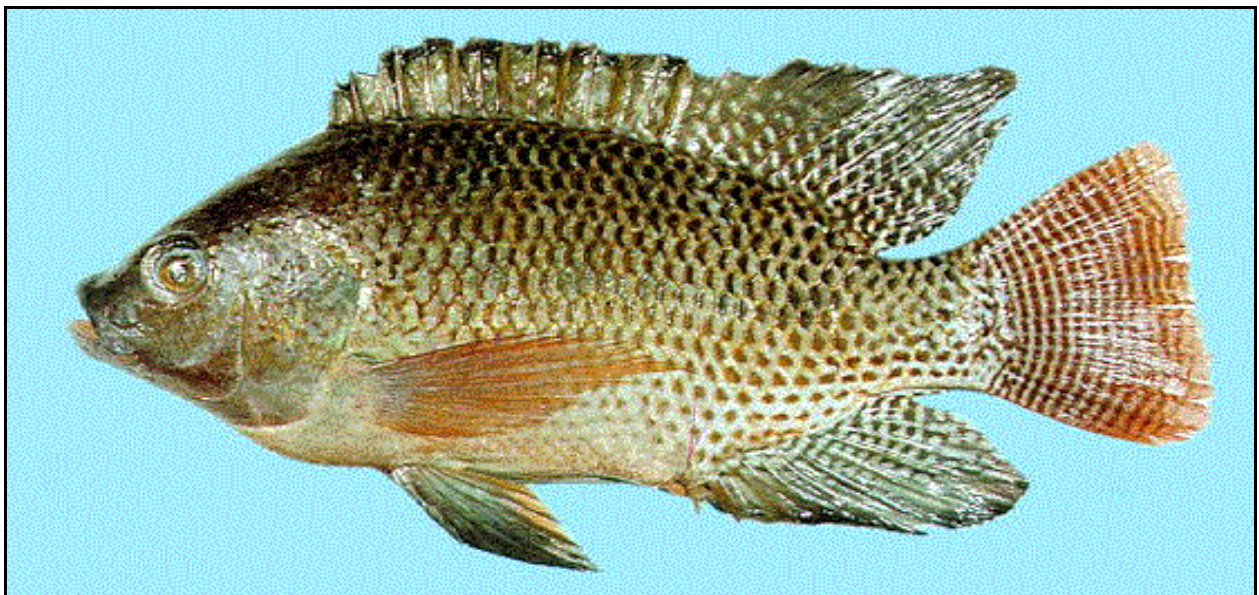

Information Systems for the Co-Management of Artisanal Fisheries

Field Study 1 - Bangladesh



**UK Department for International Development
Fisheries Management Science Programme
Project R7042**

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1. *Executive Summary*

Government Objectives

Fisheries management, administration, development, extension and training in Bangladesh is the responsibility of the Department of Fisheries (DOF) under the wing of the Ministry of Fisheries and Livestock (MOFL). The over-arching objectives of the national fisheries policy of the Government of Bangladesh (Ministry of Fisheries and Livestock, 1998) are to:

- Increase fish production
- Alleviate poverty by expanding employment opportunities and improving socio-economic conditions of fishers.
- Fulfil the demand for animal protein.
- Achieve economic growth through foreign exchange from fish exports.
- Maintain ecological balance, conserve biodiversity, ensure public health and provide recreational facilities.

These objectives are sought through a complex array of management instruments, access rights and policy initiatives including remnants of the original *jalmohal* (water estate) leasing system, more than ten technical conservation measures, the New Fisheries Management Policy (NFMP), and a number of co-management initiatives (eg Oxbow Lakes Project and the Community Based Fisheries Management Project (CBFM)).

Against this backdrop of management systems and arrangements, a number of (donor-assisted) government programmes have been instigated in an attempt to improve production from inland fisheries. A number of existing (extension) programmes further aim to strengthen institutional capacity, transfer technology and improve resource management. The MOFL is also currently developing a National Fisheries Policy for long term sectoral development comprising five main components, three of which relate to inland fisheries and aquaculture. The proposed activities of the forthcoming Fourth Fisheries Project implicitly assumes a number of further sector policies, particularly for the inland capture sector (Chapter 4).

Information Requirements to Support Management Objectives

A considerable obstacle to developing a prototype co-management FIMS for Bangladesh is that the policy proposals and objectives described above are not supported by fundamentally important details of the respective roles and responsibilities of the state, fishing communities and other stakeholders within the complex array of existing access arrangements. Consequently, no detailed management plans and strategies exist from which to identify data and information, collection and feedback requirements (Chapter 5).

Management objectives and data requirements of the DoF with respect to a co-management FIMS have recently been examined through the proposed 'Fisheries Resource Management Support' (FRMS) Project and (DOF-)amended versions; 'Fisheries Information Management Project' (FIMP), 'Strengthening Information Management and Planning in the Fisheries Sector' and 'Support for Information management and Planning' (SIMP). The main objective of this five year £3.2m initiative

is to strengthen the national capacity for fisheries resource management, particularly regarding the collection of fisheries data and its use to better formulate resource use strategies and to better target sectoral development inputs. In addition to a training and institutional development component, the main activities of the project to meet this objective included the identification appropriate data collection methodologies and develop of a Fisheries Information Management System (FIMS).

Broad data requirements were identified in the project proposal on the basis of *a priori* assumed management objectives. However, a fundamental weakness of the project was a failure to detail how the additional information and resource requirements, identified by the DOF and the projects planners, would be used within coherent management strategies in support of the national fisheries objectives and policy proposals for the sector.

In response to these comments, and in spite of considerable effort on the part of DFID in the form of regular meetings and workshops with DoFL over a three month period, management roles, responsibilities and strategies, and corresponding data/information requirements to achieve any specific objectives could not be established, and therefore the project was “shelved”.

Similar difficulties were experienced by this field study. Through semi-structured interviews, key members of the DoF were asked to identify their data and information requirements in support of management objectives. No consensus could be established; staff identified extensive lists of biological and socio-economic information and data that they believed were relevant, but with virtually no justification as to how it would be used for active management purposes and with little thought given to how it could be collected given the existing and foreseeable resources and institutional capacity of the DoF. Similarly, no consensus could be established concerning the most appropriate form of the output from the FIMS to evaluate the performance of any management strategies and to guide future management and planning activities.

To provide some basis with which to develop and test a relevant and purposeful prototype co-management FIMS at this field study location, it was therefore necessary to make a number of assumptions regarding appropriate roles and responsibilities of the DoF and fishing communities:

- The state has a very limited capacity to actively manage the country’s aquatic resources due to the complex and dynamic nature of the fisheries, the existing fundamental lack of any coherent management strategies, its weak institutional capacity and paucity of resources.
- Active resource management can be more effectively conducted at the community level on the basis of *adaptive management*. However, the GOB DoF will always have a significant role in the management of the country’s fisheries resources, in particular as a coordinator, legislator and administrator of various community-based fisheries management activities and supporting projects. A more active involvement in management will be necessary for those fisheries which are not so well suited to co-management, particularly those associated with large rivers where boundary delimitation is problematic and where the resources are highly mobile (migratory). This active involvement is also likely to extend to working with other natural resources and development planning departments to minimise sectoral interactions within the wider catchment of the fisheries (Hoggarth *et al.*, 1999). Moreover, in order to evaluate whether or not the

over-arching national objectives for the sector are being met, national monitoring and reporting responsibilities and obligations will remain an important role of the state.

- To facilitate adaptive management at the community level, the DoF should monitor the performance of community management systems or units and the details of the management strategies employed. The latter should include the mix of management instruments (e.g. relative reserve area, closed seasons, gear bans, stocking densities etc), and details of the monitoring control and surveillance employed. With this information, the DoF is then in a position to take a holistic view to identify effective management strategies and disseminate these to the wider fishing community. To be of relevance at the community level, the management performance criteria (MPC) should be established on the basis of community/fisher management objectives. These criteria should be of relevance on a national scale and therefore should also be included in the national monitoring programme.
- Potentially conflicting state responsibilities and community management objectives such as the maintenance of biodiversity may be resolved through awareness programmes and education.

Considerable effort was made to establish a collaborative relationship with the DoF through numerous meetings with members of staff supported by letters and documents highlighting the benefits of the project for the DoF. In spite of these efforts, the DoF were adamant that they were not interested in any form of collaboration with the project or its outputs (Prototype FIMS, software demonstrations, training material and workshops etc)

This reluctance to collaborate stemmed from fear that this project would jeopardise the implementation of the FRMS described above, which, in their opinion, would deliver what they believed was particularly important for improving the existing FIMS; principally funds for more resources, manpower, computer hardware etc. In other words, the DoF were highly suspicious that this project, with no major institutional and resource strengthening component, had been designed by DFID to replace the proposed FRMS project. With this suspicion, the DoF suggested that this project should be integrated into the FRMS project, and stressed that until the FRMS project had been approved according to their terms, they were not prepared to discuss or divulge any further information regarding the existing DoF FIMS. This included any further information regarding potential improvements to the existing FIMS/Fisheries Resources Survey (FRSS); additional data requirements, output requirements, details of the FRSS frame surveys, raw data, data structures etc. Therefore the basis to test the prototype co-management FIMS for Bangladesh had not only to be developed on the basis of the assumptions described above, but also without fundamental information and support from DoF (Chapter 5).

Based upon the assumptions regarding the DoF's roles and responsibilities described above, certain basic information, or default indicators (see Final Report) were identified that should be included in the FIMS to evaluate whether the overarching national objectives of the sector are being met. As described in the Final Report, such information cannot inform managers whether or not a particular output or outcome can be improved or increased, or what measures could be taken to make improvements - this usually requires *technical management models* (see Final report) which presently cannot be supported by the existing national institutional capacity and resources and are likely to be of little utility given the dynamic environment and complex nature of the fisheries. However, some consideration should be

given to monitoring basic *inputs* to the fishery to provide some understanding of any changes in the monitored *outputs*. Data and information requirements to support and coordinate community-based management systems or units are described below.

The proposed default indicators and fishery inputs that could be monitored to evaluate management performance with respect to the over-arching national objectives have been summarised in Chapter 6. Clearly a very large range of alternative indicators, inputs and outputs, and their proxies, could have been included or used as alternatives. Those included have been selected on the basis that they are intuitive and easily measured. Where possible, alternative sources of information have been indicated.

The Existing FIMS

The Fisheries Resources Survey System (FRSS) was developed with the financial and technical assistance of the FAO and has remain unchanged (including the frame surveys) since its inception in 1980. The FRSS provides catch (and some limited effort data) by district, division and country for the following sectors: rivers, *beels*, floodplains, *baors*, ponds (culture systems), sunderban habitat, shrimp farms, and industrial and artisanal marine fisheries. Details of the frame survey, sampling methodologies, data structures and estimation procedures and outputs are described in Chapter 6.

Community Objectives and Data Requirements

Community management objectives and management evaluation criteria (data requirements) were identified and summarized from (i) a review of the grey literature and semi-structured interviews with the key organisations and institutes (NGO's) involved in existing co-management arrangements and community projects, and (ii) from rural field appraisals (Chapter 7).

(i) *Review and Interview Results for Existing Co-management Projects*

The current co-management projects in Bangladesh are broadly of two types; those that aim to increase production through credit and technological input and those that attempt to engender collective decision-making through secured tenure and community organisation.

Surprisingly, the projects have so far placed little emphasis on establishing explicit community objectives. Where the relevance of identifying community objectives was acknowledged by the NGO, there were few suggestions as to what these objectives might be beyond the primary concerns of income and nutrition (maximise yield and income).

An attempt was made to infer community management objectives on the basis of the communities *management requirements* identified from the Community Based Fisheries Management (CBFM) project baseline surveys designed by ICLARM (Section 7.4). Eighteen basic requirements were identified corresponding to 5 main management tools or instruments. The different *management requirements* (instruments) identified from the surveys reflect the communities different cognised (conceptual) models of the functioning of their fisheries associated with particular habitats and their opinions on how best they can be managed. The objectives inferred from these requirements or management tools were essentially the same primary objectives proposed by the NGO's and included: maximisation of income, total yield, yield- or value-per-recruit and protection of spawning stock. Secondary objectives to achieve these primary objectives included maximisation of recruitment from natural sources, augmented natural recruitment by stocking and minimisation of conflict among fishers

(maximisation of equitable distribution of benefits).

