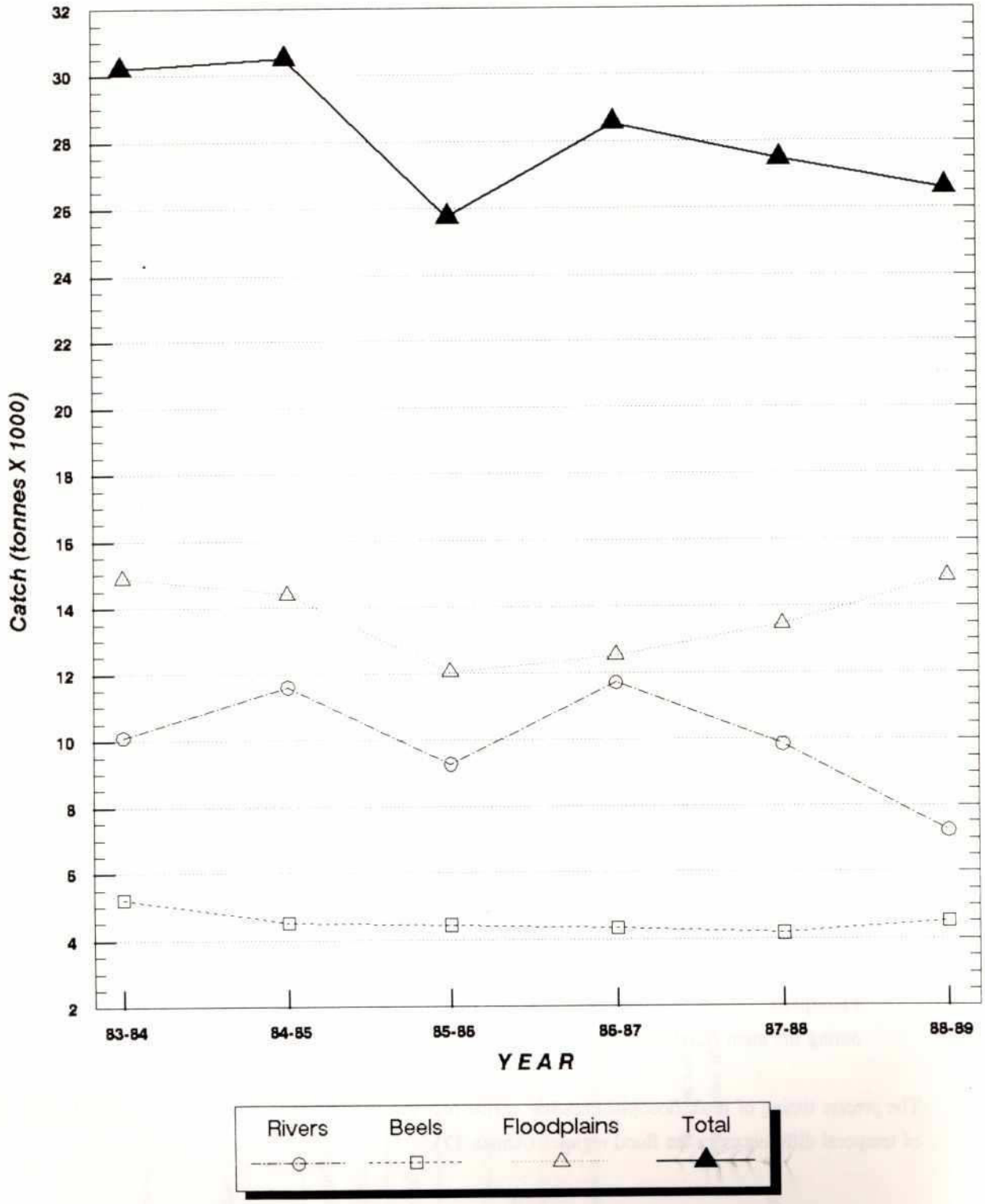
- Fishing activities on **permanent beels** intensified between November and April, when floodwaters had receded and fish were concentrated in the remaining areas of open water.

- **Floodplain** catches exhibited a minor peak in August and a major one between November and December during the main flood recession.

The precise timing of peak floodplain catches varied between districts and between years, probably as a result of temporal differences in the flood regimes (Annex 17).

Figure : III.5.1

Variation in Annual Fish Yields in NCR, 1983-89



Source : CS 1991

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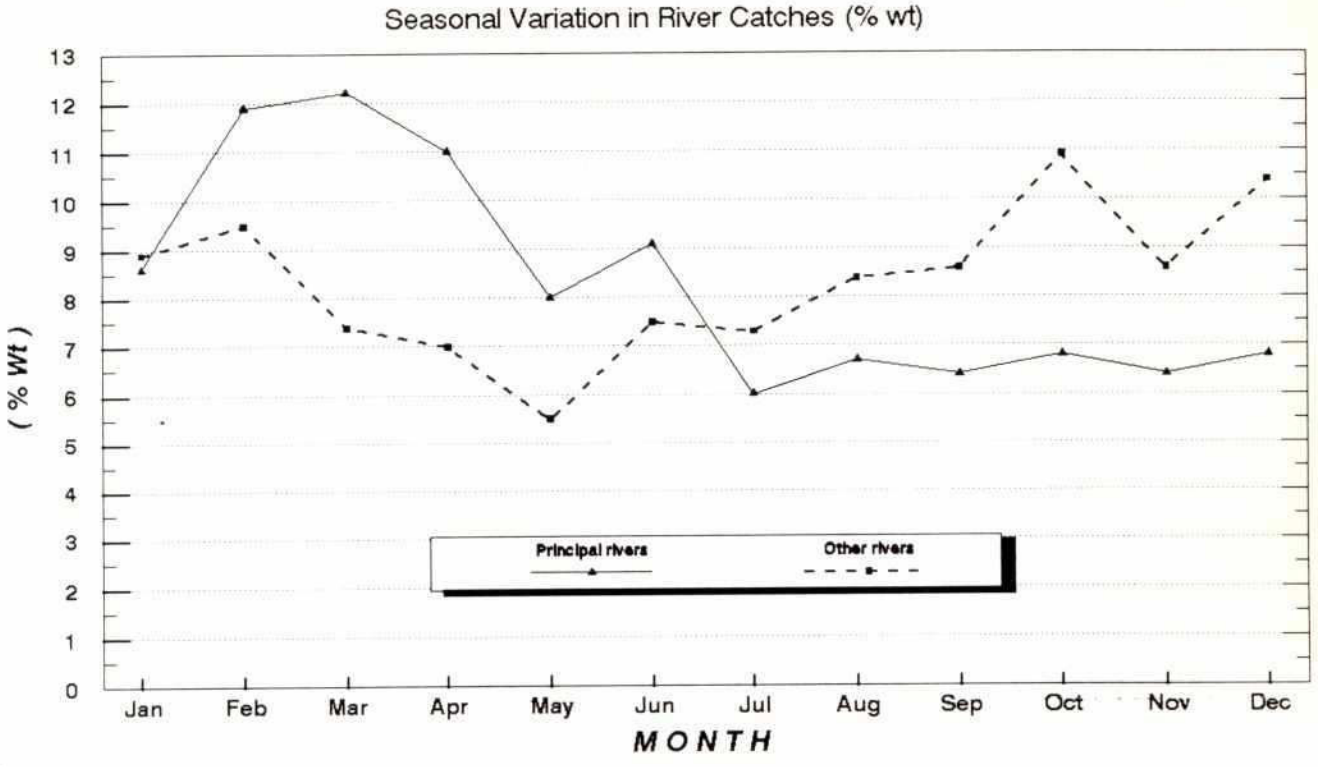
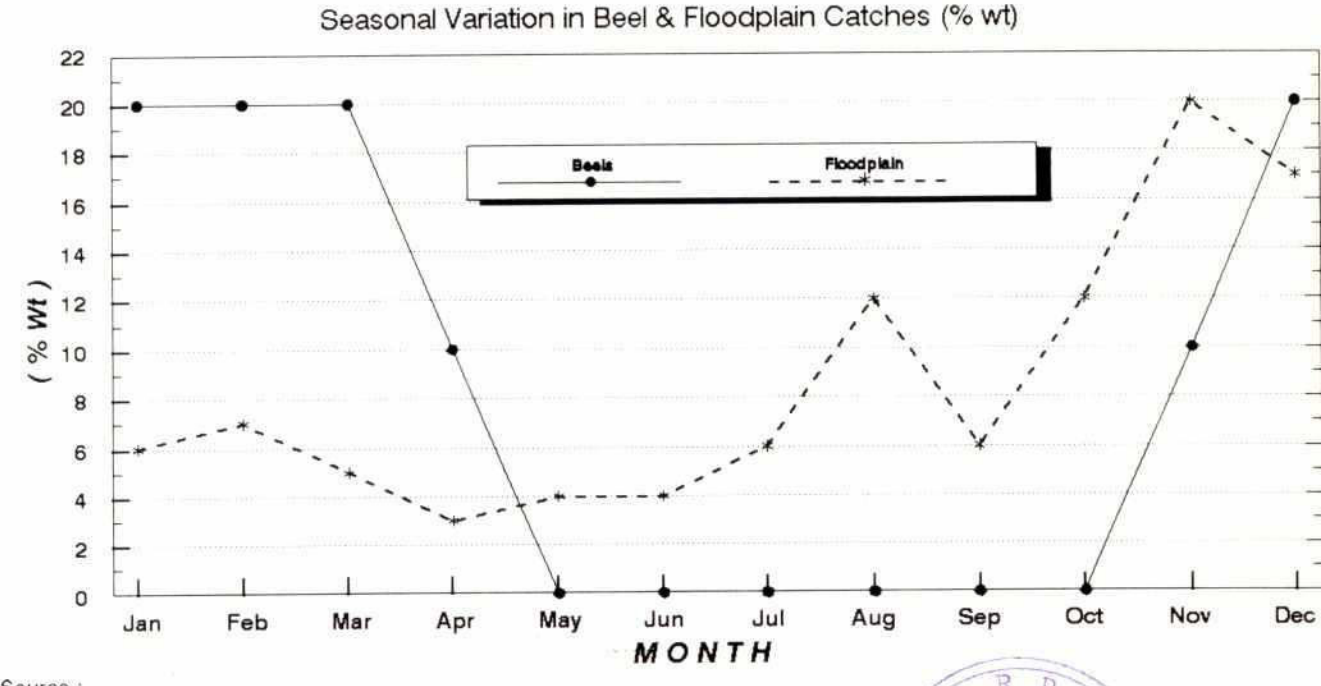
Figure : III.5.2

Seasonal Variation in Catches



Source :

Derived from Dept. of Fisheries Catch Statistics, 1987-89.



Source :

Derived from Dept. of Fisheries Catch Statistics.
As data : 1988-90 (Beels), 1987-89 (Floodplain).

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5.5.3 Catch Composition

With the exception of *Hilsa ilisha*, published statistics on individual species captured from rivers and floodplains are not available in Bangladesh. Instead, a classification system based on broad groups of different species or genera is used (Tables 5.5.3-5.5.5).

In general, catches from the **principal rivers** (Jamuna and Padma) were dominated by three groups of fish: miscellaneous (unidentified) species, *Hilsa ilisha*, and catfish comprising mainly *Wallago attu*, *Mystus* spp. and *Pangasius pangasius*. However, changes in catch composition which have been noted between 1983 and 1989 varied significantly between districts (Table 5.5.3). On the Jamuna river at Jamalpur, the proportional catch of miscellaneous species declined considerably over this period (82% to 20%) with a concomitant increase in the importance of carps and catfish. This is in contrast to lower reaches of the Jamuna, in Tangail and old Dhaka districts, where the catch of carps has declined considerably and which would appear to be part of a longer-term, widespread decrease in major carp populations of Bangladesh. The decline has been attributed to the widespread development of flood control and drainage schemes which have reduced the area of floodplain habitats and disrupted or prevented the movement of carp fry and adults between river and floodplain (Tsai 1985). The reasons for the apparent marked increase in the catch of carp in the Jamalpur area remain unclear and warrant further detailed study.

Hilsa catches increased considerably on the middle and upper reaches of the Jamuna river from 1985 onwards, attaining levels second only to the miscellaneous species group. On the River Padma, *Hilsa* appears to be even more abundant, comprising 50% to 71% of the total catch between 1983 and 1987. However, *Hilsa* catches decreased drastically in 1988/89 possibly because of the devastating floods which occurred that year. More recent catch statistics are needed to determine whether or not this decrease is temporary.

The catch from **secondary rivers** in the NCR is dominated by miscellaneous species (Table 5.5.4) which comprised 85-97% of the total catches throughout the region between 1986 and 1989. On the Old Brahmaputra river, carp catches declined markedly in Mymensingh district between 1983 and 1989, from 27% to 2%, and in Jamalpur district from 7% to 1% over the same period. Reduced dry season flows, increased siltation and increased vulnerability of carps to overfishing may all be factors involved in this decline in the fishery. Catfish stocks also appear to have suffered a similar decline on the Old Brahmaputra of Mymensingh district (Table 5.5.4).
Fisheries based on large shrimp, e.g. *Macrobrachium rosenbergii*, are insignificant throughout the NCR; however smaller shrimp species of lower commercial value have increased slightly in importance in old Dhaka district. Former commercial fisheries based on *Macrobrachium* have since declined without any apparent quantification or record.

On the **floodplains** of the NCR, miscellaneous fish species are included in the category "other inland fish" (Table 5.5.5). This group dominated the catch of subsistence fisheries in all districts during the period for which records are available (1985-89). Other groups of fish of notable importance in floodplain catches comprised catfish, snakeheads and "live fish", which include species such as *Anabas testudineus* (koi), *Heteropneustes fossilis* (singi) and Clarias batrachus (magur). All these groups are capable of remaining on the floodplain in permanent beels, ditches, canals, etc. without undergoing extensive migrations and therefore might be expected to be more resilient than migratory species such as carps to the adverse conditions imposed by FCD schemes. Despite this, catches of catfish, snakeheads and to a lesser extent live fish, have declined throughout the NCR, with the exception of

Mymensingh district. It therefore seems likely that these groups are suffering from the effects of overfishing and the use of harmful and illegal fishing methods. Small shrimp are relatively unimportant in flood plain catches apart from Dhaka district where they made up about 10 - 20% of the catch.

The only published statistics on the catch composition of **beels** refer to the former districts of Mymensingh and Sylhet (Table 5.5.6). The statistics are more detailed in terms of species identification than those relating to rivers and floodplains but, even so, between 48% and 63% of the total catch comprised unidentified fish. Of the remaining proportion of the catch, catfish such as *Wallago attu* (boal) and *Mystus aor* (air) predominated together with the smaller carp *Labeo calbasu*, small shrimp and certain small fish species such as chapila. Unpublished catch data from perennial beels in Tangail and Jamalpur districts within the NCR were examined to provide a more accurate appraisal of local fisheries in these areas (Table 5.5.7). In these districts, the proportional catch of major carps (rui, catla and mrigal) was higher (12-21%) than in the Sylhet-Mymensingh region (8%).

TABLE 5.5.3

Catch Composition by Weight (tonnes) of Principal Rivers - in each former district of the NCR

District	Major carp		Other carp		Cat fish		Live fish		Hilsa		Big shrimp		Small shrimp		Misc. fish		Total weight
	Wt.	%	Wt.	%	Wt.	%	Wt.	%	Wt.	%	Wt.	%	Wt.	%	Wt	%	Wt.
DHAKA																	
1983/84																	
Jamuna	96	11	0	0	91	10	0	0	64	7	2	<1	0	0	640	72	893
L.Padma	5	<1	1	<1	97	5	10	<1	1218	64	77	4	0	0	499	26	1907
1984/85																	
Jamuna	0	0	0	0	0	0	0	0	0	0	0	0	36	11	286	89	322
L.Padma	5	<1	1	<1	118	6	0	0	1429	68	69	3	0	0	481	23	2103
1985/86																	
Jamuna	12	1	38	4	150	15	0	0	13	1	0	0	25	3	740	76	978
L.Padma	25	3	2	<1	174	19	0	0	455	50	3	<1	6	<1	249	27	914
1986/87																	
Jamuna	4	1	3	<1	66	22	0	0	20	7	0	0	2	<1	211	69	306
L.Padma	1	<1	0	0	40	3	0	0	978	63	0	0	14	<1	513	33	1546
1987/88																	
Jamuna	0	0	2	<1	57	27	0	0	12	6	0	0	0	0	138	66	209
L.Padma	0	0	0	0	48	7	0	0	517	71	0	0	65	9	101	14	731
1988/89																	
Jamuna	0	0	0	0	37	21	0	0	6	3	0	0	0	0	130	75	173
L.Padma	0	0	0	0	65	7	0	0	142	16	5	<1	2	<1	688	76	902
JAMALPUR																	
(R.Jamuna)																	
1983/84	63	11	0	0	60	10	0	0	42	7	2	<1	0	0	422	72	589
1984/85	11	3	0	0	4	1	0	0	0	0	0	0	45	13	274	82	334
1985/86	35	4	118	15	120	15	0	0	255	32	0	0	21	3	239	30	788
1986/87	13	<1	143	9	138	9	0	0	678	43	0	0	108	7	487	31	1567
1987/88	74	6	188	14	204	16	0	0	391	30	0	0	83	6	376	29	1316
1988/89	107	7	298	21	271	19	0	0	385	27	0	0	83	6	286	20	1430
TANGAIL																	
(R.Jamuna)																	
1983/84	96	11	0	0	92	10	0	0	64	7	2	<1	0	0	642	72	896
1984/85	12	4	3	<1	14	5	0	0	0	0	0	0	13	4	263	86	305
1985/86	20	10	1	<1	8	4	0	0	3	1	7	3	9	4	159	77	207
1986/87	1	<1	1	<1	0	0	0	0	49	36	0	0	26	19	58	43	135
1987/88	5	3	0	0	0	0	0	0	54	31	0	0	19	11	97	55	175
1988/89	2	2	2	2	1	1	0	0	22	23	0	0	10	11	57	61	94

Source : Department of Fisheries Catch Statistics 1983–1989.

1987/88	5	3	0	0	0	0	0	0	22	23	0	0	10	11	57	61	94
1988/89	2	2	2	2	1	1	0	0									

Source : Department of Fisheries Catch Statistics 1983–1989.