The NGO surveys and routine monitoring programmes record basic *inputs* and *outputs* (see Final Report) to evaluate whether these primary objectives are being met under the various management systems or strategies. Common data recorded under these programmes include catch weight by species and gear type, fishing effort by gear type, market price by species, income and various welfare indicators, costs and fish consumption.

Additional data is also recorded to evaluate and interpret the success of the management systems for achieving much broader objectives beyond those sought by individual fishers. These relate more to national, ethical or political objectives including the distribution of benefits among user or ethnic groups and the role of women in society demanding information on access arrangements, income or welfare indicators by ethnic or user group, and women's activities.

The CBFM survey also incorporates information on local perceptions of management problems and potential solutions as suggested by the fishers themselves and a variety of other information used to interpret fishermen behaviour.

(ii) *Rural Field Appraisal Results*

The rural field appraisal examined community management objectives in four villages located in Bogra District. Three of the villages were located in the vicinity of three different beels (Gobarchapa, Lohajang and Satbila), the remaining village was located on the banks of the Bangali River.

The methodology and approach was based upon the techniques and recommendations developed within the extensive participatory appraisal literature. Conversation was guided through semi-structured interview and open questions within the dialogue method of appraisal (Kassam, 1998).

In the same way as described above, management objectives were inferred from *management requirements* identified through discussions with fishers. Data and information requirements corresponding to these management objectives were established on the basis of the information fishers identified would be required to verify if the *management requirement* had been successfully implemented.

Additional information was collected to profile the individual respondents and the community and fisheries that they operate within. Details on fishing method, seasonality, location and access arrangements were collected from each respondent. Fishers ranked their influence on local management decisions and the degree to which the community are unified and can co-operate. Other information collected included details of past projects or interventions and the historic and present nature of conflict.

The field appraisal revealed very similar *management requirements* and, therefore, the same inferred objectives, to those identified from the CBFM surveys. Corresponding data and information requirements to evaluate the success to which the objectives are met were identified as "more money", "larger catch", "more fish caught", "larger fish caught" and "higher unit price". These approximate to the basic *outputs* described above.

2. Introduction

2.1 The Objectives of the Project

To enable better management and appropriate development of artisanal fisheries, by developing and testing a generic fisheries information management system (FIMS) suitable for significantly different situations. To achieve this the project will:

- a. Describe community and government fishery management objectives for significantly different case study situations.
- b. Develop guidelines for appropriate integrated frame survey and sampling methodologies
- c. Develop a generic data model and prototype FIMS; describe the utility of the generic data model for fisheries
- d. Describe the costs of implementing the FIMS at case study sites, and nationally and the unit costs of implementing the FIMS.

This report describes the results of the first of the two field-based case study components of the project which was conducted in Bangladesh between March and April 1999.

2.2 Objectives of the Field Based Study

As outlined in the Project Memorandum, the objectives of the field-based component for each case study site are to:

- (i) Establish and describe government and community management objectives
- (ii) Establish and describe the evaluation criteria (default indicators and formal and informal models) used to judge the success to which the management objectives are being achieved and to guide management objectives towards the desired objectives.
- (iii) Describe the data requirements for (ii), any shortfalls and future requirements.
- (iv) Describe the frame surveys and sampling methodologies to meet the data requirements.
- (v) Describe the data structures used to store and collate the data.
- (vi) Collect and describe example datasets/ databases.
- (vii) Establish units costs to support the existing FIMS.

2.3 Field Study Approach

These objectives were achieved through discussions with key members of the Government of Bangladesh Department of Fisheries, the Department for International Development, the Fisheries Management Support Office, CARE Bangladesh, Centre for Advanced Studies and numerous other non-governmental organisations, and through reviews of published and grey literature.

Fishing community management objectives and data and information requirements were established for each main waterbody and fishery type from a review of the grey literature, semi-structured interviews with key organisations and institutions involved and from field appraisals. Existing community-based and co-management projects were reviewed with respect to monitoring, evaluation and the nature and role of the community participation. Common and unique criteria were identified. Emphasis was given

to identifying objectives and criteria relevant to management at the local level, rather than those to meet management responsibilities nationally. This approach aimed to utilise the skills and experiences of NGO's that have worked collaboratively with stakeholders. The field appraisals were designed to augment and cross-check the results of the reviews.

2.4 Field Work Team

The field work described in this report was carried out between March 10th and April 9th 1999 by the following project staff:

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2.5 *Structure of the Report*

Following this section, the report is divided in 5 main chapters and 14 Annexes. Chapter 3 provides some basic background on the country and its fisheries. Chapter 4 reviews the management of the fisheries including institutional arrangements, management objectives and instruments, access rights and the legal framework, technical conservation measures, new management policies including co-management, and an outline of the main activities of the forthcoming Fourth Fisheries Project. Chapter 5 describes obstacles experienced during the fieldwork to achieve a fundamental objective of the field study - identifying government data and information requirements. Based upon the information reviewed in Chapters 3 and 4 and assumptions regarding roles and responsibilities of the DoF and fishing communities, basic data and information requirements are identified in Chapter 6. This chapter also contains reviews of the existing sampling methodologies and frame surveys, the database and data structures. The final Chapter 7 describes the synthesis of community management objectives and data and information requirements from a combination of literature reviews, discussions with NGO's and field appraisals.

3. *Inland Fisheries and Aquaculture*

3.1 *Background*

Bangladesh lies between South and South-East Asia just north of the Tropic of Cancer between 20°45' N and 26°40' N and between 88°03' E and 90°42' E (Figure 1). It has a total land area of 143 998 km²; approximately the same size as England and Wales. The country is a vast alluvial delta created by the Ganges and Brahmaputra rivers characterised by very flat plains which never rise more than 10 metres above sea level (Hossain *et al.*, 1987; Murray, 1991). For administrative purposes, the country is divided into 6 Divisions, 64 Districts and 460 *Thanas*.

The climate is sub-tropical and tropical and there are three main seasons: the monsoon or 'wet' season (June-October), the 'cold' season (November-February) and the 'hot' season (March-May) with temperatures ranging 21°C - 35°C. Annual rainfall varies from 1000mm in the West to 5000mm in the North near Assam. Three quarters of the total annual rain falls in the four month monsoon period between June and September (Murray 1991).

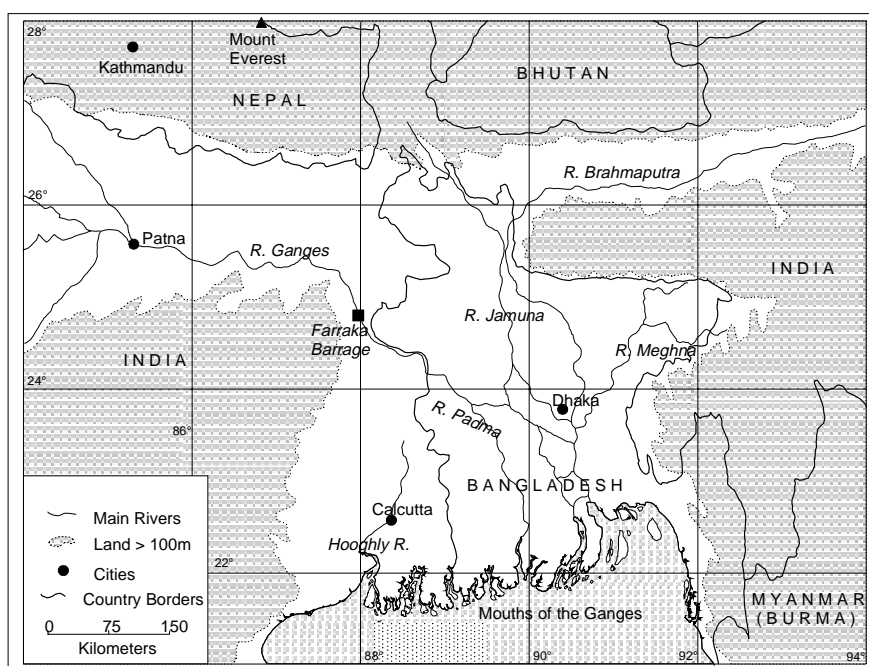


Figure 1 The Geographic location of Bangladesh

Historically, the exploitation of aquatic resources has played an important role in the economy, culture and tradition of the people of Bangladesh. It has been estimated that at least 11% of the population (1.5 million) depend principally on the fisheries sector for their livelihood, and 73% of rural households (11 million people) engage in part-time fishing. The sector accounts for 4% of GDP and more than 11% of annual export earnings. Fish is an important element in the diet in Bangladesh, providing 80% of animal protein and 8% of the total protein intake in the average diet. Fish also provide an important source of calcium, fats and vitamins (Anon, 1998).

Recent estimates (1996/97) of total fish production are in the order of 1.3 million tonnes. The inland capture fisheries are the most important components within the sector, contributing to 51% of total production compared to aquaculture (21%), artisanal marine fisheries (27%) and industrial marine fisheries (1%) Figure 2 (Anon, 1998).

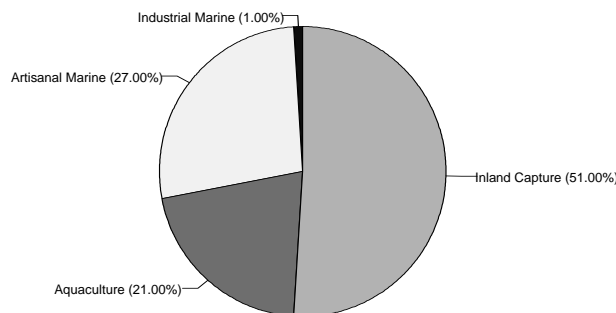


Figure 2 Intra-sectoral contributions to total fish production in Bangladesh. Source: Anon (1998).

3.2 Inland Fisheries and the Environment

The inland capture fisheries of Bangladesh exploit aquatic resources from a diverse range of habitats including the main rivers (Padma, Jumuna and Mehna), their tributaries, canals (*khals*) and seasonally inundated floodplains. The floodplains themselves contain a complex of seasonal and perennial waterbodies including artificial and natural (oxbow) lakes (*boars*), natural depressions (*beels* and *haors*), fish pits (*kuas*) and household ponds created by excavating soil to construct raised platforms upon which houses are built. Kaptai Lake, located in the southeastern part of the country created by the construction of a dam across the Karnafuli River in Chittagong, and the Sunderbans or coastal margins of the country also provide a further source of aquatic resources.

Floodplain inundation occurs each year in response to seasonal monsoon rainfall over the drainage basins of the major rivers. River discharge rates (and water level) rise in March or April and reach a maximum during the peak rainfall period between August and September. During this period a point is reached (bankfull level) when the rivers can no longer drain the volume of water contained within them and subsequent increases result in the rivers overspilling their natural levees onto the adjacent plains. Here the water spreads slowly out and eventually inundates the floodplain. The floodplains remain inundated for up to eight months of the year in low lying areas. As the dry season approaches between October to December, waters recede (drawdown) to the main river channels, isolating bodies of water within *beels*, *hoars*, *kuas* and other flood-inundated water bodies present on the floodplain. These may be perennial or seasonal depending upon their size, depth and drainage and evaporation rates (Halls, 1998).

In Bangladesh over 60% of the total land area (approximately 90 000 km²) may be flooded. The depth of inundation varies according to location, relief and soil type Hossain *et al* (1987). Further details of flooding patterns in Bangladesh are illustrated by Welcomme (1985 p32).

This seasonal pattern of inundation is the principle driving force behind the high productivity associated with tropical river systems. Inorganic nutrients and sediments transported in the floodwater promotes primary production from phytoplankton, epiphytic algae, grasses and higher plants and the ephemeral conditions also produce ‘dynamic edge effects’ which promote the decomposition of organic material thereby releasing nutrients back into the floodplain (Junk *et al*, 1989). The rapid increase in primary production and area available for colonization by aquatic organisms following inundation supports a diverse community of highly productive fauna. Fish exploit this surge of production, feeding upon the abundant food resources to grow rapidly during the period of inundation. The floodplain also provides sheltered spawning grounds with plenty of refuges in amongst the submerged vegetation for the young and juvenile stages. Pools, lakes, *beels* and canals, replenished with water by the flood pulse, also provide dry season refuges for floodplain resident species of fish (Welcomme, 1985).

By contrast primary and secondary production in the main channel is relatively low. A shifting sandy substrate, great depth, turbidity, turbulence and strong current, make the main channel unfavourable for primary production. Siltation, swift currents and absence of aquatic vegetation also make the beds of most large rivers unsuitable for benthic organisms and few higher animals have adapted to utilize this biotope exclusively. Those that do tend to be predators of fish or aquatic invertebrates which depend to a great extent directly or indirectly upon the primary production upon the floodplains (Junk *et al*, 1989). The ephemeral and unpredictable nature of the floodplain environment naturally selects for species with very high rates of reproduction, growth, early maturity and high fecundity. These *r*-selected communities are able to respond quickly to changes in environmental conditions, exploiting favourable floods. Fish production and stock resilience to exploitation is therefore generally higher on the floodplain than within more stable environments dominated by *K*-selected species (Lowe-McConnell, 1987). The floodplain environment also promotes species diversity due to its dynamic habitat structure; "The regular flood pulse allows organisms to develop adaptations and strategies for efficient utilization of habitats and resources within the river-floodplain environment" Junk *et al* (1989).

Therefore, although the main rivers do support large fisheries, the highest yields are associated with the floodplain habitat (Figure 3). The main channel is used mainly as a migration route for gaining access to feeding and spawning grounds upon the floodplain or as a refuge during the dry season. Catches from Kapati Lake and the Sunderbans contribute approximately only 2% of the total catch (Figure 3).

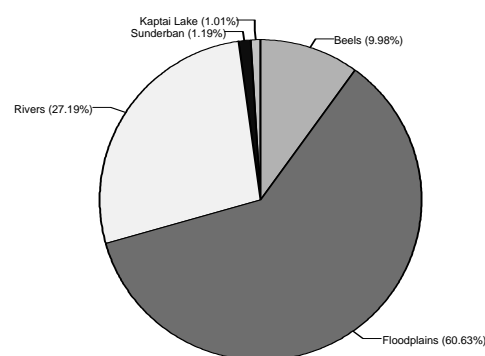


Figure 3 Total inland catch for 1995/1996 by major habitat categories. Source: Department of Fisheries.

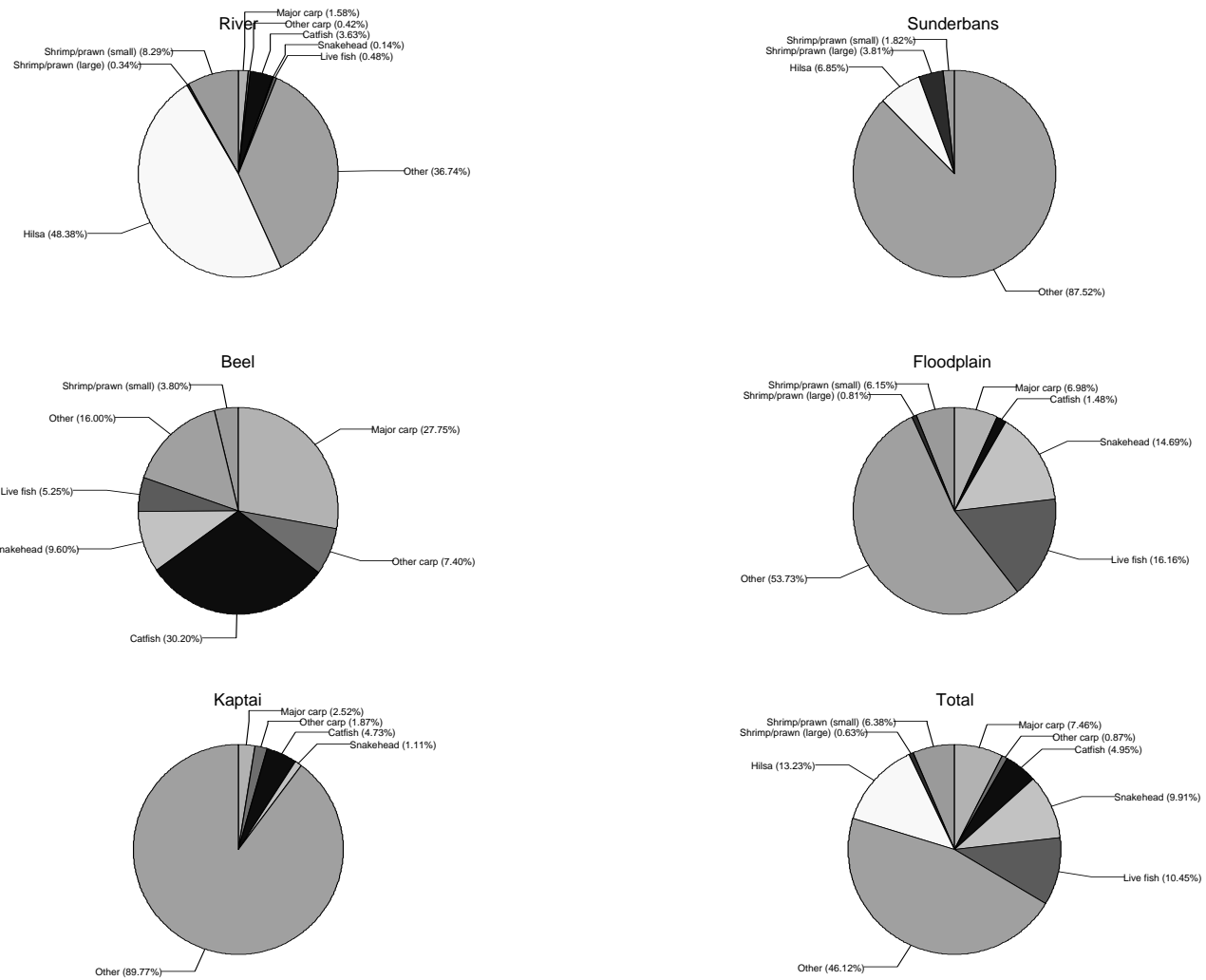


Figure 4 Total inland production (capture) by major species and sector for 1995/1996 Source: Department of Fisheries.

More than 200 species of fish are exploited in Bangladesh. The single most important species is the anadromous shad *Hilsa ilisha* which constitutes approximately 50% of the riverine catch and approximately 13% of the total inland catch. Other important species include major carp, shrimp and prawn, snakehead and catfish, but their relative importance varies among the major habitats (Figure 4).

Similar to other floodplain river systems, the diversity of habitats and fish species in Bangladesh are reflected by an equally diverse ranges of fishing gears. More than 100 different gears are employed in the inland fishery. Hoggarth *et al.* (1999) provide a useful categorisation system for these gears (Figure 5):

- Set-and-wait gears are set and hauled after a few hours to catch fish when they are feeding or moving around the floodplain (eg gill nets, portable traps and baited hooks).
- Chasing gears involve more active pursuit of fish sometimes in open floodplain waters (eg drag nets, push nets, some types of seines and spears).
- Barrier gears are set more permanently than set-and-wait gears to catch migratory fish during their seasonal migrations. Barrier gears may be set in the main river (where it is narrow enough), or in secondary channels where fish migrate off the floodplain during the drawdown. They may also be complete barriers (eg suspended trawl nets, bamboo barricades) or only partial barriers which do not span the full width of the channel (eg lift nets, fyke nets etc).
- Hoovering gears are used during the dry season to catch floodplain resident or migratory fish stranded in pools and isolated river channels (eg dewatering), fish drives, poisoning and electric fishing).

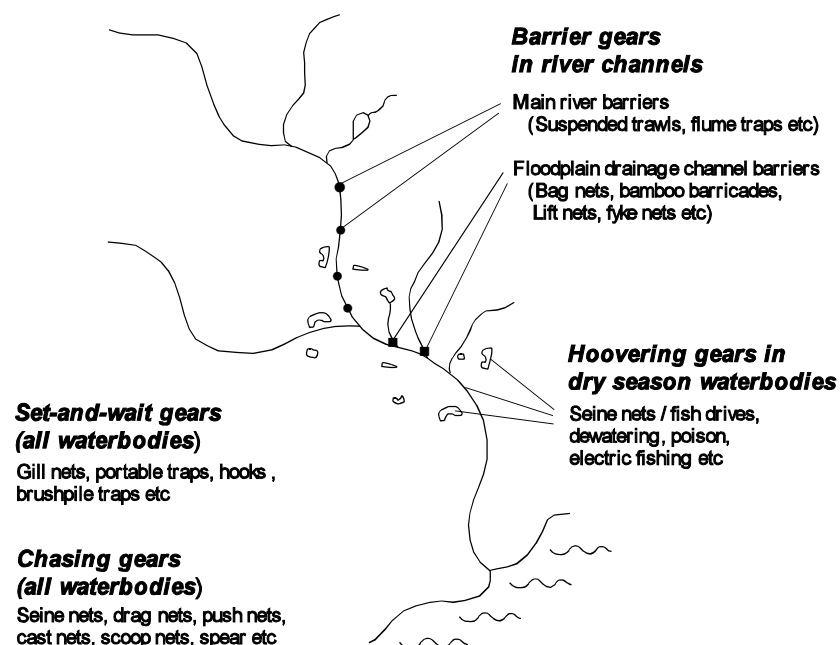


Figure 5 Types of floodplain river fishing gears employed in Bangladesh and other floodplain river systems. (Source: Hoggarth *et al* 1999)

This gear diversity enables the capture of the many different species in all the different floodplain and riverine environments, and in the various seasons of the year. The set-and-wait gears and chasing gears may catch fish at any time, but are labour intensive and relatively inefficient. Barrier and hoovering gears, in contrast, are more efficient as they catch fish at those times when they are highly concentrated in specific habitats, for example, barriers in channels, and hoovers in dry season waterbodies (Figure 6). The high efficiency of barrier and hoovering gears makes them particularly threatening for the long-term sustainability of fish stocks.

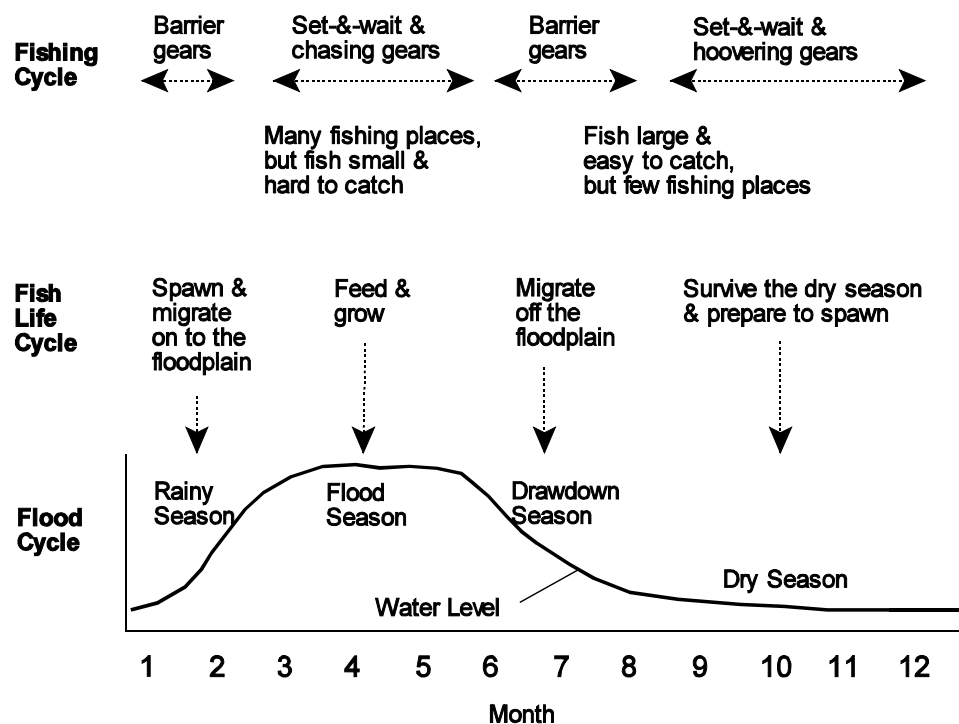


Figure 6. The relationship between the seasonal cycles of fishing, fishing biology and flooding. Source: Hoggarth *et al.*(1998).