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TABLE 5.5.4

Catch Composition by Weight (tonnes) of "Other" Rivers – in each former district of the NCR

District	Major carp		Other carp		Cat fish		Live fish		Hilsa		Big shrimp		Small shrimp		Misc. fish		Total weight
	Wt.	%	Wt.	%	Wt.	%	Wt.	%	Wt.	%	Wt.	%	Wt.	%	Wt.	%	Wt.
DHAKA																	
1983/84	3	<1	5	<1	1	<1	1	<1	0	0	0	0	298	5	5775	95	6083
1984/85	3	<1	6	<1	2	<1	2	<1	0	0	0	0	341	5	6599	95	6953
1985/86	343	6	142	2	311	5	4	<1	19	<1	25	<1	476	8	4753	78	6073
1986/87	150	2	72	<1	69	<1	0	0	48	<1	35	<1	328	4	7209	91	7911
1987/88	99	2	65	1	158	3	1	<1	12	<1	36	<1	468	8	5350	86	6189
1988/89	64	2	40	1	108	3	0	0	0	0	47	1	299	8	3083	85	3641
JAMALPUR																	
1983/84	14	3	20	4	2	<1	2	<1	0	0	1	<1	0	0	509	93	548
1984/85	33	3	45	4	5	<1	5	<1	0	0	2	<1	0	0	1149	93	1239
1985/86	0	0	6	1	8	2	1	<1	18	4	0	0	9	2	443	91	485
1986/87	0	0	3	<1	5	<1	0	0	21	3	0	0	16	2	758	94	803
1987/88	3	<1	8	1	23	3	0	0	4	<1	0	0	14	2	740	93	792
1988/89	4	<1	7	1	27	5	1	<1	7	1	0	0	9	2	478	90	533
MYMENSINGH																	
1983/84	1333	19	590	8	975	14	261	4	203	3	1	<1	0	0	3782	53	7145
1984/85	2976	19	1321	8	2164	14	589	4	445	3	1	<1	0	0	8420	53	15916
1985/86	172	2	433	5	670	7	1	<1	299	3	0	0	573	6	6830	76	8978
1986/87	126	1	344	4	576	6	26	<1	31	<1	11	<1	240	2	8442	86	9796
1987/88	100	<1	309	3	433	4	0	0	2	<1	11	<1	215	2	11062	91	12132
1988/89	35	<1	220	2	230	2	8	<1	6	<1	0	0	290	3	9892	93	10681
TANGAIL																	
1983/84																	
1984/85	199	19	88	8	145	14	39	4	30	3	2	<1	0	0	564	53	1067
1985/86	9	2	4	<1	7	1	0	0	4	<1	2	<1	9	2	447	93	482
1986/87	2	<1	0	0	12	3	0	0	0	0	0	0	0	0	442	97	456
1987/88	25	3	0	0	0	0	0	0	0	0	0	0	10	1	859	96	894
1988/89	28	6	2	<1	2	<1	20	5	0	0	0	0	9	2	383	86	444

Note: 1. Other rivers as defined by BOF in the frame survey of 1980–1981

Source : Department of Fisheries Catch Statistics 1983–1989.

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TABLE 5.5.5

Catch Composition by Weight of Subsistence Fisheries of Floodplains - in each former district of the NCR

District	Carp	Catfish	Snakehead	Live fish	Other inland fish	Small shrimp	Total weight
DHAKA							
1985/86	0	1.7	14.8	4.7	68.4	10.5	100.1
1986/87	0	0	9.4	4.0	73.2	13.4	100.0
1987/88	0	0	1.3	9.5	78.7	10.5	100.0
1988/89	0	0	0	7.1	72.0	20.9	100.0
JAMALPUR							
1985/86	0	3.0	5.4	1.8	86.4	3.3	99.9
1986/87	0	2.2	13.1	2.2	80.3	2.2	100.0
1987/88	0	0	6.1	9.7	84.2	0	100.0
1988/89	0	0	0	0	100.0	0	100.0
MYMENSINGH							
1985/86	1.6	4.8	7.0	3.0	83.5	0	99.9
1986/87	0	2.1	10.0	25.6	62.3	0	100.0
1987/88	0	2.0	14.2	19.1	62.7	2.0	100.0
1988/89	0	8.7	16.7	24.9	49.7	0	100.0
TANGAIL							
1985/86	0	3.0	5.4	1.8	86.4	3.3	99.9
1986/87	0	11.8	12.5	1.1	74.6	0	100.0
1987/88	18.9	0	0	0	81.9	0	100.8
1988/89	0	0	0	0	100.0	0	100.0

Note: No data are available prior to 1985-86.

Source : Derived from Department of Fisheries Catch Statistics 1985-1989.

TABLE 5.5.6
Catch Composition (by Weight) of Beel in the former districts of Mymensingh and Sylhet

Species	YEAR			
	85/86 (% wt)	86/87 (% wt)	87/88 (% wt)	88/89 (% wt)
Rui (Labeo rohita)	0.2	1.8	1.7	4.0
Catla (Catla catla)	0	1.0	0.4	1.8
Mrigal (Cirrhinus mrigala)	0	1.0	0.9	2.6
Kalbasu (Labeo calbasu)	0.3	5.9	2.9	6.9
Gonia (Labeo gonius)	0.2	0.6	0.6	0.8
Boal (Wallago attu)	12.4	7.8	4.7	9.5
Air (Mystus aor/seenghala)	13.5	2.7	3.9	3.0
Shol/Gazar (Channa spp)	0.8	0.7	1.0	1.3
Chital/Phali (Notopterus spp)	1.1	0.1	1.3	2.5
Koi (Anabas testudineus)	0.2	0	0.4	1.0
Singi/Magur (Heteropneustes fossilis/ Clarias batrachus)	0.2	0.1	0.4	1.5
Sarpunti (Puntius sarana)	2.6	0.1	0.1	0.9
Large shrimp (M.Rosenbergii/malcomsonii)	0	0	0	0
Small shrimp	5.9	1.9	5.2	3.8
Carpio (Cyprinis carpio)	0	0	0	0.9
Pabda (Ompok pabda)	0	0	1.3	1.7
Punti (Puntius spp)	9.6	0	6.3	2.2
Tengra (Mystus spp)	4.4	0	0	1.6
Baim (Mastacembelus spp)	0.2	0	0	0.5
Chapila (Gudusia chapra)	0.1	14.7	6.2	3.8
Others	48.3	61.6	63.1	49.8

Source : DOF 1985-1989

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TABLE 5.5.7

Catch Compositin by Weight of Permanent Beels - in Tangail and Jamlapur Districts of the NCR

Species		Tangail		Jamalpur
		1988-89 (% Wt)	1989-90 (% Wt)	1988-89 (% Wt)
Labeo rohita	(rui)	10	9	6
Catla catla	(catla)	6	10	4
Cirrhinus mrigala	(mrigal)	4	3	2
Labeo calbasu	(kalbasu)	2	2	18
Labeo gonius	(gonia)	0	0	1
Wallago attu	(boal)	19	14	19
Mystus aor/senghala	(air)	2	2	2
Channa spp	(shol/gazar)	11	12	1
Notopterus spp	(chital/phali)	1	1	1
Anabas testudineus	(koi)	7	5	0
H.fossilis/C.batrachus	(singi/magur)	6	6	0
Puntius sarana	(sarpunti)	1	0	0
M.rosenbergii/malcomsonii	(large shrimp)	1	0	0
Small shrimp		3	5	0
Miscellaneous spp		29	32	48

Note: Catch data collected by DOF from the following beels:
Tangail (Delduar thana); Singharagi, Nanduria and Mongalhar.
Jamalpur (Jamalpur upzila); Joganidaha an Bamunjee.

Source: DOF unpublished statistics

A previous study (Tsai 1987) of the changes in the catch composition of beels in the Sylet-Mymensingh basin between 1967/73 and 1984 reported that the proportion of major carps in the catch had declined from about 34% to 2-7%. The decline was attributed principally to overfishing, with the major carp population being replaced by smaller carps and miscellaneous species. The proportional catch of major carps in Jamalpur and Tangail districts, while higher than those in the Sylhet-Mymensingh basin, are substantially lower than historical levels recorded in this area.

The relative abundance of the smaller carp, *Labeo calbasu*, was significantly higher in Jamalpur (18%) than in the other regions (2-7%). The siluroid catfish *Wallago attu* formed an important part of the catch in all regions whereas snakeheads *(Channa spp)* and "live fish" such as *A.testudineus, H.fossilis* and *C.batrachus* were important only in Tangail district (Delduar thana). The reasons for such spatial differences in catch composition remain unclear but the data suggest that fish populations in Delduar thana are the least affected by FCD schemes or overfishing.

5.5.4 Carp Fry Fisheries

Traditionally in Bangladesh, carp fry have been collected from rivers, principally the Brahmaputra/Jamuna, to supply the numerous fish ponds of the country. As recently as 1984, 97% of carp fry supplied to ponds was collected from rivers (Tsai 1988). Since then, private hatcheries have rapidly developed and by 1988 only 65% of fry was supplied by collections from the wild. In the NCR important collection sites were found along the Jamuna and, to a lesser extent, Padma rivers and on secondary rivers such as the Old Brahmaputra, Dhaleswari and Kaliganga(Figure III.5.3). Nationally, the fry fishery suffered a serious decline in 1988 and 1989 when annual catches decreased from previous levels of 22-24 tonnes to only 12 tonnes. A similar rapid decline was observed in the NCR (Table 5.5.8) and the North West Region.

TABLE 5.5.8
Summary of the Carp Fry Fishery of the NCR

Year	Collection Sites	Fishermen	Nets	Boats	Catch (kg)	Catch per Net (kg)	Value of Catch (Million Tk.)
1984	50	--	5736	--	2204	0.4	6.4
1986	35	1459	4947	203	1882	0.4	5.9
1987	58	1378	3240	237	1920	0.6	4.7
1988	38	667	2370	87	1123	0.5	3.7
1989	30	547	2700	104	893	0.3	3.7

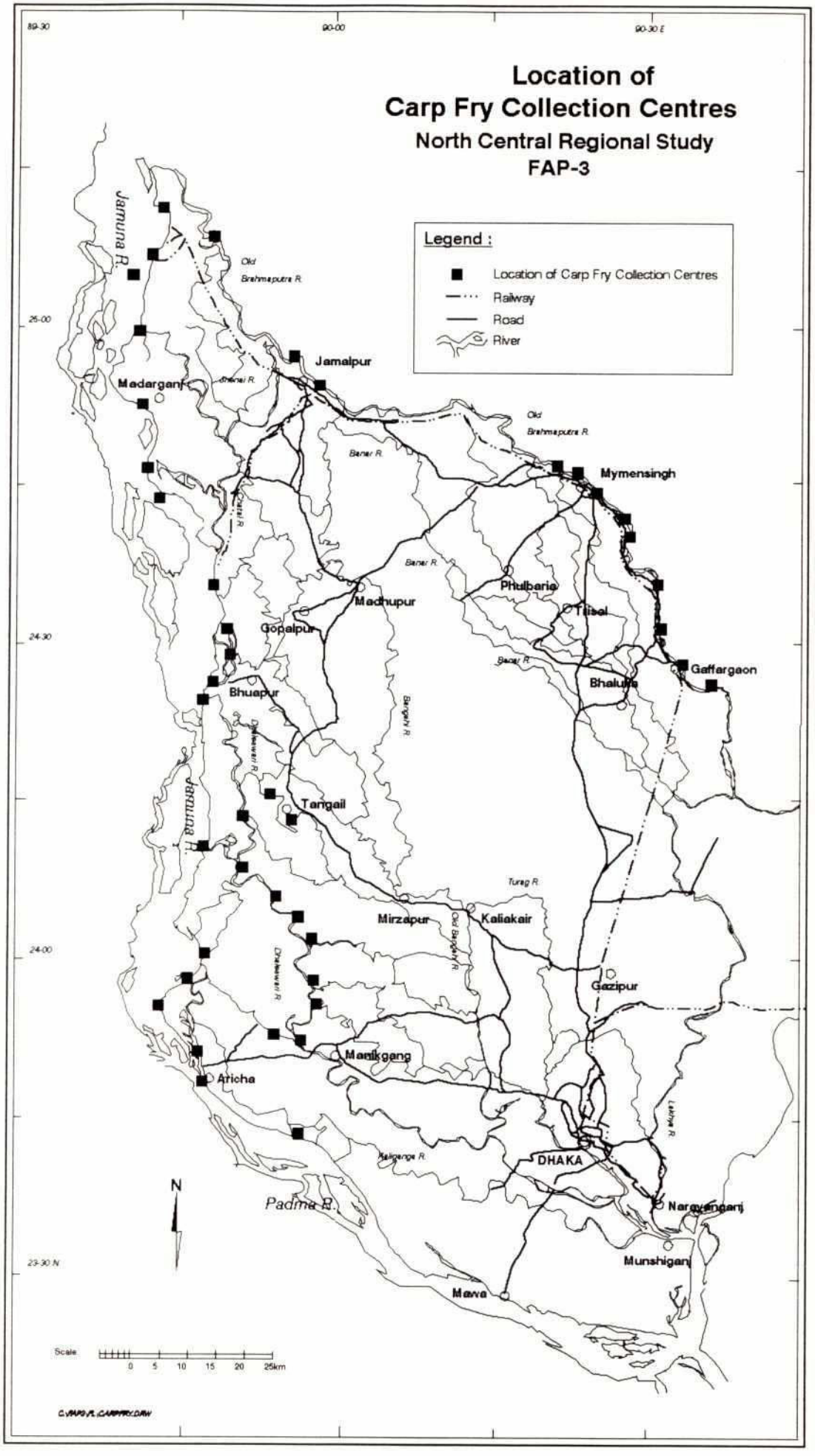
Note: The value of the catch was not given in published data for the years 1985, 1986 and 1989. Therefore approximate estimates were made using average unit prices derived from published price ranges and the total weight of the catch.

Source: 1984 data - Tsai 1986; 1986-89 data - DOF 1986-89.

Reasons for the decline remain unclear and more recent catch statistics (1989/90) are needed to ascertain whether or not the decrease is long-term. From a study carried out in 1984/5 of the carp fry fisheries on the Padma and Brahmaputra rivers (Tsai 1986) it was considered that the capture of live fry was not a primary factor in the decline of adult carp stocks.

A more cautious attitude has been adopted recently (NWRS 1991) in a study which recommended the restriction of the fry fisheries in the North West Region as part of a broader conservation policy to protect and enhance carp stocks. Such restrictions, although admirable in their intention, would clearly have a serious effect on the numerous seasonal fishermen concerned, and would also disrupt or reduce the local aquaculture fisheries which are dependent upon them for the supply of fry.

Figure : II.5.3


Location of
Carp Fry Collection Centres
North Central Regional Study
FAP-3
Legend :
Location of Carp Fry Collection Centres
Railway
Road
River
89-30
90-00
90-30 E
25-00
24-30
24-00
23-30 N
Jamuna R.
Old Brahmaputra R.
Jamalpur
Madarganj
Dhanai R.
Banar R.
Mymensingh
Phulbaria
Tisol
Madhupur
Gopalpur
Gaffargaon
Bhaluka
Bhuapur
Bangshi R.
Dhaleswari R.
Tangail
BANGLADESH
Turag R.
Mirzapur
Kaliakair
Old Bangshi R.
Gazipur
Manikganj
Aricha
Kaliganga R.
DHAKA
Lakhya R.
Padma R.
Narayanganj
Munshiganj
Mawa
N
Scale
0 5 10 15 20 25km

In the NCR therefore, prior to considering restrictions on the fishery, it would seem advisable to collect more information on the distribution, abundance and movement of fry by focusing research efforts in key areas and to assess the impact of the effect of fry fisheries in these areas. In comparison with the North West Region which accounted for 78% (9.8 tonnes) of the national fry collection in 1989, the fry fishery of the NCR is relatively small (0.9 tonnes in 1989) and fry abundance, as indicated by catch per net, is substantially lower.

The difference in the relative abundance of fry between the regions is undoubtedly related to the specific location of spawning grounds and the prevailing flow patterns in the Brahmaputra/Jamuna system. As a matter of priority, attempts should be made to search for possible carp spawning grounds in this system within Bangladesh.

5.6 Fish Resources - Culture Fisheries

5.6.1 Pond Production

Annual fish yields and catch rates from ponds in the NCR (Table 5.6.1) have been estimated (see Chapter 2) from published catch data relating to the former districts of Dhaka, Jamalpur, Mymensingh and Tangail (Annex 18) and from estimates of the total area of ponds within each thana and planning unit of the NCR (Annexes 12 and 13). Catch estimates were made for each type of pond defined by DOF,i.e. cultured, culturable and derelict, for the period 1983 to 1989 (Table 5.6.1). However, as estimates of the number and total area of ponds have never been updated since the SPARRSO survey of 1983/84, the fish production estimates based on productivity rates and total area must be regarded as highly uncertain. To make matters worse, estimates of productivity rates look very dubious, particularly those relating to culturable and derelict ponds which, by definition, receive no inputs other than those from natural sources. Productivity rates from these ponds should therefore be similar to those of natural aquatic habitats which in the NCR ranged from 25 kg/ha from the floodplain to 388 kg/ha from beels. The recent trend of increasing production from all types of pond is also difficult to explain, particularly in the case of unmanaged ponds (this unexplained trend appears to be nationwide). Similar difficulties were encountered in the interpretation of pond culture data in recent studies concerned with fisheries evaluations in the north west (NWRS 1991) and south east (SERS 1991) regions of Bangladesh.

TABLE 5.6.1

Annual Fish Production and Catch Rate of Ponds in the NCR (1983-1989)

Pond Type[1]	1983-84		1984-85		1985-86		1986-87		1987-88		1988-89	
	(t)	(kg/ha)	(t)	(kg/ha)	(t)	(kg/ha)	(t)	(kg/ha)	(t)	(kg/ha)	(t)	(kg/ha)
Cultured	4767	1161	4340	1057	4621	1126	5701	1389	6332	1543	6194	1509
Culturable	2503	869	679	236	355	123	1646	571	1262	438	1550	538
Derelict	292	150	311	160	602	310	893	459	1260	648	1078	555
Total	7562		5330		5578		8240		8854		8822	

Note: *Cultured ponds : where fingerlings stocked*
Culturable ponds : where fingerlings not stocked, i.e., no management
Derelict ponds : not suitable for fish culture due to siltation, excessive vegetaion, etc.

Source : *DOF, 1983-1989, and DOF 1986.*

5.6.2 Carp Fry Production

A notable development in the fisheries sector of Bangladesh involves the recent proliferation of private carp hatcheries and nurseries which have played an increasingly important role in the supply of fingerlings and fry to fish ponds (WB 1991). Published data on the number and production rate of private hatcheries relevant to the NCR refer to the whole of the Dhaka Division, which includes areas outside the NCR (Table 5.6.2). Unfortunately, more detailed information relating to hatchery distribution, within districts or thanas of the NCR, could not be provided by DOF headquarters.

The private sector has largely abandoned the idea of large-scale hatcheries which were characteristic of public sector developments and which generally failed to have a significant impact on fry and fingerling supply. Instead, private hatcheries and some NGOs, such as the Grameen Bank, have relied on the establishment of very simple, small hatcheries which can be dispersed over a wide area making them more accessible to farmers.

TABLE 5.6.2
Carp Fry Production from Government and Private Hatcheries

Year	Government		Private	
	No.of Hatcheries	Fry Production (kg)	No.of Hatcheries	Fry Production (kg)
1985	--	124	3	54
1986	--	365	17	94
1987	--	522	29	372
1988	19	514	29	997
1989	19	464	NA	NA

Note: 1. Government hatcheries include one facility at FRI, Mymensingh.
2. Private hatchery data refer to whole of Dhaka Division in 1987 & 1986 and to Districts of Gazipur, Mymensigh and Tangial in 1985.

Source: DOF (1983-88)

Public sector hatcheries have continued to supply carp fry to fish ponds but they have also stocked many natural waters in the NCR in an effort to enhance dwindling wild stocks. In 1989/90 a total of 3.5 million hatchery-reared fry were introduced into 26 rivers or beels in the NCR (Table 5.6.3). Unfortunately, in the absence of detailed monitoring of subsequent catches, the impact of this large-scale programme on local fisheries is not known. Elsewhere in Bangladesh, under the Third Fisheries Project, the consequence of artificial stocking of beels with hatchery-reared carp fry is currently being monitored and the results are awaited with interest.