3.3 Aquaculture and Culture-Based / Enhanced Fisheries

The distinction between capture, culture and culture-based production systems is not made explicit in the *Bangladesh Catch Statistics* (see below) and is complicated by the dynamic nature of the environment. Pond (including shrimp) culture systems are principally based upon stocking fingerlings or hatchlings into excavated or natural ponds or ‘tanks’. However, wild fish species including predatory snakeheads (*Channa spp*) often form part of the total production if the ponds are inundated by floodwaters (see below). Similarly, *baors*, which are natural features of the floodplain and invariably contain wild fish species, are stocked with fingerlings, and therefore are more characteristic of an enhanced fishery.

Many floodplains and *beels* are also stocked with carp fingerlings and shrimp hatchlings. No distinction is made between catches taken from these ‘enhanced’ fisheries and the remaining unstocked areas of the floodplain. Clearly, failure to adequately recognise these distinctions has important implications for the management and assessment of inland fisheries and therefore the design of a FIMS. According to

the GOB catch statistics, pond and shrimp culture are the most important sources of aquaculture production (Figure 7).

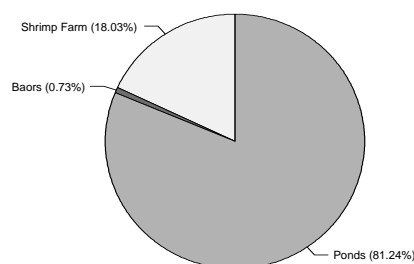


Figure 7 Relative Production by Aquaculture System Type (Source: Department of Fisheries)

Although not reported in the catch statistics, ‘pen culture’ is believed to be the second most important source of production. The total value of all freshwater aquaculture production is conservatively estimated to be over TK 280 billion Or \$600 million (Islam & Collis 1998).

3.3.1 Ponds

Ponds cover a total area of approximately 147,000 ha¹ created by the excavation of earth to build raised housing platforms upon the floodplain. A variety of species are farmed using a range of culture systems. The majority of farmers, estimated to represent more than 90% of the total area, farm fish in extensive poly-culture systems with carps (*Labeo rohita*, *Catla catla* and *Cirrhinus mrigala*) as the major species (Figure 8). Increasingly, farmers are adopting semi-intensive systems (see Islam & Collis (1998) for review).

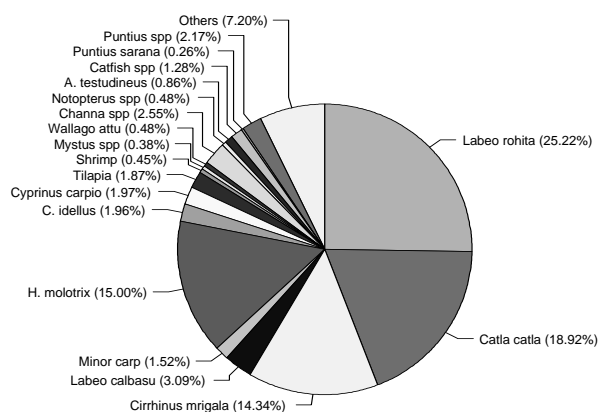


Figure 8 Species Composition (% of total production) reared in ponds for 1995/96. Source: Department of Fisheries.

¹The Fourth Fisheries Project (Islam & Collis, 1998) estimates that total pond area used for aquaculture may be closer to 300,000 ha.

3.3.2 Baors (oxbow lakes)

Baors or oxbow lakes are common natural features of floodplains in some districts of Bangladesh, created when a meandering section of a river becomes cut off from the main channel. *Boars* often become seasonally re-connected to main and secondary river channels and other floodplain waterbodies via inlets and outlets. The main bodies of *baors* are often stocked with fingerlings supporting culture-based fisheries. Inlets and outlets are screened with bamboo or concrete-and-metal fences to prevent fish from escaping. Shallow and silted parts of *baors* are sometimes excavated to form small (0.5-1.5 ha) seasonal ‘*baor* fishponds’ or lake compartments (Apu & Middendorp 1997).

The majority of *baors* are located in the south-west region of the country in the districts of Jhenaidah, Jessore, Magura, Kuhstia, Chuadanga and Faridpur. *Boars* and *baor* fishponds are stocked with major, exotic and common carps. Wild fish also form a significant proportion of the catch from *baors* (Figure 9). Production varies according to management practices, ranging from approximately 100-1800kg ha⁻¹ (see Islam & Collis 1998 for further details).

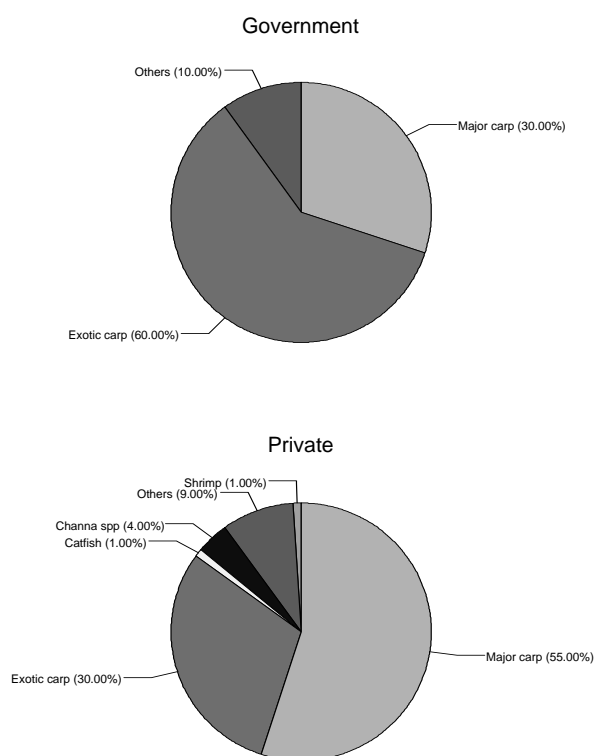


Figure 9 Species composition (% of total weight) of catches from government and privately owned *baors* for 1995/96. Source: Department of Fisheries.

3.3.3 Shrimp Farms

Shrimp farming in Bangladesh began in the late 1970's in response to the development of shrimp farming techniques in South East Asia and the strong international demand for shrimp products. In the early 1980's shrimp farming developed quickly in coastal areas of Bangladesh including Kulna, Cox's Bazar, Bagerhat, Bhola, Pathuakhali and Chittagong. In 1988/89, the total area under shrimp farming was estimated to be 108,000 ha with an average production of 168kg ha⁻¹ (FDL, 1994) The main species under production include *Penaeus Monodon*, *Metapenaeus monocerus* and *Macrobrachium rosenbergii* (Figure 10).

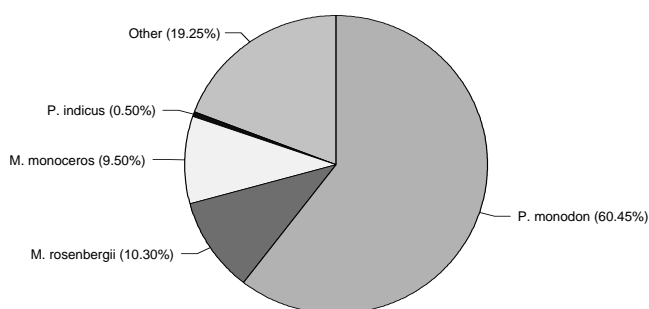


Figure 10 Species Composition (% of total production) of shrimp reared in farms in the Kulna District for 1995/96. Source: Department of Fisheries.

3.3.4 Pen culture

Pen culture employs nets or bamboo screens (*bana*) to enclose areas within waterbodies such as irrigation ditches or road side canals for fish culture. Yields of up to 5000kg ha⁻¹ have been reported for systems based upon carp poly-culture. Total area under production with this method is estimated to be 10,000 ha (Islam & Collis, 1998).

3.3.5 Cage Culture

Intensive cage culture technology has been recently introduced to Bangladesh using systems developed in other parts of Asia. Yields are estimated to be 30-40kg ha⁻¹. Approximately 500 cages (3000m³) are currently used to farm *Puntius*, *Pangasius* and *Oreochromis* species (see Islam & Collis 1998 for further details).

3.3.6 Rice-Fish Culture

Wild fish have traditionally been exploited from inundated rice fields, and many farmers construct small pits and FAD's as refuges to increase yield. Rice-fish culture involves raising small bunds around irrigated rice fields to retain flood and rainwater for up to 90 days to stock common or mirror carp and *Puntius* species. Production has been estimated to be 100-500kg ha⁻¹. Approximately 200,000 ha of area are suitable for rice-fish cultivation (Islam & Collis 1998).

3.4 Production trends

3.4.1 Main Sector Trends

According to the GOB DoFL statistics, overall sector production is increasing (Figure 11); recently at rate of approximately 6% (Anon, 1998). However, with increasing population growth, it has been estimated that supplies in 2000 will fall short of what will be required to restore them to the 1970 level (11kgs/capita per annum) by 428,000t (Anon, 1995).

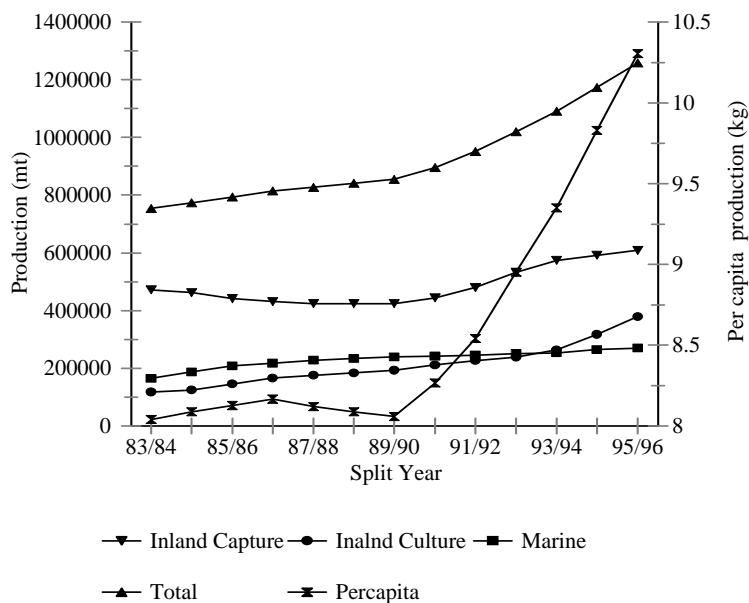


Figure 11. Total, per capita and intra-sectoral trends in annual fish production in Bangladesh. Data Source: Department of Fisheries.

3.4.2 Inland Capture Fisheries

Production from floodplain fisheries has shown strong growth between 1989/90 and 1994/95 (Figure 12). This significant (90%) increase in production, equivalent to approximately 174,000 tonnes is believed to be erroneous (Rahman, 1998) since during this period no intervention other than enhancement by the Third Fisheries Project were made in the country's floodplains which resulted in a cumulative increase in yield of only 33,000 tons during 1991-1996. For the last two years for which catch statistics are available, this component of the sector has showed signs of stabilisation. Production from the river sector declined slowly between 1984/85 and then more rapidly during the following three years. The last five years has showed some evidence for a recovery. Production from *beel* fisheries has grown steadily since 1986/87.

3.4.3 Aquaculture and Culture-Based / Enhanced Fisheries

Increases in production from all the culture (-based) systems currently monitored under the existing survey system have been significant contributing to a three-fold increases in overall output (Figure 13).

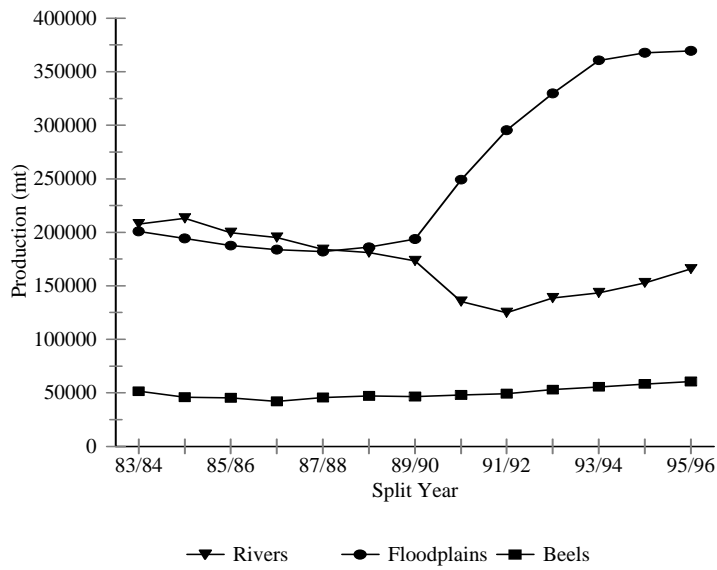


Figure 12. Trends in inland capture fish production from major inland habitat type. Data source: Department of Fisheries.

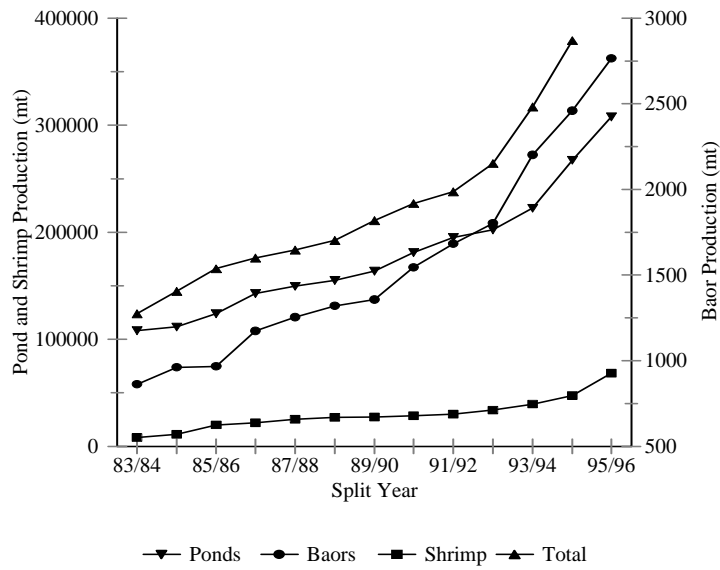


Figure 13. Trends in inland aquaculture and culture based fisheries (*baor*) production by sector. Data source: Department of Fisheries.

4. *Inland Fisheries Management*

4.1 *Institutional Arrangements*

Fisheries management, administration, development, extension and training in Bangladesh is the responsibility of the Department of Fisheries (DOF) under the wing of the Ministry of Fisheries and Livestock (MOFL) (Figure 14). Two other organisations work under the umbrella of the MOFL: Bangladesh Fisheries Development Corporation (BFDC) and the Fisheries Research Institute (FRI) (Rhaman, 1989). Several other government agencies and bodies including the Ministry of Local Government, Rural Development and Cooperatives, Ministry of Lands; Ministry of Irrigation, Water Development and Flood Control, with their affiliated institutions, are also actively involved in fisheries administration, management and development (Rahman, 1989).

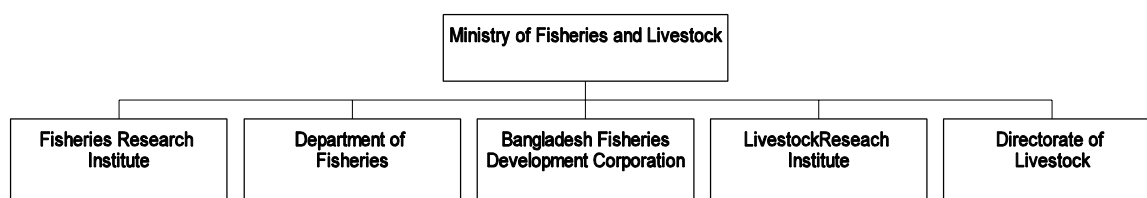


Figure 14 Organogram of the Ministry of Fisheries and Livestock (MOFL), Bangladesh

The DoF employs approximately 3500 employees at its headquarters and within four administrative divisions; Dhaka, Kulna, Chittagong and Rajshahi (Figure 15). The DoF, in recognition of the limited institutional capacity and resources, also work closely, or in tandem, with a number of non-governmental organisations (NGO's), donor and financial institutions and various fishermen cooperatives.

4.2 *National Management Objectives*

The over-arching objectives of the national fisheries policy of the Government of Bangladesh (Ministry of Fisheries and Livestock, 1998) are to:

- Increase fish production
- Alleviate poverty by expanding employment opportunities and improving socio-economic conditions of fishers.
- Fulfil the demand for animal protein.
- Achieve economic growth through foreign exchange from fish exports.
- Maintain ecological balance, conserve biodiversity, ensure public health and provide recreational facilities.

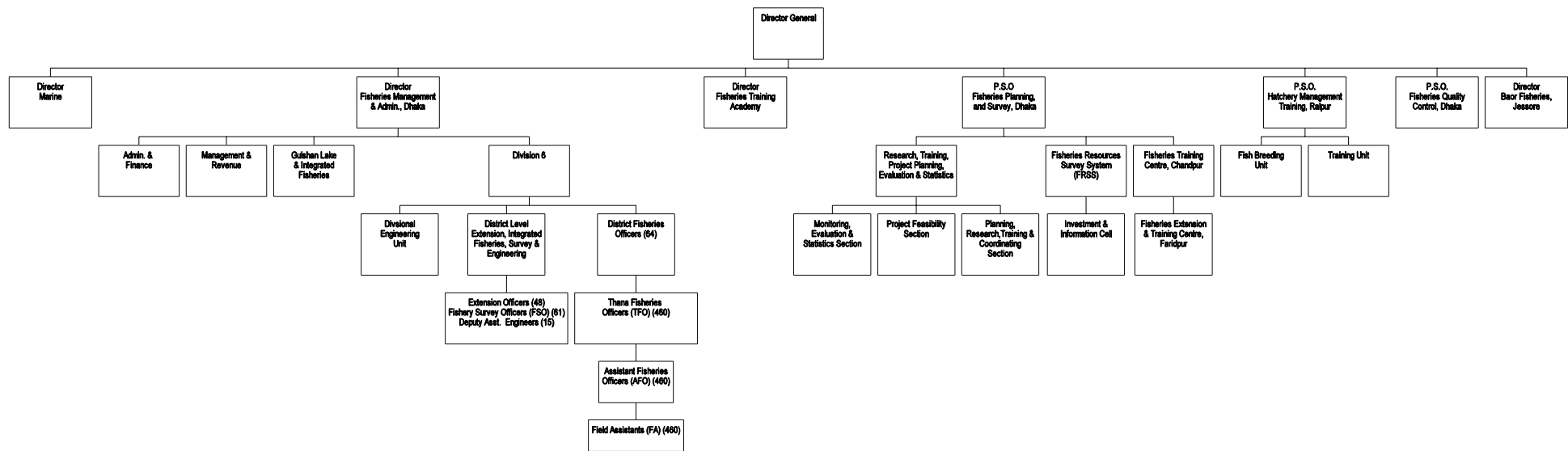


Figure 15 Organogram of the Department of Fisheries, Bangladesh.

4.3 Management Instruments, Access Rights and the Legal framework

Since the commencement of the East Bengal State Acquisition and Tenancy (SAT) Act of 1951, all inland fisheries resources (rivers, *khals* and *beels*, *baors*), except those from private fish ponds and borrow pits, have fallen under the jurisdiction of the Government, with legal ownership held by the Ministry of Land (MOL). A comprehensive system of water body registration exists, established through the Government State Manual of 1958 to collect revenue from the fishery resources contained within these waters. Rivers are segmented into compartments or *jalmohals* (water estates) and individually coded with a name and number. All *beels* are similarly named and numbered as individual *jalmohals*. In some cases, several small *beels* are lumped together as a group fishery, often including parts of adjacent rivers. Approximately 20,000 *jalmohals* are recorded in revenue registers of district government offices (Ahmed and Aguero 1987; Bernacsek, 1994).

Until 1986, management of inland fisheries has been conducted through a combination of *jalmohal* leasing and technical conservation instruments.

4.3.1 *Jalmohal* Leasing

Periodic lease rights to fish *jalmohals* are sold through a public bidding system by the MOL and the Water Development Board. In some cases, the Department of Forest and local governments are also involved in selling the lease or fishing rights. The highest bidder for a particular *jalmohal* must immediately pay a 50% deposit of the lease fee. River and seasonal (annual) waterbody *jalmohals* are normally leased out for one year, while perennial *beels* may be leased for three years. Exceptionally, *beel* leases may run for 6-9 years. Lease fees for large *beels* are often in excess of several hundred thousand taka, and therefore, leaseholders are usually rich investors who are not fishermen themselves. Leaseholders therefore subsequently organise harvesting activities by engaging sub-lessees, guards, toll collectors and fishermen under various terms and conditions. The GOB collects about Tk 460 million annually from *jalmohal* leasing (Aguero, 1989; Bernacsek, 1994).

The *jalmohal* leasing system applies only to the dry season period of the year when the individual river and *beel*, *boar* and *khal* fisheries become discrete and therefore demarcated from other fisheries by land. During the flood season, when many parts of Bangladesh are inundated by a single continuous sheet of water, the *jalmohal* system is effectively cancelled out due to the difficulty of enforcing private access rights to geographical boundaries that no longer exist. Customarily therefore, there is open access to all fishermen during this period which is of tremendous social and economic importance, particularly for the landless poor (Bernacsek, 1994).

The *jalmohal* system has been widely criticised (Bernacsek, 1994; Ahmed and Aguero, 1987; Aguero, 1989; Rhaman, 1989) principally because it promotes over-exploitation in the absence of appropriate incentives for conservation (short term leases), and control mechanisms and surveillance by the Department for fisheries (see below). Leaseholders believe it is their right to harvest all fish, which is often achieved by completely de-watering the *jalmohal*. Through exploitation by middlemen, money lenders and government revenue collectors, the fishermen themselves are also driven to maximising catch.

In essence, the *jalmohal* leasing system is oriented towards generating revenue for government and substantial incomes for leaseholders. Ownership of *jalmohals* by the MOL, (who is responsible for enforcing fishing regulations via the Department for Revenue but in reality show little interest), also

severely weakens the capacity of the MOFL to carry out its mandate to scientifically manage, protect and conserve the inland fisheries resources of Bangladesh (Bernacsek, 1994).

4.3.2 Technical Conservation Instruments and Supporting Legislation

The Department of Fisheries, under the Ministry of Fisheries and Livestock (MOFL) are responsible for the management and conservation of fisheries and other aquatic resources, and for the maintenance and improvement of inland aquatic habitats. Regulations relating to conservation and protection of fisheries resources were established under the Protection and Conservation Fish Act, 1950 and later under the Fish Act (Amendment), 1982 and the Fish Rules, 1985.

These acts and rules prohibit:

- Use of engines in rivers, canals, *khals* and *beels*.
- Construction of bunds, weirs, dams and embankments in rivers, canals and *beels* for any purpose (catching fish) other than irrigation, flood control or drainage.
- Use of explosives, poisons, guns and bow and arrows to catch fish.
- Capture or sale of juvenile *Shol* (*Wallago* spp), *Gazar* and *Taki* (*Channa* spp) between 1st April and 31st August.
- Capture of carp species: *Rui* (*Labeo Rohita*), *Catla* (*Catla catla*), *Mrigal* (*Cirrhinus mrigala*), *Kalbaus* (*Labeo calbasu*) and *Ghania* between 1st April and 30th June (some variation according to specific waterbodies- see First Schedule).
- Sale of Carp spp, *Hilsha*, *Pugus*, *Bhola* and *Aor* below 23cm and *Silon* below 30cm between certain periods of the year (see Second Schedule).
- Capture and sale of frogs.