TABLE 5.6.3

Summary of the Carp Fry Stocking Programme of Natural Waters, 1989-1990

District	Thana	Water Body	Number of Fry Stocked ('000)
Dhaka	Dhaka	Turag River	250
	Dhamrai	Bangshi River	200
	Dohar	Padma River	175
	Keraniganj	Buriganga River	100
	Keraniganj	Dhaleswari River	100
	Nawabganj	Ichamati River	100
	Nawabganj	Ilshabari River	75
Gazipur	Gazipur	Balu River	100
	Gazipur	Turag River	50
	Kaliakoir	Turag River	50
	Kapasia	Lakhya River	50
	Sripur	Khoraid River	25
	Sripur	Banar River	50
Jamalpur	Jamalpur	Old Brahmaputra River	200
	Jamalpur	Araliaghat River	100
	Melandah	Jhenai River	150
	Sarishabari	Peujalkari	150
Manikganj	Ghior	Dhaleswari River	100
	Harirampur	Padma River	150
	Harirampur	Kaliganga River	150
	Shibalaya	Gedabhati W.B.	100
Munshiganj	Munshiganj	Khodedadpar	45
	Serajdikhan	Dhaleswari River	90
	Srinagar	Arial beel	90
	Tongibari	Dhaleswari River	75
Tangail	Bhuapur	Jhenai River	100
	Bhuapur	Amladah beel	100
	Kalihati	Futikjani River	100
	Madhupur	Hamid beel	100
	Madhupur	Keradah	100
	Tangail	Jogni River	200
Total			**3525**

Source: DOF Unpublished data.

5.7 Economic and Nutritional Value of Catch

5.7.1 Economic Value

Estimates were made of the economic value of the total catch from both capture and culture fisheries in the NCR using the most recent data (1988/89) presently available (Table 5.7.1). The estimates were based on average current fish prices obtained by fishermen and farmers in the NCR (see section 5.4). Since prices vary considerably between districts, seasons, fish species and individual size, the values applied to total catches in Table 5.7.1 must regarded as approximate only. Variations in catch composition from different aquatic habitats exploited by the capture fisheries were taken into account in the analysis by assuming higher average fish prices from rivers and beels (Tk.40/kg and Tk.30/kg respectively) than that from the floodplain where small miscellaneous species of lower commercial value (Tk.25/kg) predominate. Likewise, estimates relating to culture fisheries assume that the principal catch from managed ponds comprised major carps valued at Tk.45/kg while unmanaged ponds produced only wild, floodplain species of lower commercial value (Table 5.7.1). Taken together, the capture and culture fisheries of the NCR produced an estimated 35,000 tonnes with a value to fishermen and farmers of about 1,109 million Taka.

5.7.2 Nutritional Value

Fish is an extremely important component of the diet of people in Bangladesh, providing about 70-80% of the total animal protein intake (BBS 1988). Although data from nutritional and household expenditure surveys are somewhat conflicting, certain trends are apparent:

- a decline in per capita consumption of fish from 33g per day in the 1960's to 21g per day in the 1980's;
- a widening of the gap between urban and rural fish consumption with the former increasing faster than the latter; and
- marked inequality between rural consumers with landless households averaging only 16g/person/day and farmholders with more than 3 acres of land consuming twice that amount.

The most recent estimate of just over 26,000 tonnes of fish from the capture fisheries of the NCR provides sufficient animal protein to feed, at current levels of per capita availability, i.e. 7.5 kg per annum (WB 1991), about 3.5 million people. When the contribution from pond culture in the region is added, then the total is sufficient to feed about 4.7 million people. This number is well below the total population of the region, provisionally estimated at about 15 million for 1991 (11.5 million excluding Dhaka), which implies that a substantial quantity of fish must be imported from other regions of Bangladesh, principally *Hilsa* from the south and various other species from the haor area of the north east and from the fisheries of the Meghna river.

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TABLE 5.7.1

Total Catch and its Value from the Capture and Culture Fisheries of the NCR, 1988-1989

Type	Catch (tonnes)	Value (milion Tk)
Capture Fisheries:		
Rivers	7222	288.9
Beels	4501	134.9
Floodplain	14866	371.8
Total Capture Fisheries	**26589**	**795.6**
Culture Fisheries:		
Cultured ponds	6197	247.8
Culturable ponds	1550	38.8
Derelict ponds	1078	27.1
Total Culture Fisheries	**8825**	**313.7**
Total Capture and Culture	**35414**	**1109.3**

Note: Value of catch based on estimates of average current (1991) fish prices in the NCR: Rivers Tk.40.00; Beels Tk.30.00; Floodplain Tk.25.00; Cultured ponds Tk.45.00; Culturable and Derelict ponds Tk.25.00.

Source : DOF 1988-1989.

CHAPTER 6
CONSTRAINTS AND POTENTIAL FOR DEVELOPMENT

6.1 General

The following discussion presents a brief overview of the general constraints hindering the maintenance and development of capture and culture fisheries in the NCR as a whole, and the prospects for future development of these fisheries in the absence of further FCD/I schemes. Clearly, constraints and development prospects will vary between different areas of the NCR; however, in the absence of detailed surveys of the fish resources and fisheries of each Planning Unit of the NCR, it seems more useful to restrict the present discussion to the broader regional level.

6.2 Capture Fisheries

6.2.1 Major Constraints

The major constraints hindering the maintenance and development of inland capture fisheries of Bangladesh have been reviewed in detail in recent years[1/]. The greatest problem identified has been that caused by the extensive development of various flood protection programmes, often linked with improved drainage and irrigation schemes (Ali 1991, Minkin 1989 MPO 1987b). Nationally, the overall effect of these programmes has been to convert vast areas of seasonal wetlands which once supported productive fisheries into agricultural areas, principally for the purpose of increased rice production (MPO 1987b). A characteristic feature of the FCD/I developments has been the almost total disregard for their impact on fish resources and fisheries. It is only very recently, particularly as a result of the Flood Action Plan, that the potential impact of FCD/I schemes on the fisheries sector has been considered at the pre-feasibility stage of the planning process.

6.2.2 Effects of FCD/I

Over many years in the NCR, a variety of flood protection measures have been introduced. These include:

- embankments along the main rivers (Jamuna and Padma)
- the establishment of numerous small-scale FCD/I schemes,
- the raising of major roads in flood-prone areas and
- the construction of embankments to protect towns lying adjacent to rivers, e.g. Dhaka, Tangail.

Unfortunately, no efforts have been made to quantify the adverse effects of these measures on fisheries.

1/ References: Ali 1991, Islam 1988, Minkin 1989, MPO 1987a, MPO 1987b, Nuruzzaman 1990.

However, the general effects are well known from studies carried out in other areas of Bangladesh (MPO 1987) and those relevant to the NCR are listed below:

Habitat Loss: The reduction in floodplain area results in a decrease in the size of spawning and nursery grounds, and the area available for fish growth. This in turn leads to a reduction in fish production, not only within the FCD area but also in areas outside it.

Interference with Migrations: FCD structures such as embankments and regulators on rivers disrupt or prevent the seasonal migration of fish (adults, juveniles and fry) and shrimp between rivers and floodplain habitats. This results in a decrease in fish production and diversity and a change in catch composition, with the loss of highly valued migratory species such as major carps, and a predominance of small miscellaneous species of lower commercial value.

Reduction in Fisheries: The loss of floodplain areas leads to a reduction in or disappearance of the open-access subsistence fisheries which are especially important in terms of nutrition for the poorest sections of the rural community. The livelihoods of professional fishermen are also endangered by a reduction in the area of seasonal and perennial fishing grounds and a decrease in catch rate. Many fishermen are forced to seek alternative employment or emigrate.

Increased use of Agro-chemicals: Within FCD areas the introduction or expansion of irrigated HYV rice crops has led to the increased application of chemical fertilizers and pesticides. The potential toxic effects of the latter on various components of the aquatic ecosystem including fish are well known but as yet, no environmental monitoring programmes have been established in Bangladesh.

6.2.3 Other Constraints

Other constraints on fisheries development in the NCR are listed below:-

a) Lack of Effective Fisheries Management.

Although legislation exists to protect and conserve fish stocks, the enforcement of fisheries regulations is sadly neglected, resulting in the widespread use of harmful and illegal fishing methods. Such methods are often actively encouraged in many public water bodies (jalmahals) leased by influential rural businessmen from the Ministry of Land under its revenue-orientated policy which promotes short-term profits at the expense of the long-term welfare of exploited fish stocks. Under the leasing system of jalmahals, the struggle for short-term gains by lessees and fishermen invariably results in over fishing of fish stocks.

Any attempts to improve the present situation, such as the recent establishment of the New Fisheries Management Policy, must take into account the existing rural power structure and try to contain the influence and economic dominance of local patrons.

The problem of overfishing may be more widespread given the recent influx of Muslims into the fisheries sector in recent years. Unfortunately, no reliable information on the numbers of fishermen operating in the NCR is available but other data suggest an increase of about 10% in the number of fishermen exploiting the inland waters

of Bangladesh during the last decade (BBS 1990). Although the latest population census statistics have not yet been published, it is believed that the population in the NCR has increased by about 20% during the last decade, from 12.7 million to 15.3 million people (see SR IV). This scale of population increase and its concomitant demands on food (protein) supply and employment must certainly have increased the already heavy pressure on existing fish stocks at a time when the area of floodplain habitats was being drastically reduced by FCD/I schemes.

b) Lack of Information

Information essential for fisheries planning purposes,including the formulation of development and management policies, is lacking. There is an urgent need for quantification of the distribution and seasonal variation in numbers and area of different types of water bodies usable for fish production. A greater understanding is required of fish resources in terms of the biology, behaviour and population dynamics of commercially important species including the miscellaneous floodplain species.

This information can only be obtained by long-term research programmes. More accurate and detailed information is required on the various fisheries of the region which are presently monitored by the FRSS of the DOF. There is an urgent need to improve the organisation and structure of this system and to strengthen the capability of the DOF in undertaking this task.

c) Recognation

To achieve the improvements in the areas listed above requires a change in the general perception of the significance of the fisheries sector by Government policy makers. In the past, fish resources of Bangladesh have generally been taken for granted and consequently essential research on capture fisheries and the collection of detailed fisheries statistics have been neglected. Today, the DOF and FRI urgently require increased financial and technical support to enable them to make the necessary improvements in both fisheries research programmes and statistical collection systems.

d) Reduced Dry Season River Flows.

Fishermen complain about reduced dry season flows and increased siltation in the Padma, Old Brahmaputra and Dhaleswari rivers. The construction of the Farakka barrage in India has resulted in lower dry season flows in the Padma while siltation at the confluence of the Jamuna and Old Brahmaputra is believed to have resulted in lower dry season flows in the latter. The situation on the Dhaleswari remains unclear and requires further investigation. Lower dry season flows not only harm fish stocks by reduction in the area of available riverine habitats, but also by increasing their susceptibility to capture in dwindling pool areas where fish concentrate. In addition, the Farakka barrage is believed to have blocked the upstream spawning migration of major carps and thereby reduced the stock substantially (Tsai 1985).

e) Water Pollution.

Mention has already been made of the potential problems posed by the increasing use of pesticides which are capable of contaminating water courses and adversely affecting fish, particularly juveniles. Although there is as yet no quantitative data upon which to base judgements, the risks of contamination are likely to be extensive since pesticides are closely associated with the widespread cultivation of HYV boro rice.

More localised pollution problems occur in the main rivers draining Dhaka district, the Buriganga and Lakhya. Here a wide variety of industrial pollutants together with domestic sewage effluents pollute the main water courses (Bhagan 1983) but their effect on local fish populations has not apparently been quantified.

Many rivers draining the central highland area of the Madhupur Tract carry high loads of suspended solids which can result in increased siltation downstream. Further investigation is required of the possible link between deafforestation in the northern areas of the Madhupur Tract and increased erosion during flash floods resulting in higher loads of suspended solids and increased siltation downstream.

f) Fish Disease.

Epizootic ulcerative disease was reported in Bangladesh for the first time in 1988. The disease apparently resulted in large-scale mortalities of numerous indigenous species throughout the country but reliable quantitative data are lacking (Ali·1991). The disease has been reported recently from Thailand, Burma, Philippines, Malaysia and Sri Lanka. It reappeared in Bangladesh in the dry seasons of 1989 and 1990 but its impact on natural fish populations has not so far been adequately studied.

6.2.4 Development Prospects

Given the major constraints outlined above, it is difficult to be optimistic about the prospects for future development of the capture fisheries of the NCR. Compared with other areas of Bangladesh and wider geographical regions, the fish yield from the floodplains of the NCR is low (Tables 6.2.1 and 6.2.2). This is probably the result of the combined adverse effects of FCD/I schemes on fish stocks, inadequate fisheries management and the scarcity of large areas of permanent water bodies in the region. Continued FCD developments will undoubtedly lead to further significant reductions in flood plain fisheries.

Ignoring for the moment the implication of future FCD schemes on capture fisheries, two broad initiatives offer scope for the future conservation and possible enhancement of wild fish stocks:-

New Fisheries Management Policy (MFMP)

The first initiative has already commenced and involves the establish ment by DOF of the New Fisheries Management Policy which aims to eliminate exploitative practices by replacing the leasing system with a system of licensing, both to redirect benefits to fishermen rather than former leaseholders and to improve the productivity and sustainability of fish resources. The new system has achieved mixed success; for example, on the large jalmahal of the Padma-Jamuna fishery many fishermen failed to renew licences during the second year of the NFMP (BCAS 1989). Difficulty in securing credit facilities from banks was reported as a major difficulty facing fishermen of this jalmahal. It is evident, therefore, that implementation of the NFMP must take into account a wide range of factors, including socio-economic elements which influence fishing communities in the NCR. For the NFMP to succeed, a clear understanding of the socio-political structures in rural communities is required together with the commitment on the part of government institutions such as DOF to contain or counteract the economic dominance of former leaseholders.

TABLE 6.2.1

Estimated Annual Yields from Capture Fisheries (1988-1989)

Habitat	Area (km^2)	Catch (tonnes)	Catch Rate (kg/ha)
Rivers	492	7222 (6637)[1/]	147 (135[1/]
Beels	116	4501	388
Floodplain	5927	14866	25
Total	**6535**	**26589 (26004)**	**41 (40)**

Note: Values of catch and catch rate given in parentheses refer to floodlain related species only, i.e.,Hilsa catches excluded from data.

Source: See Table 4.1 for methods of estimating areas of different water.
Catch estimates derived from Department of Fisherie Catch Statistics 1988-1989.

TABLE 6.2.2

Floodplain Yield in Bangladesh and Elsewhere

Location	Floodplain (kg/ha/gr)	Source
NCR	32	CS 1992
Bangladesh	79	CS 1992
Lower Mekong, Asia	41	Welcomme 1985
Niger, Africa	30-75	Welcomme 1985
Orinoco, South America	44	Welcomme 1985
Tropical Floodplains	40-60	Welcomme 1985

Note:1. Consultants' estimates based on combined catch data from beels and floodplain in 1988-1989 and inundated areas of floodplain under "normal" flood conditions.

2. Estimates of catch rates in other geographical areas based on maximum flooded areas.

Source: CS 1992, Welcomme 1985.

Database

The second initiative could be undertaken at relatively little cost with careful planning and efficient organisation by specialists from the DOF and BWDB. This would involve the establishment of a detailed and comprehensive database to describe all existing structures in the NCR which interfere with natural flood and drainage patterns and to identify those which have had the greatest adverse effect on fish stocks by disrupting or preventing migrations. The information could be collected using the collaborative efforts of government personnel and local fishermen in each thana. Once the database has been established, it would be possible to compile a priority list of those structures judged to cause (or have caused) the greatest damage to fish resources and fisheries in the region. With this detailed background information steps could then be taken to introduce improvements in the design or use of existing structures to increase the free passage of fish (adults, juveniles or fry) and shrimp between river and floodplain habitats.

Used together, the two initiatives would probably have a synergistic effect if carried out on a sufficiently large-scale and benefits in terms of increased stock size may well be seen quite rapidly, possibly within two years.

6.3 Culture Fisheries

6.3.1 Constraints

The major constraints hindering the development and expansion of aquaculture in Bangladesh have been reviewed recently (WB 1991, Bennett 1991, Ameen 1987, Magid 1991). Those relevant to aquaculture development in the NCR are listed below:

Financial Constraint: The lack of accessible credit has been identified as a key constraint to aquaculture development. Institutional sources of credit such as development banks tend to be excessively bureaucratic and very reluctant to offer loans to small-scale farmers because of their lack of collateral. The vast majority of the rural population therefore relies on non-institutional sources of credit through friends, relatives or fish traders. The latter often charge high levels of interest and commit borrowers to long-term arrangements involving the supply of harvested fish, often at below-market prices (Bennett 1991).

Social Constraint: Multiple ownership and multiple use of ponds pose major constraints to development. Conflicts of interest between the needs of fish pond cultivation and other uses such as access for cattle, washing and bathing make it difficult to reach communal pond management agreements under conditions of multiple ownership.

Risk Factors: There are a number of factors which may inhibit the adoption of pond culture by farmers or reduce the likelihood of obtaining credit from banks. These include the risk of flooding or drought, fish disease, theft or poisoning of fish, unavailability of feeds, variable quality of fingerlings and lack of technical knowledge or advice.

Marketing Problems: As pond aquaculture expands, pold access roads and the lack of transport and storage facilities (ice plants and cool stores) may constrain the further development.

6.3.2 Development Prospects

The prospects for small-scale, low input aquaculture seem good. Several studies have demonstrated that pond aquaculture is a comparatively attractive investment in rural Bangladesh, comparing favourably with the major agricultural alternative, rice cultivation (Bennett 1991, Ameen 1987). Since fish prices are rising more rapidly than those of rice (BBS 1990) and the profitability of pond cultivation becomes more widely appreciated, it seems likely that more farmers will turn to aquaculture as an alternative source of income. There are several promising development approaches:-

Upgrading Ponds

The main scope for increasing production in the near future is by upgrading unmanaged (culturable and derelict) ponds and improving the management of those already under cultivation. In the NCR, 59% (41,538) of all ponds recorded in 1983/84 were classified as culturable or derelict (Annex 13). Since then, no further pond surveys have been carried out; however, it seems likely that there is still a large number of ponds capable of being brought

into production. Substantial finance will be needed to do this and therefore credit facilities to small-scale farmers must be improved. If institutional sources of credit such as the development banks remain inflexible in their attitude to small-scale farmers, efforts should be made to encourage credit facilities through other sources such as NGOs, e.g. the Grameen Bank which has already achieved an extremely successful record of loan repayments from poor farmers.

Training and Extension

The establishment of a much more effective training and extension service by DOF is required to help them in this process. The Aquaculture Extension Project funded by DANIDA in Mymensingh has shown what can be achieved in promoting the spread of small-scale fish farming through well-planned, intensive training and extension programmes.

Supply of Feedstocks/Fingerlings

Problems in the supply of feedstocks and good quality fingerlings have been recognised as potential constraints to development and realistic means of improving their future supply have been identified in recent studies (Bannett 1991, Ameen 1987). Aquatic weeds have considerable potential as pond feeds, especially the water hyacinth which has been used by a number of NGOs (e.g. Grameen Bank) to produce a highly successful compost. Grasses such as Napier grass grown on pond banks also offer potential for increased production of fish feed (Benett 1991). Fingerling farming would appear to be an attractive proposition to poor farmers. The ODA Parbatipur Project in the North West Region has clearly demonstrated the profitability of fingerling cultivation in paddies using catch pits for partial harvesting as and when fish are required by local markets. The rapidly expanding private sector looks certain to take a large share of the fingerling supply market in the future. This should result in the gradual reduction in the need for fry collected from rivers in the NCR and thus, perhaps, benefit wild carp stocks.

Other Technologies

Several other aquaculture technologies appropriate for small-scale farmers of the NCR are at various stages of testing in Bangladesh. Of these, integrated farming using fish, ducks or chickens and rice/fish farming would appear to offer most promise. The potential for rice/fish farming is especially relevant since it offers scope for the production not only of indigenous carps but also numerous other floodplain species and also for the production of carp fingerlings for pond stocking. The potential for deep-water aman rice/fish farming in the NCR is presently being investigated by BRRI and further research efforts should be encouraged.

CHAPTER 7
IMPACT OF FCD ON FISHERIES OF EACH PLANNING UNIT

7.1 Description of Fisheries

In this section, quantitative descriptions of the aquatic habitats and fisheries in each of the thirteen Planning Units of the NCR are presented. Data on annual fish production from capture and culture fisheries in each PU during the period 1983 to 1989 are also summarised in Annexes 19-23. Estimates of the economic value of capture and culture fisheries in each PU for 1988/89 are presented in Annexes 24 and 25 respectively. A summary of the magnitude and value of the carp fry fishery by PU is given in Annex 26.

It is important to reiterate here that the data presented in the annexes listed below and in the descriptions of each PU which follow must be regarded as very approximate since the statistical collection systems upon which they are based require improvement and more detailed information is needed on the spatial distribution and size of water bodies and the fisheries they support in each PU.

P.U.1

Area	:	Total	:	89,351 ha
		Cultivated	:	70,009 ha
Population			:	737,706 (1981)

Aquatic Habitats	:					
Rivers	:	Principal	:	98 km		
		Others	:	162 km		
		Total	:	260 km		
Beels	:	Total Nos. 31,	Area	:	420 ha	
Floodplain (% area)	:	F_0 = 24%,	F_1 = 55%,	F_2 = 21%,	F_3 = <1%	
Area	:	(F_1 - F_3) = 53,207 ha				
Ponds	:	Total Nos. = 2,682	Area	378 ha		

Annual Fish Catch (tonnes) and Value (Tk. millions) 1988-89

Waterbody Type		Weight	% Wt. Capt & Cult	Value (Tk)	% Value Capt & Cult
Rivers	Principal	1237	33	49.4	40
	Others	334	9	13.4	11
	Sub-Total	**1571**	**41**	**62.8**	**51**
Beels		221	6	6.6	5
Floodplain		1581	42	39.5	32
Total Capture Fisheries		**3373**	**89**	**108.9**	**88**
Ponds		428	11	15.6	12
Total Capture & Culture		**3801**		**124.5**	

Catch Rates

Rivers	Principal	12.6 tonnes/km
	Others	No. data: above catch estimates do not relate to total river length but rather to unspecified lengths of rivers surveyed by FRSS, 1981.
Beels		526 kg/ha
Floodplain		30 kg/ha
Ponds	Cultured	2026 kg/ha
	Culturable	488 kg/ha
	Derelict	455 kg/ha

P.U.2

Area	:	Total	:	73,963 ha
		Cultivated	:	59,850 ha
Population			:	604,558 (1981)

Aquatic Habitats	:					
Rivers	:	Principal	:	18 km		
		Others	:	125 km		
		Total	:	143 km		
Beels	:	Total Nos. = 43, Area	:	666 ha		
Floodplain (% area)	:	F_0 = 30%,	F_1 = 48%,	F_2 = 17%,	F_3 = 5%	
Area	:	(F_1 - F_3) = 41,895 ha				
Ponds	:	Total Nos. = 2,230	Area	314 ha		

Annual Fish Catch (tonnes) and Value (Tk. millions) 1988-89

Waterbody Type		Weight	% Wt. Capt & Cult	Value (Tk)	% Value Capt & Cult
Rivers	Principal	243	13	9.7	17
	Others	60	3	2.4	4
	Sub-Total	**303**	**16**	**12.1**	**21**
Beels		261	14	7.8	14
Floodplain		1020	53	25.5	45
Total Capture Fisheries		**1584**	**83**	**45.4**	**80**
Ponds		330	17	11.6	20
Total Capture & Culture		**1914**		**57.0**	

Catch Rates

Rivers	Principal	13.5 tonnes/km
	Others	No. data: above catch estimates do not relate to total river length but rather to unspecified lengths of rivers surveyed by FRSS, 1981.
Beels		391 kg/ha
Floodplain		24 kg/ha
Ponds	Cultured	1633 kg/ha
	Culturable	670 kg/ha
	Derelict	569 kg/ha

P.U.3

Area	:	Total	:	172,391 ha
		Cultivated	:	127,979 ha
Population			:	1,486,749 (1981)

Aquatic Habitats	:					
Rivers	:	Principal	:	--		
		Others	:	480 km		
		Total	:	480 km		
Beels	:	Total Nos. = 222,	Area	:	4850 ha	
Floodplain (% area)	:	F_0 = 27%,	F_1 = 51%,	F_2 = 20%,	F_3 = 2%	
Area	:	(F_1 - F_3) = 93,425 ha				
Ponds	:	Total Nos. = 13,325	Area	1506 ha		

Annual Fish Catch (tonnes) and Value (Tk. millions) 1988-89

Waterbody Type		Weight	% Wt. Capt & Cult	Value (Tk)	% Value Capt & Cult
Rivers	Principal	--	--	--	--
	Others	899	11	36.0	15
	Sub-Total	**899**	**11**	**36.0**	**15**
Beels		2551	32	76.5	31
Floodplain		2904	36	72.6	29
Total Capture Fisheries		**6354**	**79**	**185.1**	**15**
Ponds		1649	21	62.1	25
Total Capture & Culture		**8003**		**247.2**	

Catch Rates

Rivers	Principal	--
	Others	--
Beels		526 kg/ha
Floodplain		31 kg/ha
Ponds	Cultured	1222 kg/ha
	Culturable	705 kg/ha
	Derelict	689 kg/ha

P.U.4

Area	:	Total	:	76,170 ha
		Cultivated	:	58,420 ha
Population			:	589,207 (1981)

Aquatic Habitats	:					
Rivers	:	Principal	:	11 km		
		Others	:	155 km		
		Total	:	166 km		
Beels	:	Total Nos. = 68,	Area	:	568 ha	
Floodplain (% area)	:	F_0 = 25%,	F_1 = 40%,	F_2 = 27%,	F_3 = 8%	
Area	:	(F_1 - F_3) = 43,815 ha				
Ponds	:	Total Nos. = 2,312	Area	326 ha		

Annual Fish Catch (tonnes) and Value (Tk. millions) 1988-89

Waterbody Type		Weight	% Wt. Capt & Cult	Value (Tk)	% Value Capt & Cult
Rivers	Principal	35	2	1.4	4
	Others	--	--	--	--
	Sub-Total	**35**	**2**	**1.4**	**4**
Beels		147	10	4.4	12
Floodplain		919	65	23.0	58
Total Capture Fisheries		**1101**	**78**	**28.8**	**73**
Ponds		316	22	10.6	27
Total Capture & Culture		**1417**		**39.4**	

Catch Rates

Rivers	Principal	3.2 tonnes/km
	Others	--
Beels		259 kg/ha
Floodplain		21 kg/ha
Ponds	Cultured	1239 kg/ha
	Culturable	851 kg/ha
	Derelict	682 kg/ha

P.U.5

Area	:	Total	:	212,467 ha
		Cultivated	:	212,318 ha
Population			:	1,139,598 (1981)
Aquatic Habitats	:			
Rivers	:	Principal	:	--
		Others	:	115 km
		Total	:	115 km
Beels	:	Total Nos. = 69,	Area :	1463 ha
Floodplain (% area)	:	F_0 = 57%,	F_1 = 29%, F_2 = 9%,	F_3 = 4%
Area	:	(F_1 - F_3) = 52,167 ha		
Ponds	:	Total Nos. = 11,316	Area 1,421 ha	

Annual Fish Catch (tonnes) and Value (Tk. millions) 1988-89

Waterbody Type		Weight	% Wt. Capt & Cult	Value (Tk)	% Value Capt & Cult
Rivers	Principal	--	--	--	--
	Others	576	13	23.0	17
	Sub-Total	**576**	**13**	**23.0**	**17**
Beels		492	11	14.8	11
Floodplain		1992	44	49.8	36
Total Capture Fisheries		**3060**	**68**	**87.6**	**63**
Ponds		1437	32	51.2	37
Total Capture & Culture		**4497**		**138.8**	

Catch Rates

Rivers	Principal	--
	Others	--
Beels		336 kg/ha
Floodplain		38 kg/ha
Ponds	Cultured	1407 kg/ha
	Culturable	1038 kg/ha
	Derelict	630 kg/ha

P.U.6

Area	:	Total	:	114,395 ha
		Cultivated	:	95,880 ha
Population			:	1,006,383 (1981)
Aquatic Habitats	:			
Rivers	:	Principal	:	48 km
		Others	:	261 km
		Total	:	309 km
Beels	:	Total Nos. = 40,	Area	: 451 ha
Floodplain (% area)	:	F_0 = 15%,	F_1 = 48%,	F_2 = 29%, F_3 = 8%
Area	:	(F_1 - F_3) = 81,498 ha		
Ponds	:	Total Nos. = 4,290	Area	590 ha

Annual Fish Catch (tonnes) and Value (Tk. millions) 1988-89

Waterbody Type		Weight	% Wt. Capt & Cult	Value (Tk)	% Value Capt & Cult
Rivers	Principal	9	<1	0.4	<1
	Others	478	18	19.1	25
	Sub-Total	**487**	**19**	**19.5**	**25**
Beels		116	4	3.5	5
Floodplain		1417	55	35.4	46
Total Capture Fisheries		**2020**	**78**	**58.4**	**75**
Ponds		570	22	18.7	24
Total Capture & Culture		**2590**		**77.1**	

Catch Rates

Rivers	Principal	0.2 tonnes/km
	Others	--
Beels		257 kg/ha
Floodplain		17 kg/ha
Ponds	Cultured	1239 kg/ha
	Culturable	851 kg/ha
	Derelict	682 kg/ha

P.U.7

Area	:	Total	:	90,090 ha
		Cultivated	:	67,238 ha
Population			:	831,126 (1981)
Aquatic Habitats	:			
Rivers	:	Principal	:	--
		Others	:	175 km
		Total	:	175 km
Beels	:	Total Nos. = 17,	Area	: 303 ha
Floodplain (% area)	:	F_0 = 12%,	F_1 = 39%,	F_2 = 27%, F_3 = 22%
Area	:	(F_1 - F_3) = 59,169 ha		
Ponds	:	Total Nos. = 6,555	Area	769 ha

Annual Fish Catch (tonnes) and Value (Tk. millions) 1988-89

Waterody Type		Weight	% Wt. Capt & Cult	Value (Tk)	% Value Capt & Cult
Rivers	Principal	--	--	--	--
	Others	521	22	20.8	27
	Sub-Total	**521**	**22**	**20.8**	**27**
Beels		68	3	2.0	3
Floodplain		1091	46	27.3	36
Total Capture Fisheries		**1680**	**70**	**50.1**	**66**
Ponds		712	30	25.6	34
Total Capture & Culture		**2392**		**75.7**	

Catch Rates

Rivers	Principal	--
	Others	--
Beels		224 kg/ha
Floodplain		18 kg/ha
Ponds	Cultured	1759 kg/ha
	Culturable	1558 kg/ha
	Derelict	519 kg/ha

P.U.8

Area	:	Total	:	46,065 ha
		Cultivated	:	27,192 ha
Population			:	391,729 (1981)

Aquatic Habitats	:					
Rivers	:	Principal	:	--		
		Others	:	63 km		
		Total	:	63 km		
Beels	:	Total Nos. = N/A,	Area	:	257 ha	
Floodplain (% area)	:	F_0 = 54%,	F_1 = 19%,	F_2 = 16%,	F_3 = 11%	
Area	:	(F_1 - F_3) = 12,508 ha				
Ponds	:	Total Nos. = 3,565	Area	409 ha		

Annual Fish Catch (tonnes) and Value (Tk. millions) 1988-89

Waterbody Type		Weight	% Wt. Capt & Cult	Value (Tk)	% Value Capt & Cult
Rivers	Principal	--	--	--	--
	Others	167	16	6.7	20
	Sub-Total	**167**	**16**	**6.7**	**20**
Beels		58	5	1.7	5
Floodplain		439	41	11.0	33
Total Capture Fisheries		**664**	**63**	**19.4**	**58**
Ponds		394	37	13.9	42
Total Capture & Culture		**1058**		**33.3**	

Catch Rates

Rivers	Principal	--
	Others	--
Beels		226 kg/ha
Floodplain		35 kg/ha
Ponds	Cultured	1759 kg/ha
	Culturable	1558 kg/ha
	Derelict	519 kg/ha

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P.U.9

Area	:	Total	:	78,936 ha
		Cultivated	:	57,757 ha
Population			:	661,348 (1981)
Aquatic Habitats	:			
Rivers	:	Principal	:	--
		Others	:	71 km
		Total	:	71 km
Beels	:	Total Nos. = N/A,	Area	: 279 ha
Floodplain (% area)	:	F_0 = 54%,	F_1 = 19%,	F_2 = 12%, F_3 = 15%
Area	:	(F_1 - F_3) = 26,568 ha		
Ponds	:	Total Nos. = 5,905	Area	732 ha

Annual Fish Catch (tonnes) and Value (Tk. millions) 1988-89

Waterbody Type		Weight	% Wt. Capt & Cult	Value (Tk)	% Value Capt & Cult
Rivers	Principal	--	--	--	--
	Others	299	16	12.0	21
	Sub-Total	**299**	**16**	**12.0**	**21**
Beels		62	3	1.9	3
Floodplain		803	44	20.1	35
Total Capture Fisheries		**1164**	**63**	**34.0**	**59**
Ponds		681	37	23.8	41
Total Capture & Culture		**1845**		**57.8**	

Catch Rates

Rivers	Principal	--
	Others	--
Beels		222 kg/ha
Floodplain		30 kg/ha
Ponds	Cultured	1759 kg/ha
	Culturable	1558 kg/ha
	Derelict	519 kg/ha

P.U.10

Area	:	Total	:	67,187 ha
		Cultivated	:	48,255 ha
Population			:	514,328 (1981)

Aquatic Habitats	:					
Rivers	:	Principal	:	54 km		
		Others	:	53 km		
		Total	:	107 km		
Beels	:	Total Nos. = N/A,	Area	:	369 ha	
Floodplain (% area)	:	F_0 = 9%,	F_1 = 21%,	F_2 = 40%,	F_3 = 30%	
Area	:	(F_1 - F_3) = 43,912 ha				
Ponds	:	Total Nos. = 5,037	Area	631 ha		

Annual Fish Catch (tonnes) and Value (Tk. millions) 1988-89

Waterbody Type		Weight	% Wt. Capt & Cult	Value (Tk)	% Value Capt & Cult
Rivers	Principal	175	10	7.0	13
	Others	109	7	4.4	8
	Sub-Total	**284**	**17**	**11.4**	**22**
Beels		83	5	2.5	5
Floodplain		716	43	17.9	34
Total Capture Fisheries		**1083**	**65**	**31.8**	**61**
Ponds		589	35	20.6	39
Total Capture & Culture		**1672**		**52.4**	

Catch Rates

Rivers	Principal	3.2 tonnes/km
	Others	--
Beels		225 kg/ha
Floodplain		16 kg/ha
Ponds	Cultured	1759 kg/ha
	Culturable	1558 kg/ha
	Derelict	519 kg/ha

P.U.11

Area	:	Total	:	24,987 ha
		Cultivated	:	18,564 ha
Population			:	437,568 (1981)

Aquatic Habitats	:					
Rivers	:	Principal	:	--		
		Others	:	49 km		
		Total	:	49 km		
Beels	:	Total Nos. = N/A,	Area	:	4 ha	
Floodplain (% area)	:	F_0 = 12%,	F_1 = 24%,	F_2 = 22%,	F_3 = 42%	
Area	:	(F_1 - F_3) = 16,336 ha				
Ponds	:	Total Nos. = 2,108	Area	224 ha		

Annual Fish Catch (tonnes) and Value (Tk. millions) 1988-89

Waterbody Type		Weight	% Wt. Capt & Cult	Value (Tk)	% Value Capt & Cult
Rivers	Principal	--	--	--	--
	Others	932	61	37.3	68
	Sub-Total	**932**	**61**	**37.3**	**68**
Beels		1	<1	<0.1	--
Floodplain		375	24	9.4	17
Total Capture Fisheries		**1308**	**85**	**46.7**	**85**
Ponds		223	15	8.0	15
Total Capture & Culture		**1531**		**54.7**	

Catch Rates

Rivers	Principal	--
	Others	--
Beels		250 kg/ha
Floodplain		23 kg/ha
Ponds	Cultured	1759 kg/ha
	Culturable	1558 kg/ha
	Derelict	519 kg/ha

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P.U.12

Area	:	Total	:	36,970 ha
		Cultivated	:	
Population			:	3,195,129 (1981)
Aquatic Habitats	:			
Rivers	:	Principal	:	--
		Others	:	66 km
		Total	:	66 km
Beels	:	Total Nos. =	Area :	
Floodplain (% area)	:	Mainly urban area		
Ponds	:	Total Nos. = 2,722	Area 589 ha	

Annual Fish Catch (tonnes) and Value (Tk. millions) 1988-89

Waterbody Type		Weight	% Wt. Capt & Cult	Value (Tk)	% Value Capt & Cult
Rivers	Principal	--	--	--	--
	Others	157	20	6.3	23
	Sub-Total	**157**	**20**	**6.3**	**23**
Beels		--	--	--	--
Floodplain		110	14	2.8	10
Total Capture Fisheries		**267**	**34**	**9.1**	**34**
Ponds		519	66	17.8	66
Total Capture & Culture		**786**		**26.9**	

P.U.13

Area	:	Total	:	101,485 ha
		Cultivated	:	76,616 ha
Population			:	1,129,512 (1981)

Aquatic Habitats :

Rivers	:	Principal	:	73 km		
		Others	:	36 km		
		Total	:	109 km		
Beels	:	Total Nos. = N/A,	Area	:	1967 ha	
Floodplain (% area)	:	F_0 = 11%,	F_1 = 22%,	F_2 = 24%,	F_3 = 43%	
Area	:	(F_1 - F_3) = 68,188 ha				
Ponds	:	Total Nos. = 8,180	Area	1041 ha		

Annual Fish Catch (tonnes) and Value (Tk. millions) 1988-89

Waterbody Type		Weight	% Wt. Capt & Cult	Value (Tk)	% Value Capt & Cult
Rivers	Principal	900	23	36.0	29
	Others	91	2	3.6	3
	Sub-Total	**991**	**25**	**39.6**	**32**
Beels		441	11	13.2	11
Floodplain		1499	38	37.5	30
Total Capture Fisheries		**2931**	**75**	**90.3**	**73**
Ponds		977	25	34.2	27
Total Capture & Culture		**3908**		**124.5**	

Catch Rates

Rivers	Principal	12.3 tonnes/km
	Others	--
Beels		224 kg/ha
Floodplain		22 kg/ha
Ponds	Cultured	1759 kg/ha
	Culturable	1558 kg/ha
	Derelict	519 kg/ha

7.2 Impact Assessment

7.2.1 Capture Fisheries

The methodology outlined by MPO in 1985 (MPO 1987b) was followed in making an assessment of the potential impact on fisheries of FCD projects on floodplain-dependent fisheries. The method is fairly crude but, in the absence of more detailed information on fish productivity and biomass in different water depths on the floodplain, it offers the most acceptable analytical approach available at present. The method has been applied recently in an analysis of the effects of proposed FCD and FCDI projects on the fisheries of the South East Region of Bangladesh (SERS 1991).

The method is based on a combined estimate of the yield per unit area of floodplain-dependent fish in rivers, beels and floodplains. In Bangladesh, floodplain-dependent fish have been taken as all species except *Hilsa ilisha* which is restricted to rivers throughout its life cycle. The assessment method thus takes into account not only the direct loss of fish from the affected floodplain within the FCD area but also the consequent reduction in productivity of adjacent river and beel habitats.