A number of amendments to the Fish Rules, 1985 have recently been proposed (Ahmed, 1997) to:

- Permit the use of engines and construction of bunds etc for aquaculture purposes.
- Prohibit the capture of fish by de-watering.
- Include other species of carp to Rule 5.
- Prohibit the capture of fry or post larvae of shrimps and prawns other than for aquaculture.
- Destroy fishing gears employed in contravention to the Fish Rules.

Fish Sanctuaries

Under the GOB financed Integrated Fisheries Development Project, 10 fish sanctuaries have been established in different regions of the country covering a total area of 9000 hectares of river and *beel* habitat. Their effectiveness is diminished to a large extent by the governments limited enforcement and surveillance capacity (see below).

Enforcement and surveillance

Enforcement of the above legislation is the responsibility of *Thana* Fisheries Officers (TFO). Enforcement is made difficult because (i) prosecution of offenders requires a witness to testify the alleged offence was committed which they are often reluctant to do, (ii) fines are small (Tk 50-200), (iii) offences are often committed at night and (iv) there are, on average, only five TFO in each *Thana*.

4.3.3 *The New Fisheries Management Policy (NFMP)*

In 1986, the MoFL began a major new initiative to address the problems associated with the *jalmohal* lease system. This initiative was called the New Fisheries Management Policy (NFMP) and represented the first steps towards promoting co-management. The main objectives of the NFMP are to divert the maximum benefits from fishing to the actual fishermen and establish management systems which attempt to ensure the long term sustainability of fisheries resources. This is pursued by ensuring that access to fishing rights is only given to genuine fishermen by means of local peer/official selection and issuing of renewable annual fishing licences, for a fee, to approved and listed genuine fishermen (Bernacsek, 1994).

Most *jalmohals* are much too large for one fisherman to harvest, and therefore the DoF issues licences to fishermen's cooperatives, associations etc. The aggregate licence fee is based upon the lease fee that would have been collected under the old leasing system. Because fishermen usually have little capital, the NFMP also contains a credit component. Resource conservation is pursued through the installation of permanent *kathas* (brushpiles) in sanctuary areas and closed seasons for certain species (Bernacsek, 1994) Many *jalmohals* are also stocked (enhanced) and various NGO-fisher community partnerships have evolved to facilitate fish production, harvesting and marketing activities (see below).

Initially, 300 of the 20,000 *jalmohals* (and the responsibility of revenue collection) were handed over to the DoF by the MOL. However, in September 1995, the MOL abolished the leasing of *jalmohals* altogether, except at the discretion of the DoF. This effectively meant that all flowing rivers and some sites previously managed under the NFMP (not managed by licensing arrangements) became free access with neither revenue requirements nor restrictions on fishing activities attached to them. Consequently, a complex array of management systems and arrangements now prevail (Thompson, 1998):

- Open access in rivers and some previous *jalmohals*
- Leasing of *jalmohals* to powerful individuals
- Leasing of *jalmohals* to fisher cooperatives (via aggregated licence fees)
- Licensing individual fishers to fish *jalmohals*
- Open access to all resources during the flood season.

4.4 *Further Moves Towards Co-Management*

Faced with the complex and dynamic nature of the environment and fisheries characterised by highly dispersed multi-gear, multi-species harvesting systems, and presumably in recognition of their paucity of institutional capacity, resources and skills, the GoB and the DoF are increasingly favouring co-management approaches as a means of achieving the national objectives for the sector. This is reflected by the growing number of existing and planned pilot/experimental management projects and donor funded programmes with strong community-based themes or foundations which attempt to effectively transfer the responsibility of management to fishing and fish-farming communities. The most significant examples of these initiatives include the *baor* (Oxbow Lakes) Project, the Community Based Fisheries Management Project (CBFM) and the forthcoming Fourth Fisheries Project (FFP). These, and others, are described in detail in Section 7.

4.5 *Other Management Support and Development Projects*

Against this backdrop of management systems and arrangements, a number of (donor-assisted) government programmes have been instigated in an attempt to improve production from inland fisheries including floodplain stocking through *beel* nursery programmes in the Northeast region of the country under the Asian Development Bank assisted Second Aquaculture Development Project and stocking of selected floodplains in western Bangladesh under the IDA assisted Third Fisheries Project.

A number of existing (extension) programmes further aim to strengthen institutional capacity, transfer technology and improve resource management including:

- Grameen Motsho Foundation (GMF): Provision of aquaculture support services to poor women and men.
- Rangpur Dinajpur Rural Service Expanded Integrated Aquaculture Development Project (RDRS): Support to a large NGO in the Northwest to expand and develop its integrated aquaculture extension capacity.
- Northwest Fisheries Extension Project (NFEP): Strengthening the sustainable provision of aquaculture extension in Northwest Bangladesh
- Support to University Fisheries Education and Research (SUFER): Promotion of demand driven research and curriculum development in five universities in Bangladesh.
- Fisheries Training and Extension Project (FTEP): Increase DoF staff's technical and communication skills in promoting low input polyculture in ponds throughout Bangladesh.

4.6 *A New National Fisheries Policy*

The MOFL is currently working to develop a National Fisheries Policy for long term sectoral development comprising five main components, three of which relate to inland fisheries and aquaculture (see Annex 2 for further details):

(i) Inland Capture Fisheries.

The main policy proposals for inland capture fisheries include:

- Habitat conservation and appropriate care in implementing inter-sectoral activities such as FCD/I, agricultural, industrial, road and urban development projects.
- Arrangements to ensure that genuine fishermen obtain access to *jalmohals*
- Establishment of fish sanctuaries within areas of *jalmohals* and conservation of entire *jalmohals* to fish sanctuaries.
- Establishment of integrated rice-fish/prawn culture in floodplains
- Establishment of legislation to control polluting activities and use of harmful chemicals and insecticides for agriculture.
- Enforcement of Fish Rules (and proposed amendments) and conservation of fish and shrimp breeding grounds by DoF and fishing communities.

(ii) Fish Culture and Management of Closed Waterbodies.

- Encouragement of fish culture in all closed ponds stocked with exotic species.
- Establishment of Union-based demonstration farms to extend aquaculture technology.
- Females will be encouraged in fish culture
- Government owned ponds will be leased to poor fisheries
- Aquaculture feed, fish fry and shrimp post larvae production technology will be developed.
- Arrangements to ensure that local fisher communities will be given access to boars for culture, and technical and socio-economic support will be provided.

(iii) Coastal Shrimp and Aquaculture.

- Shrimp committees, responsible for the development of shrimp production, and implementing laws will be established at *Thana*, District, Division and National levels.
- Measures will be taken to conserve biodiversity in the coastal region.
- Shrimp culture in mangrove forest will be banned.
- Training will be given to shrimp larvae fishermen to reduce mortality rates during capture and transportation.
- Private entrepreneurs will be encouraged to establish shrimp hatcheries to reduce the dependency on natural shrimp post-larvae.
- Legislation will be established to prohibit the capture of shrimp during their breeding season.
- Government funded shrimp hatcheries will be established.
- Shrimp quality control and marketing will be strengthened.

A number of other related fisheries policies have also been proposed relating to landing centres, transportation and marketing, processing and quality control, export, education, research, extension, environment, credit, fishermen cooperatives and a proposal to develop a national fisheries plan (see Annex 2 for further details).

4.7 Fourth Fisheries

The proposed activities of the forthcoming Fourth Fisheries Project implicitly assumes a number of further sector policies, particularly for the inland capture sector including:

(i) Inland Capture Fisheries

- Establishment of co-managed fish sanctuaries in 50 *jalmohals* (river *duars* [scour holes] and *beels*). A Sanctuary management committee will be established comprising members of the community and representatives of NGO's and DoF (*Thana* Fisheries Officer). No lease or licence fees will be charged. Impact assessment will be examined through special studies. No details of post project monitoring have been proposed (Rahman, 1998).
- Habitat restoration of 125 *khals* and *beels* selected with the assistance of farmers, fishermen and residents. Impact assessment will be examined through special studies. No details of post project monitoring have been proposed.
- Construction of 10 fish passes to increase recruitment and biodiversity within FCD/I schemes. The engineer in charge of the FCD/I scheme will be responsible for operation and maintenance

of the fish pass. Impact assessment will be examined through special studies. No details of post project monitoring have been proposed (Rahman, 1998).

- Stocking of floodplains (*beels*) with carp fingerlings in more than 80 *beels* throughout the country. The DoF will lease *beel jalmohals* to fishing communities (*beel* Management Coordination Committees (BMCC)) over a ten year period. During the first five years, stocking costs will be incrementally transferred to the BMCC, so that at the end of the five year period, all stocking and lease costs will become the responsibility of the BMCC. Institutional, management and credit support will be provided by NGO's. The local fishing communities and NGO's will establish *beel* boundaries and households that are to participate in the programme. Fishing licenses will be issued to participants (full-and part-time, subsistence fishermen and *kua* (fish pit) owners to recover the stocking and lease costs. The cost of the license will vary according to gear efficiency and fishing location. Non-license holders will not be able to fish once the *beel* is stocked (Rahman, 1998).

Large floodplains having a flood season area greater than 3000 ha are difficult to manage under the participatory approach described above. *Beels* with a catchment (floodplain) area in excess of 3000 ha will be stocked and managed by the DoF according to methodology developed under the Third Fisheries Project where beneficiaries pay the *jalmohal* lease cost and part of the cost of stocking (Rahman, 1998).

Monitoring and evaluation will be conducted in 10 small and 5 large stocking sites by a consulting firm and will include details of the numbers of fishermen involved, fishermen income, size and species catch composition, yield per unit area and physical and biological attributes of the *beel*/floodplain.

- Hilsa Conservation and Management by establishing six riverine sanctuaries enforced by the DoF. Landings of Hilsa will be monitored by a special study at important landing sites: Chittagong, Sandwip, Hatia, *kuakata*, Bhola, Barisal, Chandpur, Goalundo and Dhaka, and sampled for size composition and sex. It is unclear how this information will be used for management (Rahman, 1998).

(ii) Aquaculture

- Intensive Aquaculture Demonstration to support the development of a sustainable aquaculture demonstration programme at *Thana* level to promote new production technologies (see Islam & Collis, 1998 for further details)

(iii) Shrimp Culture

These projects aim to increase shrimp production by encouraging and extending sustainable production technologies (see Karim & Stellwagen, 1998 for further details).

A number of other training, extension, research and environmental programmes are also included in the project (see Alam, 1998 for further details).

5. *Obstacles to developing a FIMS for Bangladesh*

5.1. *Roles, Management Objectives, Strategies and Data Requirements*

A considerable obstacle to developing a prototype co-management FIMS for Bangladesh is that the policy proposals and objectives described in the previous section are not supported by fundamentally important details of the respective roles and responsibilities of the state, fishing communities and other stakeholders within the complex array of existing access arrangements. Consequently, no detailed management plans and strategies exist from which to identify data and information, collection and feedback requirements.

Management objectives and data requirements of the DoF with respect to a co-management FIMS have been tentatively examined through the proposed 'Fisheries Resource Management Support' (FRMS) Project and (DOF-)amended versions; 'Fisheries Information Management Project' (FIMP), 'Strengthening Information Management and Planning in the Fisheries Sector' and 'Support for Information management and Planning' (SIMP).

The main objective of this five year £3.2m initiative is to strengthen the national capacity for fisheries resource management, particularly regarding the collection of fisheries data and its use to better formulate resource use strategies and to better target sectoral development inputs. In addition to a training and institutional development component, the main activities of the project to meet this objective included the identification of appropriate data collection methodologies and to develop of a Fisheries Information Management System (FIMS).

Broad data requirements (see FRMS 'Annex 3' in Appendix 3) were identified by the project on the basis of very general *a priori* assumed management objectives (MSY and MEY) and with some limited recognition of the importance of access rights and the distribution of benefits. The fundamental weakness of the project was a failure to detail how the additional information and resource requirements, identified by the DOF and the projects planners, would be used within coherent management strategies in support of the national fisheries objectives and policy proposals for the sector. These concerns were made explicit by Kevin Sparkhall, Head of DFID, Bangladesh:

The project memorandum failed to adequately identify "...the use that will be made of the information... and what information is needed and for what purpose". It was concluded that "... the problem of information preparation and management needs to be set in the wider context of the role of the DoF and constraints on this being fulfilled"....