Because of the risk of additional bias when converting catch estimates from district level to individual PUs, it was considered more appropriate for the purpose of impact assessment to use estimates of yields from different aquatic habitats from the region as a whole. The analysis resulted in an overall yield of 40 kg/ha for the NCR in 1988/89 (Table 6.2.1) which is somewhat lower than that for the whole of Bangladesh (50 kg/ha) for the same period. The yield was valued at Tk30/kg based on average current (1991) prices in the NCR, which ranged from Tk25/kg for small miscellaneous species which dominated the overall catch to Tk.40/kg for larger species such as carp and catfish. This price was applied directly to catch rates to estimate the financial value of the yield per unit area.
Because of the lack of basic information concerning the operating and investment costs incurred by fisheries in different aquatic habitats, these have been ignored in the present analysis. In addition, no attempt has been made to apply an economic price rather than financial price to fish. Such a procedure was applied in an economic evaluation of fisheries of the SE Region (SERS 1991) using a standard conversion factor of 0.82 but the basis for its use was not clearly demonstrated. In a similar study carried out in the NW Region (NWRS 1991), an arbitrary estimate of fish production cost of Tk.10/kg was subtracted from the gross unit value (Tk.35/kg) of the combined catch from rivers, beels and floodplains. Again, the basis of this cost estimate was not substantiated.

Hydromodelling investigations have formed an essential component of the NCR study through the development of a coarse Pilot Computer Model (CPCM) of the region. After calibration of the model, quantitative assessments were made of the impact of various pre-selected engineering schemes on flooding patterns (both spatial and temporal) in each PU using river flow data of 1989. A summary of the schemes is given in Table 7.2.1. The assessments were based on reductions in floodplain area (F_1-F_3) resulting from various engineering interventions. Areal losses were integrated through time and space by taking into account temporal changes in floodplain area throughout the flood season. This graphical method is based on changes in the area under the flood curve (% area in F_1-F_3 category) due to FCD schemes. Typical curves for each flood category are shown in Figure III-7.1 using PU 6 as an example.

TABLE 7.2.1

Summary of Pre-Selected Schemes

Scheme Nr.	Scheme Name	Description	Main Planning Units Affected
RS1*	Jamalpur P.P. - main works	Major embankment + some compartmentalisation drainage/river improvement	PU1
RS2	Gopalpur - Bhuapur main drainage + Kauljani drainage	Major embankment + compartmentalisation + drainage/river improvement	PU1,PU2,PU4
RS3	Dhaleswari-Kaliganga main embankment	Major embankment + compartmentalisation	PU6a,PU7
RS4	Pungli-L.Bangshi-Buriganga river improvement /drainage	Main Drainage & River Improvement	PU2,PU6a,PU7,PU8
RS5	Eastern compartmentalisation	Major embankment + compartmentalisation	PU3
RS6	Bhuapur-Aricha embankment	Major embankment + compartmentalisation	PU6a,PU6b,PU10,PU7
RS7	Savar/Gazipur Improvement	Drainage Improvement	PU8,PU9
R01	Flood Warning	Flood Warning	All PU's
R02	Flood Proofing	Flood Proofing	All PU's
R03	Flood Preparedness	Flood Preparedness	PU's 4,6,7,10,11,13

Note * RS1 has been studied to Feasibility Level by FAP 3.1, which includes an analysis of the impact on fisheries

In Table 7.2.2 a worked example is given of the assessment of the impact of FCD scheme RS2 (Jamuna embankment and improved drainage) on the production and value of the capture fisheries in PU 4. The same method was applied in all cases where FCD schemes resulted in an estimated reduction in floodplain area (F_1-F_3) exceeding 5% (Table 7.2.3). A problem was encountered when applying this method to PU 6 where estimated losses in fish production almost equalled the size of the existing fishery. Since reductions in floodplain area ranged from 54% to 59%, it was clear that fish losses had been over estimated. This was probably due to the under-estimation of the size of the existing floodplain fishery using the FRSS system based on the number and average catch of fishing households. Such under estimation would also explain the surprisingly low estimates of yield of the floodplain fishery (17 kg/ha) in a PU which contains large areas of apparently good fishing grounds. An alternative approach was therefore used to assess the impact of FCD schemes on the fisheries in this PU. The method was based simply on applying the percentage reductions in floodplain area to the estimate yield of the capture fishery in 1988/89. The results obtained using this method provided a more realistic assessment of the impact of the various FCD schemes (Table 7.2.3).

TABLE 7.2.2

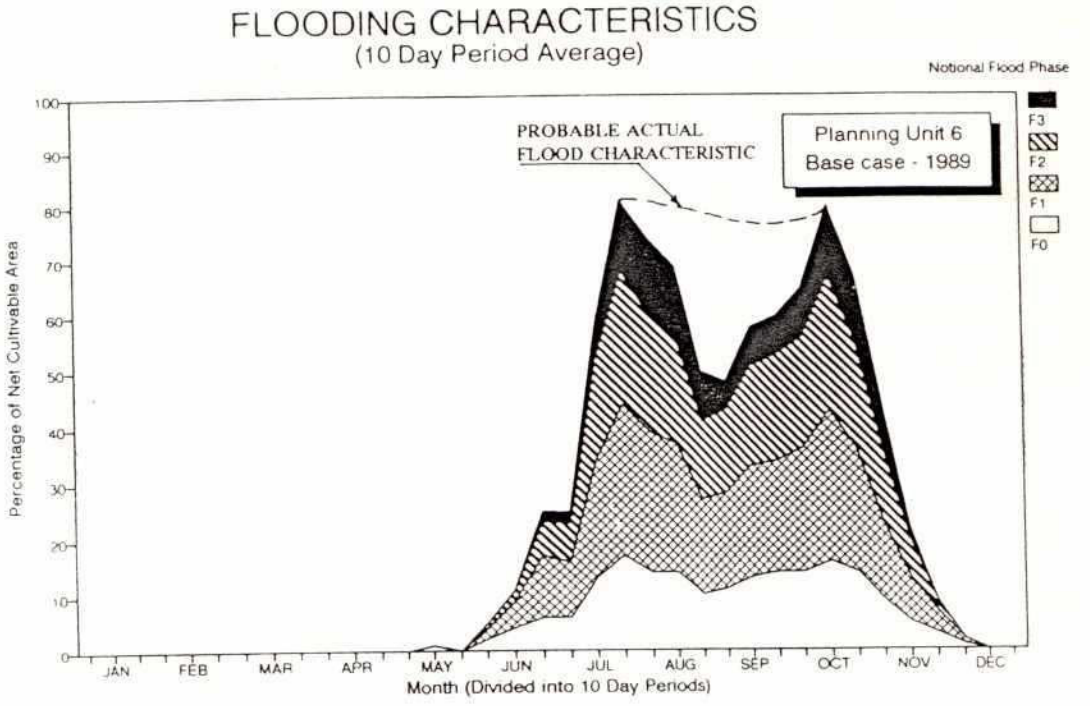
Impact of FCD Scheme RS2 on the Capture Fisheries on PU 4

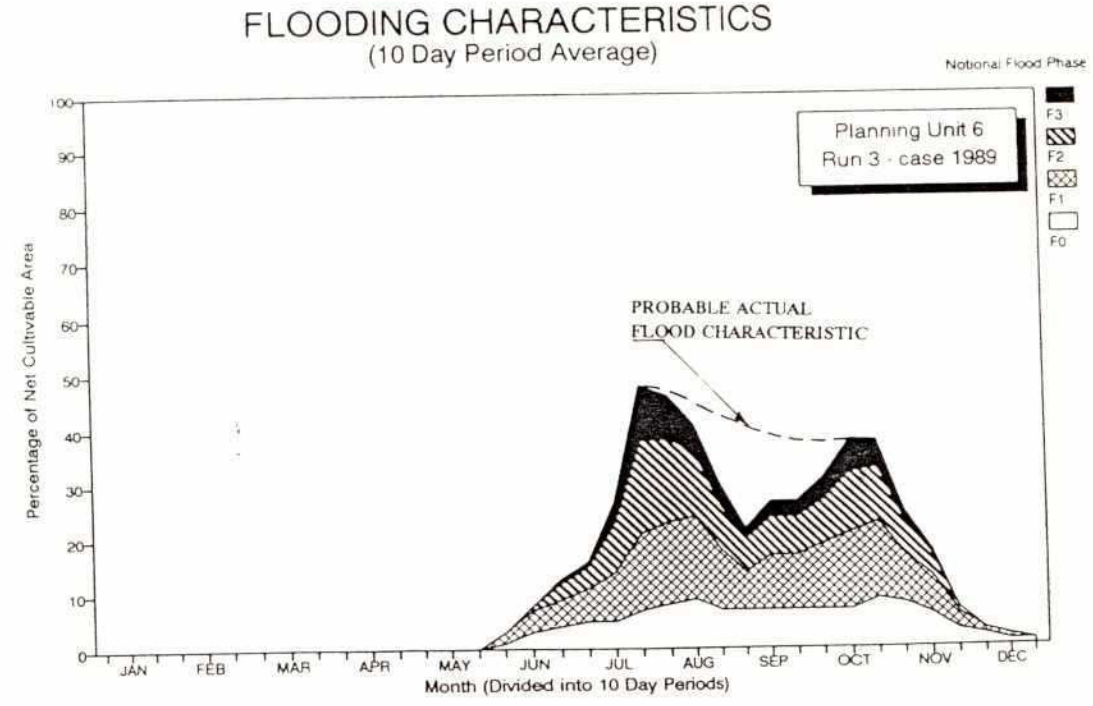
Item	Unit	Without Project				With Project
		River	Beel	Floodplain	Total	Total
Catch	t	35	147	919	1101	--
Unit Price	Tk/kg)	40	30	25	--	--
Value	Tk.mil.	1.4	4.4	23.0	28.8	16.7[1/]
F_1-F_3 area	ha	--	--	--	43815	10077
Change catch	%	--	--	--	--	- 37%
Value	%	--	--	--	--	- 42%

Note: 1. Lost catch valued @ Tk.30/kg on 403 tonnes (40 reduction kg/ha)

Source: CS 1992.

Figure III.7.1
Flooding Characteristics in PU 6





Source : PSR I, CS 1992

Under the range of FCD schemes examined, greatest reductions in floodplain area occurred in PUs 1,2,4,6,7,8 and 10 which resulted in highest losses (26-72%) of capture fisheries in PUs 4,6,7 and 10 (Table 7.2.3). Greatest reductions in floodplain area and capture fisheries resulted from the major embankment schemes relating to the Jamuna river alone, from Bhuapur to Aricha, or to the embankment of the Jamuna, Dhaleswari and Kaliganga rivers. Serious reductions in floodplain habitat were also recorded in PU 1 resulting from the embankment of the Jamuna and a restricted inflow of the Jhenai river, an offtake of the Old Brahmaputra river.

It is unfortunate that at the time of this short-term study no quantitative information had been generated by the CPCM concerning the potential changes in flooding regime due to the South West Dhaka Project. This scheme involves large-scale compartmentalisation in PUs 6,10 and 13 (Table 7.2.1) by the embankment of the Jamuna, Padma, Dhaleswari and Kaliganga rivers together with improved drainage facilities. Despite the present lack of quantitative data, it seems fairly certain that the scheme would significantly reduce both floodplain areas and capture fisheries of these PUs.

TABLE 7.2.3

Effect of FCD Options on Capture Fisheries Production and Catch Value in the NCR

PU	Scheme[1]	Reduciton in area of F_1-F_3 (%)	Without Project		With Project		Change (%)	
			(Tonnes)	(Tk)	(Tonnes)	(Tk)	Weight (%)	Value (%)
1	RS1	21	3373	108.9	2926	95.5	- 13	- 12
2	RS2	20	1584	45.4	1249	35.3	- 21	- 22
4	RS2	23	1101	28.8	698	16.7	- 37	- 42
5	RS2	8	3060	87.6	2893	82.6	- 5	- 6
6	RS6	54	2020	58.4	942	26.9	- 53	- 54
	RS6*	56	2020	58.4	902	25.7	- 55	- 56
	RS3+RS4	59	2020	58.4	842	23.9	- 58	- 59
7	RS4	9	1680	50.1	1467	43.7	- 13	- 13
	RS6	26	1680	50.1	1065	31.6	- 37	- 37
	RS6+RS4	25	1680	50.1	1088	32.3	- 35	- 36
	RS3+RS4	51	1680	50.1	473	13.9	- 72	- 72
8	RS6	13	664	19.4	599	17.4	- 10	- 10
	RS6+RS4	12	664	19.4	604	17.6	- 9	- 9
	RS3+RS4	23	664	19.4	549	15.9	- 17	- 18
10	RS4	9	1083	31.8	925	27.1	- 15	- 15
	RS6	18	1083	31.8	767	22.3	- 29	- 30
	RS6+RS4	16	1083	31.8	802	23.4	- 26	- 26
11	RS6+RS4	6	1308	46.7	1269	45.5	- 3	- 3
13	RS6+RS4	7	2931	90.3	2740	84.6	- 7	- 6

Note: 1 For details of schemes see Table 7.2.1;
Source: CS 1991

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Even in those schemes for which quantitative data on potential changes in flooding regimes were available, it was not possible to assess quantitatively certain impacts on fish resources and fisheries, because of the lack of information upon which to base estimates. For instance, it was not possible to quantify the effects of various FCD interventions, e.g. embankments, regulators, in terms of their disruption to, or prevention of, fish migrations between rivers and floodplains. It was also not possible to quantify the effects of changes in income distribution, or fish consumption, of rural communities resulting from the loss or reduction in open-access fishing grounds during the annual monsoon. Further socio-economic investigations are required to collect information of this kind which should then be incorporated into future impact assessments.

7.2.2 Culture Fisheries

One of the positive impacts on the fisheries sector which might be expected from the implementation of FCD schemes is the increased development of aquaculture under conditions of improved control over flooding and drought. However, from the many FCD/I schemes which have been established in Bangladesh there is little evidence to suggest that the potential for increased aquaculture production has been realised in flood protected areas. The Chandpur Irrigation Project (CIP) is often quoted as an example of the benefits of increased aquaculture development following FCD/I. However, this project is not typical since there was massive investment within the CIP. This involved the construction of the Raipur fish hatchery which encouraged the expansion of pond aquaculture not only within the CIP area but also in areas outside it. Thus, the direct effect of FCD/I on aquaculture development remains unclear.

As a result of the difficulties encountered in the interpretation of published data relating to pond aquaculture in the NCR (see Section 5.6), it was not possible to determine development trends; nor was it possible to rely, with any certainty, on the most recent estimates of pond production. Consequently, attempts to assess quantitatively the impact of the pre-selected FCD schemes in the NCR on culture fisheries was considered unrealistic. Instead, estimates of pond production were included in an overall assessment of the effects of FCD on fish resources but were assumed in all cases to remain unchanged. From the results obtained (Table 7.2.4), it is clear that even when culture fisheries are included in the analysis, the overall % reductions in fish production and its financial value remain high in PUs 2,4,6,7, and 10.

Although it has not been possible to assess quantitatively the effects of FCD schemes on aquaculture development in the NCR, it is probable that pond cultivation will expand in the future, both within and outside FCD areas, as part of a general diversification of agricultural activities (see Section 6.3). Within FCD areas, the shift from capture to culture fisheries will exacerbate the existing inequalities between different sections of the rural community. Beneficiaries of increased pond cultivation will include the more affluent farmers who already own ponds or land on which ponds can be constructed. Those worst affected will be the poor, landless subsistence fishermen and, in some cases, professional fishermen who are unable to obtain either income or food from aquaculture development.

TABLE 7.2.4
Effects of FCD Options on Total Fish Production and Catch Value in the NCR

TABLE 7.2.4

Effects of FCD Options on Total Fish Production and Catch Value in the NCR

PU	Scheme [1]	Reduction in area of F1 - F3 (%)	Without Project						With Project						Change	
			Capt		Cult		Total		Capt		Cult		Total		Weight	Value
			(tonnes)	Tk.	(tonnes)	Tk.	(tonnes)	Tk.	(tonnes)	Tk.	(tonnes)	Tk.	(tonnes)	Tk.	(%)	(%)
1	RS1	21	3373	108.9	428	15.6	3801	124.5	2926	95.5	428	15.6	3354	111.1	- 12	- 11
2	RS2	20	1584	45.4	330	11.6	1914	57.0	1249	35.3	330	11.6	1579	46.9	- 18	- 18
4	RS2	23	1101	28.8	316	10.6	1417	39.4	698	16.7	316	10.6	1014	27.3	- 28	- 31
5	RS2	8	3060	87.6	1437	51.2	4497	138.8	2893	82.6	1437	51.2	4330	133.8	- 4	- 4
6	RS6	54	2020	58.4	570	18.7	2590	77.1	942	26.9	570	18.7	1512	45.6	- 42	- 41
	RS6+RS4	56	2020	58.4	570	18.7	2590	77.1	902	25.7	570	18.7	1472	44.4	- 43	- 42
	RS3+RS4	59	2020	58.4	570	18.7	2590	77.1	842	23.9	570	18.7	1412	42.6	- 45	- 45
7	RS4	9	1680	50.1	712	25.6	2392	75.7	1467	43.7	712	25.6	2179	69.3	- 9	- 9
	RS6	26	1680	50.1	712	25.6	2392	75.7	1065	31.6	712	25.6	1777	57.2	- 26	- 24
	RS6+RS4	25	1680	50.1	712	25.6	2392	75.7	1088	32.3	712	25.6	1800	57.9	- 25	- 24
	RS3+RS4	51	1680	50.1	712	25.6	2392	75.7	473	13.9	712	25.6	1185	39.5	- 50	- 48
8	RS6	13	664	19.4	394	13.9	1058	33.3	599	17.4	394	13.9	993	31.3	- 6	- 6
	RS6+RS4	12	664	19.4	394	13.9	1058	33.3	604	17.6	394	13.9	998	31.5	- 6	- 5
	RS3+RS4	23	664	19.4	394	13.9	1058	33.3	549	15.9	394	13.9	943	29.8	- 11	- 11
10	RS4	9	1083	31.8	589	20.6	1672	52.4	925	27.1	589	20.6	1514	47.7	- 9	- 9
	RS6	18	1083	31.8	589	20.6	1672	52.4	767	22.3	589	20.6	1356	42.9	- 19	- 18
	RS6+RS4	16	1083	31.8	589	20.6	1672	52.4	802	23.4	589	20.6	1391	44.0	- 17	- 16
11	RS6+RS4	6	1308	46.7	223	8.0	1531	54.7	1269	45.5	223	8.0	1492	53.5	- 3	- 2
13	RS6+RS4	7	2931	90.3	977	34.2	3908	124.5	2740	84.6	977	34.2	3717	118.8	- 5	- 5

Note 1 : For details of schemes, see Table 7.2.1

Source : CS 1991

CHAPTER 8
PROPOSED FISHERIES PROJECTS

8.1 Background

In view of the substantial potential reductions in floodplain-dependent fisheries resulting from possible FCD schemes, it is clear that the future regional plan should consider the inclusion of fisheries research and development programmes to minimise and/or compensate for the adverse effects of FCD interventions. Such fisheries initiatives should be established in those areas which face the greatest potential reduction in their existing capture fisheries, i.e. PUs 4,6,7 and 10. It should be noted that whilst the impact of the South West Dhaka Project has not been assessed quantitatively here, it is almost certain to significantly reduce the fisheries of PUs 6,10 and 13 (see Section 7.2). Important reductions to the fisheries of PUs 1 and 2 have also been predicted but, in the case of PU 1, more detailed fisheries investigations are to be undertaken as part of the Jamalpur Priority Project (FAP 31).

Further information and analysis is required to be able to propose measures to mitigate or overcome any adverse impacts on fisheries. This should be done at the feasibility level of study when aspects such as changes in hydrological regimes of remaining habitats, increased surface water extraction from existing habitats, loss of natural stock replenishment, replacement of robust natural fisheries with agriculture and the increased risk of production loss due to disease and lower biodiversity should be discussed.

8.2 Proposed Projects

As part of the prospective North Central Regional Development Plan it is recommended that two fisheries projects be considered for inclusion. One focuses on efforts principally on capture fisheries while the other is concerned mainly with culture fisheries. The broad framework of each project is outlined below.

Compensation measures might include increased use of land for fish culture in lands that would be otherwise brought into rice cultivation etc.. Also pen and case culture on both semi-intensive and intensive levels in narrow rivers or khals, irrigation canals; the development of fish landing and fish marketing facilities might be appropriate.

Other recommendations include:-

- that of FAP 8A where the consultant has planned for some retarding areas, primarily planned for flood protection, should also be used for fish culture. With proper coordination as to the pond size, depth, and bank design, with adequate consideration for harvesting and restocking, these ponds could help compensate for the loss otherwise caused by the flood protection measures.

- mitigation of loss of fish production through artificial stocking of fingerlings, as has been carried out by the DOF from its Fish Seed Multiplication Farms (>100) and a few hatcheries, although there are too few of such initiatives to meet the present demand. After hatching , hatchlings must be maintained in a nursery area before distribution to farms and open waters for dispersal. There are a number of strategies that can be adopted:-
    - nursery area built next to hatchery (e.g. North West Fisheries Extension Project, Parbatipur)
    - nursery area built into seasonal beels (e.g. Third Fisheries Project)
    - use of nursery areas by individual farmers or cooperatives
    - use of cages as nursery pens in open waters
    - use of paddy fields as nurseries (e.g. North West Fisheries Project)

8.2.1 Fisheries sub-project FS1 - Jamuna-Dhaleswari System

Project Area : Planning Unit 6 (Figure 7.2.1)

Objectives : To conserve and enhance wild fish stocks by the establishment of a more effective fisheries management programme and by the introduction of mitigatory measures to reduce the adverse impact of FCD interventions.

Strategy : The proposed programme combines elements of both adaptive research and fisheries development which can be divided into the following components.

Component 1 : Research into the most appropriate design of water control structures such as sluice gates and regulators to facilitate the free passage of fish (adults, juveniles and fry) and shrimp between rivers and floodplain, thereby enhancing natural colonisation and reduce the adverse impacts of FCD. This component of the programme may involve collaboration with FAP 17, FAP 16 and FAP 13 in the determination of the optimum designs of various structures and with FAP 20 in the construction and testing of the performance of new structures in the project area.

Component 2 : Research into natural annual migrations/movements of fish (adult, juvenile and fry) between floodplain habitats and rivers. A much greater under standing is needed of the seasonal movements of fish to provide sound advice on the magnitude and timing of floods which are necessary for the maintenance of fish populations.

Component 3 : Research involving stock assessment of selected species in rivers, beels and floodplain habitats. This will provide information essential to the formulation of rational fisheries management and development policies and for a more accurate quantitative assessment of the impact of FCD schemes on capture fisheries. Close collaboration with FAP 17 and FAP 16 is envisaged during the implementation of this component of the programme.

Component 4 : Support of the district Department of Fisheries to enable it to effectively enforce fisheries regulations to protect and conserve fish stocks and to implement the New Fisheries Management Policy on those jalmahals recently transferred from the Ministry of Land, especially the jalmahal of the Dhaleswari river.

Component 5 : Protection of important large, perennial beels to conserve both water resources and the fisheries which they support from the adverse effects of FCD. One or two of the most important perennial beels should be designated as prohibited fishing zones to serve as natural reservoirs of floodplain fish stocks.

Component 6 : Provision of credit facilities to licensed fishermen involved in the NFMP. The most effective means of channelling credit to fishermen would appear to be through NGOs such as the Grameen Bank.

8.2.2 Fisheries Sub-project FS2 - Development of Aquaculture

Project Area: Planning Units 10 and 13.

Objectives : To encourage the spread of aquaculture in under utilised habitats and to explore the possibilities of utilising certain habitats for both fish and rice production.

Strategy : This project also contains elements of adaptive research and development which can be divided into the following components.

Before undertaking the project, an estimate of potential pond production indicating the anticipated future situation both with (W) and without (WO) FCD/FCDI projects should be made. Giving the numbers of fry, fingerlings, harvestable fish, weight of harvestable fish, pond area and yield (t/ha).

Component 1 : Stocking of carp fry by DOF and private sector hatcheries of under-utilised water bodies which are considered suitable for fish production. This component represents an extension and expansion of the stocking programme already undertaken by DOF in an effort to enhance major carp stocks in the NCR. It is important that a monitoring programme be established to determine the effectiveness of stocking different types of habitats, e.g. canals and beels at varying stocking densities, and to enforce fisheries regulations in those areas.

Component 2 : Support government institutions such as the Bangladesh Rice Research Institute and the Fisheries Research Institute in the implementation of research programmes concerned with rice/fish farming. The development of such integrated farming techniques should encourage mutual co-operation between the traditionally conflicting interests of fisheries and agriculture in areas of improved flood control and drainage.

Component 3 : Provision of credit to small-scale farmers to enable them to take advantage of the increased opportunities of aquaculture development using simple, low-cost, tried and tested techniques. The most effective channel for the provision of credit would seem to be NGOs such as the Grameen Bank.

Component 4 : Support of the district Department of Fisheries to enable it to effectively enforce fisheries regulations to protect wild and stocked fish and to implement aquaculture, extension and training programmes.

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MPO	1987b	Fisheries and flood control, drainage and irrigation. MPO Technical Report No. 17.
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NWRS	1991	Interim Report, North West Regional Study (FAP 2).Vol. 4, Annex 5, Fisheries. Report submitted to FPCO, Dhaka.

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SRIII - Fisheries
Annexes

Annex III.1

TERMS OF REFERENCE

Fishery Specialist

The fishery resource in the North Central Region has been identified as significant in both economic terms and in its contribution to the nutritional requirements of the people. The fishery specialist will work closely with the local fishery expert and the environmentalist in the following tasks:

i Estimate the fishery resources in the region (both capture and culture fisheries).

ii Assess the potential impacts of alternative development strategies on the fishery of resource.

iii Recommend measures to mitigate or overcome any adverse impacts on fisheries.

iv Make recommendations for fishery initiatives that may be incorporated into the regional development plan.

Organisations and Officials Consulted

Date	Organisation	Official	Contacted by
26.09.1991	Department of Fisheries	Mr.R.Banik Mr.Aziz Mr.S.Choudhury	JS, QJA
27.09.1991	Third Fisheries Project	Ms.J.Beckwith, Team Leader Mr.K.Fisher	JS
28.09.1991	Department of Fisheries	Mr.R.Banik Mr.S.Choudhury	JS, QJA
29.09.1991	BARC		JS, QJA
30.09.1991	SPARRSO	Mr. O.Kader, PSO	JS QJA
01.10.1991	BARC		QJA
04.10.1991	Department of Fisheries	Mr.K.A.Huq, Asstt.Director	QJA
06.10/1991	Department of Fisheries	Mr.Liaquat Ali, Asstt.Director Mr.R.Banik Mr.S.Choudhury Mrs.M.Begum, Deputy Chief,Planning	JS, QJA
07.10.1991	Department of Fisheries	Mr.Liaquat Ali, Asstt.Director	QJA
09.10.1991	ADAB	Mr.S.A.Ahmed,Prog Officer	QJA
11.10.1991	Department of Fisheries	Mrs.M.Begum,Deputy Chief,Plnning	QJA
13.10.1991	Department of Fisheries	Mr.A.al-Mehedi Asstt.Cartographer Mrs.R.Rani Das, Cartographer	JS, QJA
15.10.1991	MPO	Mr.A.Halim,D.Director,Fisheries	JS, QJA
15.10.1991	FAP-3.1	Mr.P.Ame, Fisheries Specialist	JS
15.10.1991	BRAC	Mr.A.Alan,Prog.Co-ordinator	QJA
16.10.1991	Department of Fisheries	Mr.Marsal, Asstt.Director	QJA
20.10.1991	World Bank (Library)	Mr.Imtiaz Uddin Ahmed,Prog.Oficer	JS, QJA
20.10.1991	ADAB	Mr.S.A.Ahmed,Prog.Officer	QJA
22.10.1991	Aquaculture Extension Project, Mymensingh(DANIDA)	Mr.N.A.Aleeny Training Officer Mr.R.Jansen Aqua.Exten.Advisor Mr.D.Deppert	JS, QJA
22.10.1991	Upazila Fisheries Office Muktagacha and Boril beel	Mr.R.C.Sarker Asstt.U.F.O. Mr.R.A.Fakulip F.A Proj. Training Officer, AEP Fishermen	JS, QJA

Note : JS - James Scullion
QJA - Q.J.Ahmed

Total Number of Fishing Villages and Boats on the Rivers Jamuna and Lower Padma in Planning Units of the NCR

Planning Unit	Jamuna River	Villages			Boats
		Seasonal	Permanent	Total	
1	Jamuna	4	14	18	154
2	Jamuna	3	9	12	190
4	Jamuna	1	7	8	117
6	Jamuna	0	6	6	31
10	Jamuna & lower Padma	11	13	24	395
13	Lower Padma	30	38	68	2027
NCR		49	87	136	2914

Source : DOF 1980-81

Total Number of Fishing and Boats on Major Rivers in Planning Units of the NCR

Planning Unit	River	Villages			Boats
		Seasonal	Permanent	Total	
1	Old Brahmaputra	5	4	9	273
2	Old Brahmaputra	1	2	3	49
3	Old Brahmaputra & Lakhya	1	21	22	339
5	Lakhya	0	8	8	275
6	Dhaleswari	0	17	17	180
7	Dhaleswari	0	13	13	125
9	Lakhya	0	16	16	198
11	Dhaleswari & Lakhya	0	10	10	240
12	Lakhya	1	1	2	74
13	Dhaleswari	0	5	5	60
NCR		8	97	105	1813

Note : Major rivers as defined in DOF 1980-81. None located in PU4.

Source : DOF, 1980-81

Annex III-5

Total Number of Fishing Villages and Boats on Minor Rivers in Planning Units of the NCR

Planning Units	River	Villages			Boats
		Seasonal	Permanent	Total	
3	Banar	21	19	40	146
5	Banar	16	14	30	101
7	Bangsi & Kaliganga	0	22	22	218
8	Bangsi	0	6	6	111
10	Kaliganga	0	5	5	72
11	Buruganga	0	15	15	376
12	Buriganga	0	2	2	29
NCR		37	83	120	1053

Note : Minor rivers as defined in the FRSS Frame Survey, DOF 1980-81. None located in PU4.

Source : DOF, 1980-81.

Major Rivers of the North Central Region

Rivers	Length (km)
Principal Rivers	
Jamuna	198
Padma (Lower)	104
Total	**302**
Other Rivers	
Bajua	25
Balu	30
Banar	120
Bangshi	153
Bangshi south	71
Barinda	31
Buriganga	22
Chatal	55
Chatal south	21
Dhaleswari	145
Dhaleswari south	46
Dhantara	14
Elangjani	29
Futikjani	51
Tehamati	44
Jhenai	90
Jhenai east	32
Jhenai west	11
Kaliganga	62
Kaoraid	14
Khiro	45
Khiro south	39
Lakhya	115
Louhajang	60
Nangali north	17
Nangali south	16
Old Brahmaputra	175
Pungli	56
Shilla	62
Spill Channels of Jamuna River	36
Sutia	75
Turag	55
Total	1817
Grand Total : Principal + Other Rivers	**2119**

Source : CS, 1991

Major Rivers within each Planning Unit of the NCR

Planning Unit	River	Length
1	Chatal	55
	Chatal south	21
	Jamuna	98
	Jhenai	36
	Old Brahmaputra	50
	Sub–Total	**260**
2	Bangshi	15
	Futikjani	6
	Jamuna	18
	Jhenai	54
	Jhenai east	32
	Jhenai west	11
	Old Brahmaputra	7
	Sub–Total	**143**
3	Banar	120
	Kaoraid	7
	Khiro	45
	Khiro south	39
	Lakhya	14
	Old Brahmaputra	118
	Shilla	75
	Sutia	62
	Sub–Total	**480**
4	Bangshi	39
	Dhaleswari north	11
	Futikjani	44
	Jamuna	11
	Nangali north	17
	Nangali south	16
	Pungli	28
	Sub–Total	**166**
5	Bajua	25
	Banar	4
	Bangshi	59
	Kaoraid	7
	Lakhya	12
	Turag	8
	Sub–Total	**115**
6	Bangshi	12
	Barinda	15
	Dhaleswari	42
	Dhaleswari north	35
	Elangjani	29
	Jamuna	48
	Kaliganga	4
	Louhajang	60
	Makal	9
	Pungli	28
	Spill Channels of Jamuna	36
	Sub–Total	**318**

Planning Unit	River	Length
7	Bangshi	12
	Bangsi south	40
	Barinda	15
	Dhaleswari	63
	Dhantura	14
	Kaliganga	31
	Sub–Total	**175**
8	Bangshi	16
	Karnatali	6
	Tongi khal	4
	Turag	37
	Sub–Total	**63**
9	Balu	12
	Lakhya	59
	Sub–Total	**71**
10	Dhaleswari	4
	Ichamati	22
	Jamuna	23
	Kaliganga	27
	Padma	31
	Sub–Total	**107**
11	Buriganga	11
	Dhaleswari	24
	Karnatali	6
	Lakhya	6
	Turag	2
	Sub–Total	**49**
12	Balu	19
	Buriganga	12
	Lakhya	24
	Tongi khal	4
	Turag	7
	Sub–Total	**66**
13	Dhaleswari	14
	Ichamati	22
	Padma	73
	Sub–Total	**109**
	Total NCR	**2122**

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Total Numbers and Area of Beels in each Upazila of the NCR

Name of Upazila	Planning Unit 1					Planning Unit 2					Planning Unit 3					Planning Unit 4					Planning Unit 5					Planning Unit 6				
	No.	Area (ha)	% of Upa-Zila	No.	Area (ha)	% of Upa-Zila	No.	Area (ha)	% of Upa-Zila	No.	Area (ha)	% of Upa-Zila	No.	Area (ha)	% of Upa-Zila	No.	Area (ha)	% of Upa-Zila	No.	Area (ha)	% of Upa-Zila	No.	Area (ha)	% of Upa-Zila	No.	Area (ha)
Dhaka	-	-		0	0		0	0		0	0		0	0		0	0		0	0		0	0		0	0
Dhamrai	6	84		0	0		0	0		0	0		0	0		0	0		0	0		0	0		0	0
Dohar	2	2024		0	0		0	0		0	0		0	0		0	0		0	0		0	0		0	0
Keraniganj		-		0	0		0	0		0	0		0	0		0	0		0	0		0	0		0	0
Nawabganj		-		0	0		0	0		0	0		0	0		0	0		0	0		0	0		0	0
Savar	2	20		0	0		0	0		0	0		0	0		0	0		0	0		0	0		0	0
Total	10	2128		0	0		0	0		0	0		0	0		0	0		0	0		0	0		0	0
Joydevpur	-	-		0	0		0	0		0	0		0	0		0	0	20	0	0		0	0		0	0
Kaliakair	-	603		0	0		0	0		0	0		0	0		0	0	48	0	289	6	0	36		0	0
Kaliganj	1	-		0	0		0	0		0	0		0	0		0	0		0	0		0	0		0	0
Kapasia	4	901		0	0		0	0		0	0		0	0		0	0		0	0		0	0		0	0
Sripur	103	-		0	0		0	0		0	0		0	0		0	0	68	70	0		0	0		0	0
Tongi	-	-		0	0		0	0		0	0		0	0		0	0		0	0		0	0		0	0
Total	108	1504		0	0		0	0		0	0		0	0		0	0		70	289		0	36		0	0
Dewanganj	4	31	12	0.48	4		0	0		0	0		0	0		0	0		0	0		0	0		0	0
Islampur	16	106	52	8	35		0	0		0	0		0	0		0	0		0	0		0	0		0	0
Jamalpur	18	249	17	3	42	30	5	75	25	5	62		0	0		0	0	19	3	47		0	0		0	0
Madarganj	4	124	100	4	124		0	0		0	0		0	0		0	0		0	0		0	0		0	0
Melandaha	12	89	100	12	89		0	0		0	0		0	0		0	0		0	0		0	0		0	0
Serishebari	7	240	44	3	106	52	4	125		0	0		0	0		0	0		0	0		0	0		0	0
Total	61	839		31	420		9	200		5	62		0	0		0	0		3	47		0	0		0	0
Daulatpur	12	65		0	0		0	0		0	0		0	0		0	0		0	0	33	4	21		0	0
Ghior	3	435		0	0		0	0		0	0		0	0		0	0		0	0	23	1	100		0	0
Harirampur	4	55		0	0		0	0		0	0		0	0		0	0		0	0		0	0		0	0
Manikganj	-	-		0	0		0	0		0	0		0	0		0	0		0	0		0	0		0	0
Saturia	7	8		0	0		0	0		0	0		0	0		0	0		0	0	9	1	1		0	0
Shibalaya	-	-		0	0		0	0		0	0		0	0		0	0		0	0		0	0		0	0
Singair	2	131		0	0		0	0		0	0		0	0		0	0		0	0		0	0		0	0
Total	28	694		0	0		0	0		0	0		0	0		0	0		0	0		5	122		0	0
Lohajang	-	-		0	0		0	0		0	0		0	0		0	0		0	0		0	0		0	0
Munshiganj	-	-		0	0		0	0		0	0		0	0		0	0		0	0		0	0		0	0
Sirajdikhan	-	-		0	0		0	0		0	0		0	0		0	0		0	0		0	0		0	0
Srinagar	-	-		0	0		0	0		0	0		0	0		0	0		0	0		0	0		0	0
Tongiberi	-	21		0	0		0	0		0	0		0	0		0	0		0	0		0	0		0	0
Total	0	21		0	0		0	0		0	0		0	0		0	0		0	0		0	0		0	0
Bhaluka	30	130		0	0		0	0	26	8	34		0	0	74	22	96		0	0		0	0		0	0
Fulberia	28	2980		0	0		0	0	75	21	2235		0	0	25	7	745		0	0		0	0		0	0
Gaffargaon	192	2583		0	0		0	0	97	186	2506		0	0		0	0		0	0		0	0		0	0
Muktagachha	3	15		0	0		0	0	84	3	13		0	0	16	0.48	2		0	0		0	0		0	0
Mymensingh	-	-		0	0		0	0	62	0	0		0	0		0	0		0	0		0	0		0	0
Trishal	9	-		0	0		0	0	100	9	0		0	0		0	0		0	0		0	0		0	0
Total	262	5708		0	0		0	0		227	4787		0	0		0	0		30	844		0	0		0	0
Narayanganj	-	-		0	0		0	0		0	0		0	0		0	0		0	0		0	0		0	0
Rupganj	-	-		0	0		0	0		0	0		0	0		0	0		0	0		0	0		0	0
Total	0	0		0	0		0	0		0	0		0	0		0	0		0	0		0	0		0	0
Basail	30	102		0	0		0	0		0	0	68	20	69		0	0	32	10	33						
Bhuapur	25	808		0	0	29	7	234		0	0	38	10	307		0	0		0	0						
Delduar	3	30		0	0		0	0		0	0		0	0		0	0	100	3	30						
Ghatail	22	45		0	0	5	1	2		0	0	61	13	27	34	7	15		0	0						
Gopalpur	10	140		0	0	100	10	140		0	0		0	0		0	0		0	0						
Kalihati	25	167		0	0		0	0		0	0	77	19	129		0	0	18	5	30						
Madhupur	49	272		0	0	33	16	90		0	0	9	4	24	58	28	158		0	0						
Mirjapur	29	283		0	0		0	0		0	0	4	1	11	37	11	105	53	15	150						
Nagarpur	4	13		0	0		0	0		0	0		0	0		0	0	95	4	12						
Sakhipur	1	5		0	0		0	0		0	0		0	0	100	1	5		0	0						
Tangail	2	38		0	0		0	0		0	0		0	0		0	0	99	2	38						
Total	200	1903		0	0		35	466		0	0		68	568		48	283		38	293						
	669	12797		31	420		44	666		231	4849		68	568		151	1463		44	451						