"My main questions concern the use made of the information for improved resource management. I could not, at least initially, see a lot of substance in this dimension of the project even though the importance of the issues is acknowledged. The proposal therefore, looks like a data collection project with some genuflection towards wider information needs"...

The project needs to assess the "...key roles of the DoF and constraints on effectively carrying out certain management tasks relating to them, leading to the identification of the role of improved data collection and judgements about how far what we hope to achieve through the project is feasible and worthwhile"...

“The outputs look too technical and data related and not sufficiently related to the whole system. I would like to see a case made for the inputs proposed and for the project structure”

In response to these comments, and in spite of considerable effort on the part of DFID in the form of regular meetings and workshops with DoFL over a three month period, management roles, responsibilities and strategies, and corresponding data/information requirements to achieve any specific objectives could not be established, and therefore the project was “shelved” (Simon Bland pers comms).

Similar difficulties were experienced by this project. Through semi-structured interviews, key members of the DoF were asked to identify their data and information requirements in support of management objectives. No consensus could be established; staff identified extensive lists of biological and socio-economic information and data but with virtually no justification as to how it would be used for management purposes and with little thought given to how it could be collected given the existing and foreseeable resources and institutional capacity of the DoF. Similarly, no consensus could be established concerning the most appropriate form of the output from the FIMS to evaluate the performance of any management strategies and to guide future management and planning activities.

It must be clearly borne in mind that it is certainly not the responsibility of this research project to set management roles and responsibilities of the DoF, fishing communities and other stakeholders in the fishery, or design detailed (co-)management strategies or plans in pursuit of national fisheries policy on behalf of the GOB. Therefore, in order to provide some basis with which to develop and test a relevant and purposeful prototype co-management FIMS at this field study location, it was necessary to make a number of assumptions regarding appropriate roles and responsibilities of the DoF and fishing communities:

- The state has a very limited capacity to actively manage the country’s aquatic resources due to the complex and dynamic nature of the fisheries, the existing fundamental lack of any coherent management strategies, its weak institutional capacity and paucity of resources.
- Active resource management can be more effectively conducted at the community or fishermen level on the basis of adaptive management. However, the GOB DoF will always have a significant role in the management of the country’s fisheries resources, in particular as a coordinator, legislator and administrator of various community-based fisheries management activities and supporting projects. A more active involvement in management will be necessary for those fisheries which are not so well suited to co-management, particularly those associated with large rivers where boundary delimitation is problematic and where the resources are highly mobile (migratory). This active involvement is also likely to extend to working with other natural resources and development planning departments to minimise sectoral interactions within the wider catchment of the fisheries (Hoggarth *et al.*, 1999). Moreover, in order to evaluate whether or not the over-arching national objectives for the sector are being met, national monitoring and reporting responsibilities and obligations will remain an important role of the state.
- To facilitate adaptive management at the community level, the DoF should monitor the performance of community management systems or units and the details of the management strategies employed. These should include the mix of management instruments (relative reserve

area, closed seasons, gearbans, stocking densities), and details concerning monitoring control and surveillance. With this information, the DoF are then in a position to take a holistic view to identify and communicate lessons of management strategies between fishing communities. To be of relevance at the community level, the management performance criteria (MPC) should be established on the basis of community/fisher management objectives. These criteria should be of relevance on a national scale and therefore should also be included in the national monitoring programme.

- Potentially conflicting state responsibilities and community management objectives such as the maintenance of biodiversity may be resolved through awareness programmes and education.

5.2 Collaboration with the DoF.

Considerable effort was made to establish a collaborative and cooperative relationship with the DoF through numerous meetings with members of staff (see Annex 1) supported by letters, and documents highlighting the benefits of the project for the DoF (see Annex 4). In spite of these efforts, the DoF were quite adamant that they were not interested in any form of collaboration with the project or its outputs (Prototype FIMS, software demonstrations, training material and workshops etc).

This reluctance to collaborate stemmed from their fear that this project would jeopardise the implementation of the FRMS, which, in their eyes, would deliver what they believed was particularly important for improving the existing FIMS; principally funds for more resources, manpower, computer hardware etc. In other words, the DoF were highly suspicious that this project, with no major institutional and resource strengthening component, had been designed by DFID to replace the proposed FRMS project. With this suspicion, the DoF suggested that this project should be integrated into the FRMS project, and stressed that until the FRMS project had been approved according to their terms, they were not prepared to discuss or divulge any further information regarding the existing DoF FIMS. This included any further information regarding potential improvements to the existing FIMS/FRSS; additional data requirements, output requirements, details of the FRSS frame surveys, raw data, data structures etc.

Therefore the prototype co-management FIMS had not only to be developed on the basis of the assumptions described above, but also without fundamental information and support from DoF.

Given their key role in the project and the main target for project uptake, quite clearly, collaboration should have been agreed with the DoF at the project inception, and not the field work, stage.

6. *Development of a Co-Management FIMS for Bangladesh*

This final chapter identifies relevant data and information requirements that should be included in the prototype FIMS on the basis of the assumed roles and responsibilities of the state and fishing communities identified in the previous chapter. The existing FIMS is reviewed to establish existing data and information requirements and to make recommendations on an appropriate sampling methodology.

6.1 *Identification of National Data and Information Requirements*

Based upon the assumptions made in the previous chapter regarding DoF's roles and responsibilities, certain basic information, or default indicators (see Final Report) should be included in the FIMS to evaluate whether the overarching national objectives of the sector are being met. As described in the Final Report, such information cannot inform managers whether or not a particular output or outcome can be improved or increased, or what measures could be taken to make improvements - this usually requires technical management models (see Final report) which cannot be supported by the existing national institutional capacity and resources and are likely to be of little utility given the dynamic environment and complex nature of the fisheries. However, some consideration should be given to monitoring basic inputs to the fishery to provide some understanding of any changes in the monitored outputs. Data and information requirements to support and coordinate community-based management systems or units are identified in Section 7.

The proposed default indicators and fishery inputs that could be monitored to evaluate management performance with respect to the over-arching national objectives are summarised in Table 1 below. Clearly a very large range of alternative indicators, inputs and outputs and their proxies could have been included or used as alternatives. Those included in the table have been selected on the basis that they are intuitive and easily measured. Where possible, alternative sources of information have been indicated.

Table 1 Proposed default indicators (outputs) and basic explanatory variables (inputs) that could be monitored to evaluate management performance with respect to the over-arching national objectives of the MoFL.

Objective	Proposed Information Requirements	
	Default Indicators (Fishery Outputs)	Factors affecting outputs (Fishery Inputs)
Increase fish production	<ul style="list-style-type: none"> Total catch/production from capture, culture, and culture based fisheries. 	<ul style="list-style-type: none"> Fish abundance.¹ Total fishing effort.¹ Market prices (demand). Cost of fishing / production (enhancement and culture).
Poverty alleviation. Expansion of employment opportunities improvement of socio-economic conditions.	<ul style="list-style-type: none"> Numbers of people involved in fishing (BBS). Fishermen income. Fish consumption. 	<ul style="list-style-type: none"> Cost of fishing. Market demand and prices. Fish abundance.¹
Fulfill demand for animal protein	<ul style="list-style-type: none"> Fish production per capita. Nutritional indicators (BBS). 	<ul style="list-style-type: none"> Population number (BBS). Total catch/production.
Achieve economic growth through foreign exchange from fish exports.	<ul style="list-style-type: none"> Economic indicators eg GDP (Department of Trade?). Foreign exchange earnings from fish products (monitored elsewhere?). 	<ul style="list-style-type: none"> Fish prices. Total catch/production exported (monitored by DoF?). Exchange rates (monitored elsewhere?).
Maintain ecological balance and conserve biodiversity.	<ul style="list-style-type: none"> Abundance (CPUE) of main species. Abundance (CPUE) of all species (by special study?). 	<ul style="list-style-type: none"> Fishing effort¹. Fishing effort¹ by gear type. Environmental monitoring (responsibility of DoF?).

¹. Fish abundance (catch per unit effort (CPUE)) measures must be stratified by gear, habitat and season due to natural variation in fish abundance by habitat type and because gear catchability, q varies according to gear type, habitat type and hydrological conditions (seasons). For the latter reason, fishing effort measures should also be stratified by gear type, habitat type and season. Fishing effort may be measured in terms of gear hours, numbers of fishermen operating different gear types, or numbers of different gears. BBS- Bangladesh Bureau of Statistics.

6.2 The Existing FIMS - the Fisheries Resources Survey System (FRSS)

The following review draws heavily from Anon (1990), Felts (1991) and FDL (1994).

The Fisheries Resources Survey System (FRSS) was developed with the financial and technical assistance of the FAO/UNDP (BGD/79/015) project between 1980 and 1984 to provide the first reliable catch statistics by waterbody type for fisheries resources monitoring, planning and management².

The frame surveys were conducted with the assistance of the Bangladesh Space Research and Remote Sensing Organisation (SPARRO), which in combination with ground truthing by survey officers, established the total number and area of the waterbodies in the country. Survey officers also collected data on the number of fishing units, villages and boats involved in fishing. On the basis of the frame surveys, sampling units were chosen and fixed, and data collected from these on a regular basis. By extrapolation, catch data is estimated by district, division and country for the following sectors: rivers, *beels*, floodplains, *baors*, ponds (freshwater aquaculture systems), sunderban habitat, shrimp farms, and industrial and artisanal marine fisheries. Since its inception, the FRSS frame surveys and sampling systems have remained unchanged.

6.2.1 FRSS Output

The output produced by the FRSS is published in an annual report format - *Fish Catch Statistics of Bangladesh* containing 29 tables (Table 2). This information effectively represents all the data available for the planning, development and management of the Fisheries of Bangladesh.

Most of the data presented in the statistics relate to fisheries outputs, particularly total catch or total catch per unit area. Information required for active management and planning including fishery inputs or factors affecting outputs (eg CPUE, fishing costs, market prices etc) are potentially available from the FRSS data recorded, but are not presented in the statistics. All of the data are presented in tabular format making it difficult to assess, and attempt to explain, trends with time. None of the information or data are feedback to fishermen, fishing communities and other important stakeholders.

According to the World Bank (1991), the existing information provided by the FRSS is "...often incomplete, inconsistent, inaccurate or outdated. A major effort is needed to improve the quality control on this data". Notwithstanding this, the FRSS is seen as "...a step on the right direction." Consensus exists among the DoF and other users of the FRSS output that the frame survey requires updating, that existing sample sizes are generally inadequate but limited by the paucity of resources, and that the output should be more timely and orientated to providing information relevant for management and planning.

6.2.2 Frame Surveys, Sampling Methodologies and Estimation Procedures

Because the principle focus for this case study is the inland fisheries of Bangladesh, details of the marine resource surveys have not been included. For a review of the marine surveys of Bangladesh see FDL/MRAG (1995). Copies of all survey forms described below are given in Annex 5.

² Prior to its establishment, fisheries production had been estimated from per capita fish consumption and population number (see FDL, 1994).