Name of Upazila	Planning Unit 7					Planning Unit 8			Planning Unit 9			Planning Unit 10			Planning Unit 11			Planning Unit 12			Planning Unit 13		
	No.	Area	% of Upa-	No.	Area	% of Upa-	No.	Area	% of Upa-	No.	Area	% of Upa-	No.	Area	% of Upa-	No.	Area	% of Upa-	No.	Area	% of Upa-	No.	Area
Dhaka	-	-		0	0		0	0		0	0		0	0		0	0	100	0	0		0	0
Dhamrai	6	84	100	6	84		0	0		0	0		0	0		0	0		0	0		0	0
Dohar	2	2024		0	0		0	0		0	0		0	0		0	0		0	0	96	2	1943
Keraniganj			11	0	0		0	0		0	0		0	0	89	0	0		0	0		0	0
Nawabganj			5	0	0		0	0		0	0	49	0	0		0	0		0	0	46	0	0
Savar	2	20	5	0.10	1	77	2	15		0	0		0	0	18	0.36	4		0	0		0	0
Total	10	2128		6	85		2	15		0	0		0	0		0.36	4		0	0		2	1943
Joydevpur				0	0	23	0	0	57	0	0		0	0		0	0		0	0		0	0
Kaliakair	-	603	6	0	36	40	0	241		0	0		0	0		0	0		0	0		0	0
Kaliganj	1			0	0		0	0	100	1	0		0	0		0	0		0	0		0	0
Kapasia	4	901		0	0		0	0	31	1	279		0	0		0	0		0	0		0	0
Sripur	103			0	0		0	0	32	33	0		0	0		0	0		0	0		0	0
Tongi	-			0	0	68	0	0	32	0	0		0	0		0	0		0	0		0	0
Total	108	1504		0	36		0	241		35	279		0	0		0	0		0	0		0	0
Dewanganj	4	31		0	0		0	0		0	0		0	0		0	0		0	0		0	0
Islampur	16	106		0	0		0	0		0	0		0	0		0	0		0	0		0	0
Jamalpur	18	249		0	0		0	0		0	0		0	0		0	0		0	0		0	0
Madarganj	4	124		0	0		0	0		0	0		0	0		0	0		0	0		0	0
Melandaha	12	89		0	0		0	0		0	0		0	0		0	0		0	0		0	0
Serishebari	7	240		0	0		0	0		0	0		0	0		0	0		0	0		0	0
Total	61	839		0	0		0	0		0	0		0	0		0	0		0	0		0	0
Daulatpur	12	65		0	0		0	0		0	0	42	5	27		0	0		0	0		0	0
Ghior	3	435	6	0.18	26		0	0		0	0	71	2	309		0	0		0	0		0	0
Harirampur	4	55		0	0		0	0		0	0	60	2	33		0	0		0	0	6	0	3
Manikganj	-	-	70	0	0		0	0		0	0	30	0	0		0	0		0	0		0	0
Saturia	7	8	91	6	7		0	0		0	0		0	0		0	0		0	0		0	0
Shibalaya	-	-		0	0		0	0		0	0	82	0	0		0	0		0	0		0	0
Singair	2	131	100	2	131		0	0		0	0		0	0		0	0		0	0		0	0
Total	28	694		9	164		0	0		0	0		10	369		0	0		0	0		0	3
Lohajang	-	-		0	0		0	0		0	0		0	0		0	0		0	0	100	0	0
Munshiganj	-	-		0	0		0	0		0	0		0	0	4	0	0		0	0	81	0	0
Sirajdikhan	-	-		0	0		0	0		0	0	4	0	0	14	0	0		0	0	82	0	0
Srinagar	-	-		0	0		0	0		0	0		0	0		0	0		0	0	90	0	0
Tongiberi	-	21		0	0		0	0		0	0		0	0		0	0		0	0	100	0	21
Total	0	21		0	0		0	0		0	0		0	0		0	0		0	0		0	21
Bhaluka	30	130		0	0		0	0		0	0		0	0		0	0		0	0		0	0
Fulberia	28	2980		0	0		0	0		0	0		0	0		0	0		0	0		0	0
Gaffargaon	192	2583		0	0		0	0		0	0		0	0		0	0		0	0		0	0
Muktagachha	3	15		0	0		0	0		0	0		0	0		0	0		0	0		0	0
Mymensingh	-	-		0	0		0	0		0	0		0	0		0	0		0	0		0	0
Trishal	9	-		0	0		0	0		0	0		0	0		0	0		0	0		0	0
Total	262	5708		0	0		0	0		0	0		0	0		0	0		0	0		0	0
Narayanganj	-	-		0	0		0	0		0	0		0	0	23	0	0	57	0	0	20	0	0
Rupganj	-	-		0	0		0	0	50	0	0		0	0		0	0	13	0	0		0	0
Total	0	0		0	0		0	0		0	0		0	0		0	0		0	0		0	0
Basail	30	102		0	0		0	0		0	0		0	0		0	0		0	0		0	0
Bhuapur	25	808		0	0		0	0		0	0		0	0		0	0		0	0		0	0
Delduar	3	30		0	0		0	0		0	0		0	0		0	0		0	0		0	0
Ghatail	22	45		0	0		0	0		0	0		0	0		0	0		0	0		0	0
Gopalpur	10	140		0	0		0	0		0	0		0	0		0	0		0	0		0	0
Kalihati	25	167		0	0		0	0		0	0		0	0		0	0		0	0		0	0
Madhupur	49	272		0	0		0	0		0	0		0	0		0	0		0	0		0	0
Mirjapur	29	283	6	2	17		0	0		0	0		0	0		0	0		0	0		0	0
Nagarpur	4	13	3	0.20	1		0	0		0	0		0	0		0	0		0	0		0	0
Sakhipur	1	5		0	0		0	0		0	0		0	0		0	0		0	0		0	0
Tangail	2	38		0	0		0	0		0	0		0	0		0	0		0	0		0	0
Total	200	1903		2	18		0	0		0	0		0	0		0	0		0	0		0	0
	669	12797		17	303		2	257		35	279		10	369		0.36	4		0	0		2	1967

Note '-' denotes no data available

Source: LGED database based on
Pre-1985 Upazila Statistics
Fap-3 Reconnaissance Study
Department of Fisheries

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Annex III.9

Percentage Area of Upazilas in each Planning Unit of the NCR

Planning Unit No.	Planning Unit Area (ha)	Upazila	% of Upazilla area
1	105,458	Dewanganj	12
		Islampur	52
		Melandaha	100
		Madarganj	100
		Jamalpur	17
		Sarishabari	44
2	72,109	Jamalpur	30
		Sarishabari	52
		Madhupur	33
		Gopalpur	100
		Ghatail	5
		Bhuapur	29
3	171,426	Jamalpur	25
		Muktagacha	84
		Mymensingh	62
		Phulbaria	75
		Trisal	100
		Gafargaon	97
		Bhaluka	26
4	77,305	Madhupur	9
		Ghatail	61
		Bhuapur	38
		Kalihati	77
		Basail	68
		Mirzapur	4
5	222,343	Mirzapur	19
		Muktagacha	16
		Phulbaria	25
		Bhaluka	74
		Madhupur	58
		Ghatail	34
		Sakhipur	100
		Mirzapur	37
		Kaliakair	48
		Sripur	68
		Gazipur	20
6	119,160	Kalihati	18
		Basail	32
		Tangail	99
		Delduar	100
		Nagarpur	95
		Mirzapur	53
		Kaliakair	6
		Daulatpur	33
		Ghior	23
		Saturia	9
7	92,220	Nagarpur	5
		Mirzapur	6
		Kaliakair	6
		Ghior	6
		Saturia	91
		Manikganj	70
		Singair	100
		Dhamria	100
		Savar	5
		Nawabganj	5
		Keraniganj	11
8	51,417	Kaliakair	40
		Gazipur	23
		Tongi	68
		Savar	77
9	76,382	Sripur	32
		Kapasia	31
		Gazipur	57
		Kaliganj	100
		Tongi	32
10	69,246	Daulatpur	42
		Shibalaya	82
		Ghior	71
		Manikganj	30
		Harirampur	60
		Nawabganj	49
		Sirajdikhan	4
11	27,724	Savar	18
		Keraniganj	89
		Sirajdikhan	14
		Munshiganj	4
		Narayanganj	23
12	44,392	Dhaka	100
		Narayanganj	57
		Rupganj	13
13	101,780	Harirampur	6
		Nawabganj	46
		Dohar	96
		Srinagar	90
		Sirajdikhan	82
		Lauhajang	100
		Tongibari	100
		Munshiganj	81
		Narayanganj	20

Source : CS 1991

Total Numbers & Area of Beels in each Planning Unit of the NCR

Planning Unit	BEELS	
	Number	Area(ha)
1	31	420
2	44	666
3	231	4849
4	68	568
5	151	1463
6	44	451
7	17	303
8	2	257
9	35	279
10	10	369
11	1	4
12	0	0
13	2	1967
NCR	636	11596

Source: Derived from LGEB data based on Pre–1983 Upazila Statistics, and NCRS 1990

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Percentage Area of Each Planning Unit Categorised by the Depth of Flooding

Planning Unit	Area (ha)		FO	F1	F2	F3
	Total	Cultivated				
1	89,351	70,009	24	55	21	<1
2	73,963	59,850	30	48	17	5
3	172,391	127,979	27	51	20	2
4	76,170	58,420	25	40	27	8
5	212,467	121,318	57	29	9	4
6	114,395	95,880	15	48	29	8
7	90,090	67,238	12	39	27	22
8	46,065	27,192	54	19	16	11
9	78,936	57,757	54	19	12	15
10	67,187	48,255	9	21	40	30
11	24,987	18,564	12	24	22	42
13	101,485	76,616	11	22	24	43
NCR	1,147,487	829,078	31	36	19	14

Note : 1. The classification system is based on that used by MPO and the Soil Resources Development Unit according to depth of flooding in a normal year as follows :

FO = Highland with no inundation or inundation less then 30 cm.
F1 = Medium highland, shallowly inundated from 30–90 cm.
F2 = Medium lowland, inundated from 90–180 cm.
F3 = Lowland, flooded from 180–360 cm.

Settlements and water bodies are not included in the above percentage. The classification is based on patterns of crop suitability and is not based on actual measured flood depths.

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Total Number, Area and Type of Pond in each Upazila of the NCR

DISTRICT	UPAZILA Sl. No	Upazila Name	NUMBER OF PONDS Total	Cultured	Culturable	Derelict	AREA OF PONDS (ha) Total	Cultured	Culturable	Derelict	Planning Unit 1 % of Upazila	NUMBER OF PONDS Total	Cultured	Culturable	Derelict	AREA OF PONDS (ha) Total	Cultured	Culturable	Derelict	Planning Unit 2 % of Upazil	NUMBER OF PONDS Total	Cultured	Culturable	Derelict	AREA OF PONDS (ha) Total	Cultured	Culturable	Derelict
	*	Dhaka	1709	514	623	572	430	124	146	160		0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
	01.	Dhamrai	2339	764	574	1001	243	94	105	44		0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
	02.	Dohar	1340	426	354	560	169	61	69	40		0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
DHAKA	03.	Keraniganj	1298	414	304	580	112	49	54	9		0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
	04.	Nawabganj	1869	603	453	813	224	72	83	69		0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
	05.	Savar	2113	682	519	912	213	85	91	36		0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
		TOTAL	10668	3403	2827	4438	1390	485	547	358		0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
	06.	Joydevpur	3218	1027	852	1339	407	146	165	96		0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
	07.	Kaliakair	2258	720	599	939	286	103	116	67		0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
GAZIPUR	08.	Kaliganj	1411	450	374	587	179	64	72	42		0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
	09.	Kapasia	2559	817	677	1065	324	116	131	77		0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
	10.	Sripur	3349	1068	888	1393	423	152	172	100		0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
	11.	Tongi	433	138	115	180	55	20	22	13		0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
		TOTAL	13228	4220	3505	5503	1674	601	679	394		0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
	12.	Dewanganj	811	335	167	309	114	49	34	32	12	97	40	20	37	14	6	4	4		0	0	0	0	0	0	0	0
	13.	Islampur	1039	429	214	396	147	62	43	41	52	540	223	111	206	76	32	22	21		0	0	0	0	0	0	0	0
JAMALPUR	14.	Jamalpur	1472	608	303	561	208	88	61	58	17	250	103	52	95	35	15	10	10	30	442	182	91	168	62	26	18	17
	15.	Madarganj	716	296	148	272	101	43	30	28	100	716	296	148	272	101	43	30	28		0	0	0	0	0	0	0	0
	16.	Melandaha	732	302	151	279	103	44	30	29	100	732	302	151	279	103	44	30	29		0	0	0	0	0	0	0	0
	17.	Sarishabari	787	325	162	300	111	47	33	31	44	346	143	71	132	49	21	14	14	52	409	169	84	156	58	25	17	16
		TOTAL	5557	2295	1145	2117	783	334	230	219		2682	1108	553	1021	378	161	111	106		851	351	175	324	120	51	35	33
	18.	Daulatpur	1637	522	434	681	207	74	84	49		0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
	19.	Ghior	1035	330	275	430	131	47	53	31		0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
	20.	Harirampur	1787	570	474	743	226	81	91	53		0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
MANIKGANJ	21.	Manikganj	1392	444	368	580	176	63	71	42		0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
	22.	Saturia	1167	373	309	485	148	53	60	35		0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
	23.	Shibalaya	1411	450	374	587	179	64	72	42		0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
	24.	Singair	1524	486	404	634	193	69	78	45		0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
		TOTAL	9955	3175	2638	4140	1259	452	511	296		0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
	25.	Lohajang	922	294	245	383	117	42	47	28		0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
	26.	Munshiganj	1280	408	339	533	162	58	66	38		0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
	27.	Sirajdikhan	1298	414	344	540	164	59	67	38		0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
MUNSHIGANJ	28.	Srinagar	1381	504	419	658	200	72	81	47		0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
	29.	Tongibari	1185	379	314	492	150	54	61	35		0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
		TOTAL	6266	1999	1661	2606	793	285	321	187		0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
	30.	Bhaluka	3609	2194	884	531	405	311	59	35		0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
	31.	Fulbaria	3947	2400	967	580	443	340	65	38		0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
	32.	Gaffargaon	3187	1938	781	468	357	274	52	31		0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
MYMENSINGH	33.	Muktagachha	2448	1488	600	360	275	211	40	23		0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
	34.	Mymensingh	3040	1848	745	447	341	262	50	29		0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
	35.	Trishal	2026	1232	496	298	228	175	33	19		0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
		TOTAL	18257	11100	4473	2684	2049	1574	299	176		0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
NARAYANGANJ	36.	Narayanganj	1477	464	579	434	248	93	96	59		0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
	37.	Rupganj	1313	477	254	582	136	37	55	43		0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
		TOTAL	2790	941	833	1016	383	130	151	102		0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
	38.	Basail	519	214	107	198	73	31	21	21		0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
	39.	Bhuapur	693	286	143	264	98	41	29	28		0	0	0	0	0	0	0	0	29	201	83	41	77	28	12	8	8
	40.	Delduar	630	260	130	240	89	38	26	25		0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
	41.	Ghatail	1307	540	269	498	184	79	54	51		0	0	0	0	0	0	0	0	5	65	27	13	25	9	4	3	3
	42.	Gopalpur	630	260	130	240	89	38	26	25		0	0	0	0	0	0	0	0	100	630	260	130	240	89	38	26	25
	43.	Kalihati	937	387	193	357	132	56	39	37		0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
TANGAIL	44.	Madhupur	1464	605	301	558	206	88	61	58		0	0	0	0	0	0	0	0	33	483	200	99	184	68	29	20	19
	45.	Mirjapur	1118	462	230	426	158	67	47	44		0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
	46.	Nagarpur	984	406	203	375	139	59	41	39		0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
	47.	Sakhipur	1275	527	262	486	180	77	53	51		0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
	48.	Tangail	787	325	162	300	111	47	33	31		0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
		TOTAL	10544	4272	2130	3942	1458	621	429	409		0	0	0	0	0	0	0	0		1379	570	284	526	194	83	57	55
N.C.R.		GRAND TOTAL	77063	31405	19212	26446	9790	4482	3167	2140		2682	1108	553	1021	378	161	111	106		2230	921	459	850	314	134	92	88

Source file :C:\FAP3\FISH\SCLN_PN1.WK1

Annex–III.13

Total Number, Area and Type of Pond in each Planning Unit

Planning Unit Number	NUMBER OF PONDS				AREA OF PONDS (ha)			
	Total	Cultured	Culturable	Derelict	Total	Cultured	Culturable	Derelict
1	2682	1108	553	1021	378	161	111	106
2	2230	921	459	850	314	134	92	88
3	13325	8030	3250	2045	1506	1139	228	139
4	2312	955	476	881	326	139	96	91
5	11315	5087	2724	3504	1421	727	407	287
6	4289	1675	944	1670	590	243	188	159
7	6555	2121	1675	2759	769	285	317	167
8	3564	1143	913	1508	409	154	170	86
9	5905	1913	1517	2475	732	257	297	178
10	5037	1610	1315	2112	631	223	252	156
11	2108	672	559	877	224	91	98	35
12	2721	840	986	895	589	182	208	199
13	8180	2610	2185	3385	1041	371	417	252
N.C.R	70223	28685	17556	23982	8930	4105	2881	1944

Source : DOF 1986

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Annual Catch from Different Aquatic Habitats – in each former district of the NCR

Types of Water Bodies	Year					
	83/84	84/85	85/86	86/87	87/88	88/89
PRINCIPAL RIVERS (1)						
Dhaka	2800	2425	1892	1852	940	1075
Jamalpur	589	NA	788	1567	1316	1430
Mymensingh	–	–	–	–	–	–
Tangail	896	305	207	135	175	94
District Total	**4285**	**2730**	**2887**	**3554**	**2431**	**2599**
Bangladesh Total	**91701**	**76285**	**97835**	**91755**	**75288**	**75428**
OTHER RIVERS						
Dhaka	6083	6953	6073	7911	6189	3641
Jamalpur	548	1239	485	803	792	533
Mymensingh	7145	15916	8978	9796	12132	10681
Tangail	NA	1065	482	456	894	444
District Total	**13776**	**25173**	**16018**	**18966**	**20007**	**15299**
Bangladesh Total	**116065**	**136772**	**101765**	**103362**	**108529**	**105712**
BEELS (2)						
Dhaka	2213	1191	1500	1410	1164	1103
Jamalpur	NA	NA	NA	NA	NA	NA
Mymensingh	13233	13734	12811	13152	13479	15478
Tangail	1050	1003	839	628	642	603
District Total	**16496**	**15928**	**15150**	**15190**	**15285**	**17184**
Bangladesh Total	**51373**	**45893**	**45258**	**42077**	**45610**	**47019**
FLOODPLAIN						
Dhaka	24127	24127	19594	19887	20587	21300
Jamalpur	2866	2619	3784	3564	3875	4965
Mymensingh	7374	6731	11030	12434	12437	11826
Tangail	2614	2379	2920	3926	3901	4411
District Total	**36981**	**35856**	**37328**	**39811**	**40800**	**42502**
Bangladesh Total	**200616**	**194130**	**187396**	**183796**	**182037**	**186126**

Note: 1 (a) Data for Dhaka district includes the Jamuna and Lower Padma rivers only; catch data from the Upper Meghna have been omitted.

1 (b) Catch Statistics for 1984/85 refer only to the Brahmaputra River in Jamalpur district and have therefore been omitted.

2 Catch data from beels in Jamalpur district have been combined with those from Mymensingh district in the published DoF Statistics.

Source : DOF 1983–1989

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Annex–III.15

Total Number of Subsistence Fisheries Households and Average Annual catch per Household – in each former district of the NCR

District	Year											
	83/84		84/85		85/86		86/87		87/88		88/89	
	h.h	Kg/h.h	h.h	Kg/h.h	h.h	Kg/h.h	h.h	Kg/h.h	h.h	Kg/h.h	h.h	Kg/h.h
Dhaka	967	25.0	967	25.0	810	24.2	947	21.0	1136	18.1	1136	18.8
Jamalpur	239	12.0	272	9.6	381	9.9	412	8.7	412	9.4	412	12.1
Mymensingh	615	12.0	699	9.6	729	15.1	947	13.1	947	13.1	810	14.6
Tangail	218	12.0	247	9.6	193	15.1	230	17.1	230	17.0	230	19.2
District Total	**2039**	**18.2**	**2185**	**16.4**	**2113**	**17.7**	**2536**	**15.6**	**2725**	**15.0**	**2588**	**16.5**
Bangladesh Total	**8804**	**22.8**	**9511**	**20.4**	**9698**	**14.3**	**10555**	**17.4**	**10791**	**16.9**	**10887**	**17.1**

Source : DOF 1983–1989.

Note: h.h = Household

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Seasonal Variation in Catch (tonnes) from Rivers – in each of the former districts of the NCR 1988–89

District	Month												
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Total
PRINCIPAL RIVERS													
Dhaka													
Jamuna	<1	12	12	14	16	16	16	15	15	15	12	14	157
L. Padma	38	36	36	33	33	33	79	169	169	79	101	96	902
Jamalpur													
Jamuna	105	121	112	121	108	116	117	115	125	187	91	112	1430
Tangail													
Jamuna	13	4	5	8	9	11	10	9	7	3	3	12	94
Total	156	173	165	176	166	176	222	308	316	284	207	234	2583
% Annual catch	6.0	6.7	6.4	6.8	6.4	6.8	8.6	11.9	12.2	11.0	8.0	9.1	100.0
OTHER RIVERS													
Dhaka	182	157	163	369	240	235	192	202	213	92	35	76	2156
Jamalpur	32	25	32	59	53	25	27	23	24	23	14	23	360
Mymensingh	522	665	665	665	560	781	686	735	509	581	505	653	7527
Tangail	17	18	27	24	28	25	9	11	17	19	9	16	220
Total	753	865	887	1117	881	1066	914	971	763	715	563	768	10263
% Annual catch	7.3	8.4	8.6	10.9	8.6	10.4	8.9	9.5	7.4	7.0	5.5	7.5	100.0

Source : DOF, 1988–89.

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Annex–III.17

Seasonal Variation in Catch of Subsistence Floodplain Fisheries – in each of the former district within the NCR

District	Year	Month											
		Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Dhaka	87-88	<1	<1	<1	<1	3	94					1	<1
	88-89	9	13		18	43	8	7	2				
	89-90	2	2	4	15	72	3	<1				2	
	Avg.	**4**	**5**	**1**	**11**	**39**	**35**	**3**	**1**	**0**	**0**	**1**	**<1**
Jamalpur	87-88	2	3	3	6	19	16	11	14	10	4	5	7
	88-89	4	3	2	5	24	25	8	10	7	3	4	5
	89-90	5	4	4	4	10	15	5	5	8	10	19	10
	Avg.	**4**	**3**	**3**	**5**	**18**	**19**	**8**	**10**	**8**	**6**	**9**	**7**
Mymensingh	87-88	2	2	7	15	30	9	4	2	8	7	8	6
	88-89	5	2	0	24	12	7	13	22	4	6	1	3
	89-90	9	8	14	10	5	8	6	17	8	3	3	9
	Avg.	**5**	**4**	**7**	**16**	**16**	**8**	**8**	**14**	**7**	**5**	**4**	**6**
Tangail	87-88	7	33	19	8	4	5	5	4	5	4	3	4
	88-89	21	21	17	13	7	4	3	3	2	2	2	5
	89-90	5	50	5	20	3	3	5	3	2	1	1	2
	Avg.	**11**	**35**	**14**	**14**	**5**	**4**	**4**	**3**	**3**	**2**	**2**	**4**
Average of all district		6	12	6	12	19	16	6	7	5	3	4	4

Note : Monthly catches are expressed as a percentage of total annual catch in each district

Source : DOF 1987–1990

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Annual Production and Catch Rate of Fish Ponds in each former district the NCR of 1983–1989

Old District	Cultured (t)	Kg/ha	Culturable (t)	Kg/ha	Derelict (t)	Kg/ha	Total (t)
1983–1984							
Jamalpur	709	1160	143	339	60	149	912
Mymensingh	7886	1161	437	338	112	148	8435
Tangail	721	1161	145	338	61	149	927
Dhaka	2863	1161	942	338	239	148	4044
Total Districts	**12179**	**1161**	**1667**	**338**	**472**	**148**	**14318**
Total Bangladesh	**89001**	**1161**	**15170**	**338**	**3773**	**148**	**107944**
1984–1985							
Jamalpur	630	1031	79	187	103	256	812
Mymensingh	7013	1032	242	187	195	257	7450
Tangail	641	1032	80	19	105	257	826
Dhaka	2704	1097	831	298	187	116	3722
Total Districts	**10988**	**1047**	**1232**	**250**	**590**	**185**	**12810**
Total Bangladesh	**96648**	**1261**	**10889**	**243**	**4030**	**158**	**111567**
1985–1986							
Jamalpur	622	1018	74	175	135	336	831
Mymensingh	6745	933	227	176	255	336	7227
Tangail	763	1229	138	322	196	479	1097
Dhaka	3070	1245	163	59	394	244	3627
Total Districts	**11200**	**1068**	**602**	**122**	**980**	**308**	**12782**
Total Bangladesh	**100999**	**1317**	**14207**	**317**	**8598**	**338**	**123804**
1986–1987							
Jamalpur	1477	2417	120	284	277	689	1874
Mymensingh	6722	988	476	369	581	765	7779
Tangail	937	1509	405	944	174	425	1516
Dhaka	3747	1519	1513	543	613	380	5872
Total Districts	**12883**	**1228**	**2514**	**510**	**1645**	**516**	**17042**
Total Bangladesh	**95758**	**1249**	**31949**	**713**	**15169**	**596**	**142876**
1987–1988							
Jamalpur	1224	2003	162	384	151	375	1537
Mymensingh	8072	1188	668	518	811	1069	9551
Tangail	1041	1677	143	334	264	646	1448
Dhaka	4200	1703	1483	533	776	480	6459
Total Districts	**14537**	**1386**	**2456**	**499**	**2002**	**629**	**18995**
Total Bangladesh	**104791**	**1367**	**29209**	**652**	**15423**	**606**	**149423**
1988–1989							
Jamalpur	1238	2026	206	488	183	455	1627
Mymensingh	8302	1222	910	705	523	689	9735
Tangail	769	1239	365	851	279	682	1413
Dhaka	4337	1759	1286	1558	839	519	6462
Total Districts	**14646**	**1396**	**2767**	**562**	**1824**	**573**	**19237**
Total Bangladesh	**108578**	**1416**	**31511**	**703**	**14923**	**586**	**155012**

Source : DOF, 1983–1989.

Annual Catch from Principal Rivers in each Planning Unit of the NCR

Planning Unit Number	Year					
	83/84 (tonnes)	84/85 (tonnes)	85/86 (tonnes)	86/87 (tonnes)	87/88 (tonnes)	88/89 (tonnes)
1	509	*	682	1355	1138	1237
2	554	161	216	283	271	243
4	334	114	77	50	65	35
6	88	30	20	13	17	9
10	456	395	308	302	153	175
13	2344	2030	1584	1550	787	900
N.C.R	4285	2730	2887	3553	2431	2599

Note : * No data for River Jamuna at Jamalpur in 1984/85.

Source : Derived from DOF 1983–89 and DOF 1980/81

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Annual Catch from Other Rivers in each Planning Unit of NCR

Planning Unit Number	Year					
	83/84 (t)	84/85 (t)	85/86 (t)	86/87 (t)	87/88 (t)	88/89 (t)
1	343	776	304	503	496	334
2	61	139	54	90	89	60
3	620	1385	759	857	1040	899
5	929	1095	937	1217	968	576
6	67	1127	543	537	950	478
7	870	994	868	1132	885	521
8	280	320	279	364	285	167
9	499	570	498	649	507	299
10	182	209	182	237	186	109
11	1557	1780	1555	2025	1584	932
12	262	299	261	340	266	157
13	152	174	152	198	155	91
N.C.R	5822	8868	6392	8149	7411	4623

Note : 1. Other rivers comprise major and minor rivers as listed in the FRSS Frame Survey 1980/81

2. The FRSS Frame Survey did not include any rivers located in Planning Unit 4.

Source : Derived from DOF 1983–89 DOF 1980/81

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Annex III.21

Annual Catch [1] from Beels within in each Planning Unit of the NCR

Planning Unit	Area of Beel[2] (ha)	Year 83/84 (t)	84/85 (t)	85/86 (t)	86/87 (t)	87/88 (t)	88/89 (t)
1	420	189	196	183	188	192	221
2	666	300	299	265	238	244	261
3	4,850	2,183	2,265	2,115	2,168	2,221	2,551
4	568	257	244	204	204	153	147
5	1,463	658	555	537	489	473	492
6	451	203	194	162	121	124	116
7	303	136	73	92	87	72	68
8	257	116	62	78	74	61	58
9	279	126	68	85	80	66	62
10	369	166	89	113	106	87	83
11	4	2	1	1	1	1	1
13	1,967	885	476	600	565	466	441
N.C.R	11,597	5,221	4,522	4,435	4,321	4,160	4,501

Note :

1 : Total annual catches were derived from estimated beel area in each PU and average yields per hectare in each former district of the NCR

2 : Data on beel area obtained from upazila statistics (pre 1983) compiled by LGEB. The data are incomplete for many upazilas, particularly those comprising PU 7–13. therefore estimates should be regarded as minimum values.

3 : No information for beel area in Dhaka (Planning Unit 12).

Source: Derived from Department of Fisheries Catch Statistics (catch/ha of beels in each former district).

Annex III.22

Annual Catch of Floodplain Subsistence Fisheries in each Planning Unit of the NCR

Planning Unit Number	Years					
	1983-84 (t)	1984-85 (t)	1985-86 (t)	1986-87 (t)	1987-88 (t)	1988-89 (t)
1	755	683	1509	1414	1414	1581
2	585	530	1062	967	962	1020
3	1365	1233	2157	2965	2944	2904
4	613	555	1034	919	910	919
5	1603	1516	1755	1841	1898	1992
6	1091	1011	1524	1365	1375	1417
7	1883	1880	668	675	864	1091
8	777	777	259	264	344	439
9	1421	1421	474	483	628	803
10	1269	1269	423	432	561	716
11	663	663	221	226	293	375
12	195	195	65	66	86	110
13	2655	2655	885	903	1174	1499
NCR	14875	14388	12036	12520	13453	14866

Source : Derived from BBS 1981 and DOF 1983-89

Annex–III.23

Total Pond Production in each Planning Unit of the NCR: 1983–1989

Planning Unit	1983-84				1984-85				1985-86				1986-87				1987-88				1988-89			
	Types of Pond				Types of Pond				Types of Pond				Types of Pond				Types of Pond				Types of Pond			
	Cult-ured (t)	Cultu-rable (t)	Dere-lict (t)	Total (t)	Cult-ured (t)	Cultu-rable (t)	Dere-lict (t)	Total (t)	Cult-ured (t)	Cultu-rable (t)	Dere-lict (t)	Total (t)	Cult-ured (t)	Cultu-rable (t)	Dere-lict (t)	Total (t)	Cult-ured (t)	Cultu-rable (t)	Dere-lict (t)	Total (t)	Cult-ured (t)	Cultu-rable (t)	Dere-lict (t)	Total (t)
1	187	375	16	578	166	21	27	214	164	19	36	219	389	32	73	494	322	43	40	405	326	54	48	428
2	156	311	13	480	138	17	23	178	151	23	36	210	263	56	49	368	247	33	4	284	218	62	50	330
3	1322	771	21	2114	1175	43	36	1254	1063	40	47	1150	1125	84	106	1315	1353	118	149	1620	1392	161	96	1649
4	161	324	14	499	143	2	23	168	171	31	44	246	210	91	39	340	233	32	59	324	172	82	62	316
5	844	138	43	1025	750	68	60	878	826	76	101	1003	973	252	150	1375	1107	188	210	1505	1023	233	181	1437
6	282	64	24	370	251	4	18	273	299	61	76	436	367	177	68	612	408	63	103	574	301	160	109	570
7	331	57	25	413	313	94	19	426	355	19	41	415	433	172	63	668	485	17	108	610	517	132	63	712
8	179	100	13	292	170	51	10	231	192	10	21	223	234	92	33	359	262	91	56	409	271	79	44	394
9	298	34	27	359	282	89	21	392	320	18	43	381	390	161	68	619	438	158	115	711	452	137	92	681
10	259	85	23	367	245	75	18	338	278	15	38	331	339	137	59	535	380	134	101	615	392	116	81	589
11	106	33	5	144	100	29	4	133	113	6	9	128	138	53	13	204	155	52	23	230	160	45	18	223
12	211	70	30	311	200	62	23	285	227	12	49	288	276	113	76	465	310	111	129	550	320	96	103	519
13	431	141	38	610	407	124	29	560	462	25	61	548	564	226	96	886	632	222	163	1017	653	193	131	977
N.C.R	**4767**	**2503**	**292**	**7562**	**4340**	**679**	**311**	**5330**	**4621**	**355**	**602**	**5578**	**5701**	**1646**	**893**	**8240**	**6332**	**1262**	**1260**	**8854**	**6197**	**1550**	**1078**	**8825**

Source : Derived from DOF 1983–1989

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Annual Catch of Fish and its Value from the Capture Fisheries of each Planning Unit of the NCR, 1988–89

Planning Unit	River		Beel		Floodplain		Total	
	(t)	(t)	(t)	(t)	(t)	(t)	(t)	(t)
1	1,571	62.80	221	6.60	1,581	39.50	3,373	108.90
2	303	12.10	261	7.80	1,020	25.50	1,584	45.40
3	899	36.00	2,551	76.50	2,904	72.60	6,354	185.10
4	35	1.40	147	4.40	919	23.00	1,101	28.80
5	576	23.00	492	14.80	1,992	49.80	3,060	87.60
6	487	19.50	116	3.50	1,417	35.40	2,020	58.40
7	521	20.80	68	2.00	1,091	27.30	1,680	50.10
8	167	6.70	58	1.70	439	11.00	664	19.40
9	299	12.00	62	1.90	803	20.10	1,164	34.00
10	284	11.40	83	2.50	716	17.90	1,083	31.80
11	932	37.30	1	0.03	375	9.40	1,308	46.70
12	157	6.30	–	–	110	2.80	267	9.10
13	991	39.60	441	13.20	1,499	37.50	2,931	90.30
N.C.R	7,222	288.90	4,501	134.93	14,866	371.80	26,589	795.60

Note : 1 : The value of the catch from each type of habitat was estimated from the average price obtained by local fisherman in the NCR. Since fish prices vary by season, area, type of market, species and size, then the estimates of average price must be regarded as approximate only. The following average fish prices (Tk/Kg) for the current year,1991 were used in the above analysis :
1. Rivers Tk.40.00, 2. Beels Tk.30.00, 3. Floodplain Tk.25.00
(See text for further details of fish price variations.)

Source : Derrived from DOF 1988-1989

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Annex–III.25

Annual Production and its Value of Cultured Fish from each Planning Unit of the NCR, 1988–89

Planning Unit	Type of pond							
	Cultured		Culturable		Derelict		Total	
	(t)	(t)	(t)	(t)	(t)	(t)	(t)	(t)
1	326	13.0	54	1.4	48	1.2	428	15.6
2	218	8.7	62	1.6	50	1.3	330	11.6
3	1,392	55.7	161	4.0	96	2.4	1,649	62.1
4	172	6.9	82	2.1	62	1.6	316	10.6
5	1,023	40.9	233	5.8	181	4.5	1,437	51.2
6	301	12.0	160	4.0	109	2.7	570	18.7
7	517	20.7	132	3.3	63	1.6	712	25.6
8	271	10.8	79	2.0	44	1.1	394	13.9
9	452	18.1	137	3.4	92	2.3	681	23.8
10	392	15.7	116	2.9	81	2.0	589	20.6
11	160	6.4	45	1.1	18	0.5	223	8.0
12	320	12.8	96	2.4	103	2.6	519	17.8
13	653	26.1	193	4.8	131	3.3	977	34.2
N.C.R	6,197	247.8	1,550	38.8	1,078	27.1	8,825	313.7

Note : [1] : Fish prices vary considerably between areas, season, fish species and individual size. The approximate average prices (Tk/kg) estimated for all planning units were as follows : (1). Cultured ponds: Tk.45.00, (2). Culturable and derelict ponds: Tk.25.00. The estimates assume that major carps dominate catches from cultured ponds while other floodplain fish are captured from culturable and derelict ponds. Prices refer to current year,1991.

Source : Derived from DOF 1988–89.
Fish price estimates CS/1991

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Summary of the Distribution, Magnitude and Value of the Carp Spawn Fishery in each Planning Unit of the NCR

Planning Unit	1986				1987				1988				1989			
	Nets (Nr)	Wt. (Kg)	(kg/net)	Value ('000 Tk)	Nets (Nr)	Wt. (Kg)	(kg/net)	Value (Tk)	Nets (Nr)	Wt. (Kg)	Nets (Nr)	Value (Tk)	Nets (Nr)	Wt. (Kg)	Nets (Nr)	Valu (Tk
1	914	584	0.64	1794	1531	843	0.55	2328	275	171	0.62	859	650	656	1.01	2967
2	126	16	0.13	41	22	10	0.45	27	38	13	0.34	39	20	5	0.25	15
3	664	60	0.09	138	393	120	0.31	359	184	15	0.08	8	218	46	0.21	138
4	2133	704	0.33	2816	360	345	0.96	690	1012	749	0.74	2247	1277	14	0.01	42
6	336	77	0.23	117	281	174	0.62	455	450	96	0.21	360	265	90	0.34	405
7	216	99	0.46	215	217	83	0.38	165	234	17	0.07	40	145	33	0.23	65
10	558	342	0.61	774	436	345	0.79	627	177	62	0.35	143	125	50	0.40	100
N.C.R	4947	1882	0.38	5895	3240	1920	0.59	4651	2370	1123	0.47	3696	2700	894	0.33	3732

Source : Derived from DOF 1986-1989

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