Table 2 Data tables contained in the *Fish Catch Statistics of Bangladesh*

Table	Title of Table
01	Annual Total Catch and Area Productivity by Sectors
02	Species Group-wise Catch in Inland and Marine Fisheries
03	Annual Total Catch of Inland Water by Fisheries
04	Annual Catch of Riverine Fisheries by Rivers and Districts
05	Annual Total catch in Principle Rivers
06	Annual Catch in the Principle Rivers by District and Species
07	Annual Catch in the Other Rivers by District and Species
08	Annual Catch in All Rivers by District and Species
09	Annual Total Catch of the Beel Fisheries
10	Species Composition of the Beel Catch
11	Annual Catch of Kaptai Lake by Species
12	Annual Total Catch in Floodlands
13	Species Group Composition of Subsistence Catch by District
14	Total Area and Total Catch of Ponds by District
15	Species Composition of Pond Catch by District
16	Species Composition of Pond Catch
17	Annual Total Catch of Baors
18	Species Composition of Boar Catch
19	Annual Total Catch of Shrimp Farms
20	Species Production of Farmed Shrimp
21	Species Group-wise Catch of Inland Fisheries by Sectors
22	Annual Total Catch of Marine Fisheries
23	Species Group-wise catch in Marine Fisheries by Type of Fishing Gear
24	Species Group-wise Catch (during the last two years)
25	Production of Carp Hatchling in Bangladesh
26	Information on Hatchling Production in Govt. Hatcheries and Fish Seed Farms
27	Information on Hatchling Production in Private Hatcheries
28	Carp-Spawn/Fertilized Egg Collection from Natural Sources
29	Export of Fish and Fish Products

6.2.2.1 The Riverine Fisheries Survey

The Riverine Fisheries Survey is designed to provide estimates of monthly total catch and catch value by gear type and species.

Frame survey

On the basis of the original frame survey, rivers in Bangladesh are categorised as:

Principle: Padma, Meghna, Jamuna and Brahmaputra.
Major: Eg. Dhaleswari, Old Brahmaputra
Minor: Eg. Ichamati, Atrai.

During the frame survey, every village along the banks of all the principle and most of the major and minor rivers was visited and the number of small and large boats recorded. Villages with less than 50 boats were categorised as medium and those with more than 50, large.

Within each of the 64 Districts, four villages; two large and two medium, were selected. In Districts that contain principle rivers, one large and one medium village adjacent to the principle river was selected. The remaining two villages were selected from locations adjacent to major and/or minor rivers. For Districts with no principle rivers, all four villages were selected from locations adjacent to major and/or minor rivers. The selected rivers were recorded on form RF1. The villages selected within each District have remained fixed since the original frame survey was conducted.

Sampling procedures

The four selected villages within each district are sampled twice per month. At each village, the total number of fishing units (defined as “the minimum unit necessary for fishing, usually consisting of a combination of a fishing boat of any size, one or more fishing gears, and one or more fishermen”) operating different gear types on each sampling day is established by interviewing “one or two well-informed fishermen” and recorded on form RF2 along with details of the and the gear types employed. Immigrant fishing units (from other villages) which are also identified by interview, are subtracted from the total number of units recorded.

Fishing units operating the different gear types are then randomly selected for catch sampling. The number of fishing units sampled for catch for each gear type is determined according to the number of fishing units operating each gear type on the sampling day as follows:

<u>Number of Fishing Units Operating</u>	<u>Number of Fishing Units to be Sampled</u>
>10	5
5 - 9	3
2 - 4	2
1	1

For each gear type in operation, fishermen from each sampled fishing unit are then interviewed for information on the days total catch by species type, the number of fishermen within the unit, the average market price of the species caught and the gear type used (Form RF3).

Sampling in each district is undertaken by one Fisheries Survey Officer (FSO). Completed forms are sent to headquarters in Dhaka by the 10th day of the month following the sampling month.

Estimation procedures

The estimation of annual production by district is made in two steps. Firstly, the monthly catch by species is estimated for each village in the district. Secondly, the monthly catch for the district is estimated by river category (Lower and Upper Meghna, Lower and Upper Padma, Jamuna, Brahmaputra and others) and summed to give a yearly value. The basic steps are as follows:

For each species, average catch per gear is calculated from the sample interviews. These figures are multiplied by the number of boats/gear type (fishing units) operating on the survey day to give the total catch of each gear by species for the village on that day. The calculation is repeated for the second survey day in the month, resulting in two estimates of total daily catch by species for that gear type.

The two estimates are averaged and then multiplied by the number of days in the month to give total monthly catch by species for each gear type. Summing over gears gives the total catch by species for the whole village for that month.

The total monthly catch by species is divided by the total number of boats (including non-operational boats) in the sample village to give an average monthly catch per boat. This figure is multiplied by the number of boats in the district to give the total monthly catch per species for the district. The number of boats in the village and in the district are taken from the frame survey. See Anon (1990) and FDL (1995) for further details.

Computations

Let Y_{ijk} be the total fish catch for a species and gear type for the k th unit on j th day in i th village.

Then $\hat{Y}_{ij} = \frac{N_{ij}}{n_{ij}} \sum Y_{ijk}$ is the estimated catch on the j th day in the i th village where N_{ij} is total number

of fishing units working in the selected village on the day and n_{ij} is the number of sample fishing units in the selected village on the day. The monthly village estimate is given by

$$\hat{Y}_{im} = \frac{N_1}{2} \sum_{j=1}^2 \hat{Y}_{ij} \quad \text{total estimated catch for } i\text{th village where } N_1 \text{ is number of days in the month.}$$

The estimated district total catch for a month is

$$\hat{Y}_m = \frac{N \sum \hat{Y}_{im}}{n_m}$$

Alternatively, a ratio method may be employed, where N^1 is total number of boats in the district obtained from frame survey, then the monthly district catch is given by

$$\hat{Y}_{RM} = \frac{N^1}{n_m^1} (\sum \hat{Y}_{im})$$

where n_m^1 is number of boats operating in sampling villages in month m . While n_m^1 varies from month to month, N^1 does not.

The national catch of each species for each river type is given by:

$$\hat{Y}_N = \sum_{dist} \hat{Y}_i$$

where \hat{Y}_i as estimate for i th district.

For the estimated total number of operating boats in a month let X_{ij} be number of fishing units operating on the j th day from the i th village, then

$$\hat{X}_i = \frac{\sum_{j=1}^2 X_{ij}}{2} \times \text{Number of days for month}$$

is the estimated number of units operating in a month for i th village and

$$\hat{X}_m = N \frac{\sum \hat{X}_i}{n_m}$$

is the estimated number of units operating in the district for the month where N = total number of riverine villages in district and n_m = number of sampled riverine villages in the district

Adding these estimates over months, yearly estimated number of units can be obtained. National estimates can be obtained in the same way as already described.

Assumptions

The methodology described above assumes that:

- Villages in each district are selected with equal probability without replacement at the 1st stage of sampling.
- Fishing units in selected villages are drawn randomly with equal probability without replacement.
- The two sampling days in each month are selected randomly in each month.

Weaknesses of the sampling design/survey procedures

- The number of fishing units in each district may have radically changed since the frame survey conducted over 15 years potentially leading to underestimates of total catch and effort.

- Because the selection of villages and sampling days, and rivers in each district is not random, the district and national estimates obtained by extrapolation are not valid.
- Catch and effort estimates are likely to be imprecise because they are based upon recall rather than direct observation.

6.2.2.2 The Floodplain Fisheries Survey

The aim of the Floodplain or ‘Subsistence’ Fisheries Survey is to provide estimates of total monthly catch by species and by fisher category (subsistence, commercial and both subsistence and commercial), habitat and gear type.

Frame

One village in each district was selected purposively on the basis that it is representative of the district fishing activities, situated near a beel, river, canal or inundated floodplain and easily accessible. A total of 71 villages were selected for routine sampling. In each village the numbers of subsistence, commercial and part-time fishing households are identified. Ten subsistence, five subsistence and commercial and, for each gear type used, five commercial fishing households are selected for routine sampling from those identified (Form SF1). These selected households remained fixed, unless their fishing activities change, in which case they are replaced.

Sampling Procedure

The selected households are interviewed for catch and effort data on one day each month by the FSO (Forms SF2 & SF3). The FSO is also required to check the accuracy of the subsistence survey by recording catches landed at no more than six households (SF4). This procedure is not undertaken. Survey forms are submitted to the DoF once per year by the 15th July.

Estimation Procedures

Presently, only catches from subsistence fishing households are estimated by the DoF. Estimates derived for the commercial fishing households would require adjustment because of possible duplication with riverine and *beel* catches. Assuming that villages and the sampling day are selected at random, then, for any fishing category, let y_{ij} be the estimated catch of a species for the j th sample household in the i th cluster of 100 households on a survey date in a month, then

$$Y_{ij} = D_{ij} y_{ij}$$

is the estimated total catch of the species for the month for the j th household in the i th cluster of households and where D_{ij} is the corresponding number of days spent fishing during the month. And

$$Y_i = \frac{N_{2i}}{n_{2i}} \sum Y_{ij}$$

is the estimated catch of the i th cluster of households in the month where N_{2i} is the number of fishing households in the cluster belonging to the fishing household type and n_{2i} is the number of sampled fishing households in the cluster (5-10). The estimated catch for a species for the district in any given month is

$$Y = \frac{N_1}{n_1} \sum Y_i$$

where N_1 is the number of clusters of 100 households in the district (total number of households/100) and n_1 is the number of clusters in the district (1-2). The national estimates are obtained by summing the district estimates.

Assumptions

- Villages (household clusters), households and sampling days are randomly selected.

Weaknesses of the sampling design/survey procedures

- Villages (household clusters) and sampling days are not randomly selected.
- Sample sizes are very small and therefore estimates are imprecise and potentially inaccurate.
- Catches are likely to be over-estimated because villages are purposively selected near waterbodies.
- The existing frame does not include sampling strata for stocked/non-stocked floodplains. Catch estimates are therefore likely to be imprecise.
- No account is taken of the numbers of fisheries in each household or the different gear types employed.

6.2.2.3 The beel Fisheries Survey

The *beel* survey principally provides catch, fishing intensity and species composition data. The survey also provides general information about the *beel* including dimensions, connectivity with other waterbodies, ownership, vegetation cover, leasing arrangements, fishing activity (who, when, how, duration), marketing of catch, investment costs (lease, guard, fishing etc) and returns (total catch value by species). It is assumed that this information is used to set the cost of the *beel* lease.

Frame Survey

On the basis of aerial photographs and satellite imagery (see above), *beels* in each *Thana* were identified and then categorised as either large (>8 ha dry season area) or small (<8 ha dry season area).

Sampling Procedures

In each *Thana*, one small and one large *beel* was selected for sampling, giving a total of 920 *beels*. Only the same 300-400 of these *beels* are actually sampled each year.

The general information for each *beel* described above is collected once per year by a Fisheries Survey Officer (FSO) and entered on a questionnaire form (*Beel 1*).

Catch and effort sampling is also conducted by the FSO every 10 days during the period December - February when most *beel* fishing is conducted by full-time or professional fishermen. During these visits, the FSO records, from direct observation and interview, details of each fishing unit operating in the *beel* (Form *Beel 1*), including the gear types and boats employed, numbers of fishermen per unit, and the total numbers of days fished by each unit during the season. From interviews with each fishing unit, the total catch by species and gear type (*katha* (brush pile) and other gear types) caught during the previous three days is recorded on Form *Beel 3*.

On each sample day, the FSO also estimates the total days catch by species and gear type from the *beel* by sampling the catches of randomly selected fishing units. The catch for each species is summed across the samples and raised in proportion to the total number of fishing units sampled relative to the total number of fishing units operating on the sampling day (see Worksheet ‘ Observation of Sample Catches and Estimation of Total Catch in the Sample Day’).

The estimated total *beel* catch of each species during the sample day is then summarised in Form *beel* 3, with the estimated total catch of all the fishing units for the previous three days. These two figures are then summed to give the total catch by species and gear type for a four day period.

The catches calculated for each four day period are then entered into a further worksheet ‘ Summary of 4 Days Catch and Estimation of Total Catch for the Whole Season’ . The estimated total catch by species and gear type for the season is then calculated from the summed 4 day period estimates and raised by N/n where N is the total number of days in the fishing season, and n is (the number of sampling days) x 4.

The total catch by species and gear type for the whole season is finally summarised in Form *beel* 4, together with the numbers of fishing units operating in the *beel*, the gears used, and the numbers of fishermen involved.

Estimation Procedures

The completed forms are sent to the FRSS unit in Dhaka once per year where further processing takes place manually. The FRSS unit uses only the estimated total catch and total catch by species as entered in the *Beel* 4 Form.

The total annual *beel* catch by species for each *thana* is estimated as the product of the total catch per unit area of each sampled *beel* category and the total area of each *beel* category. District catch is the sum of catches from all *thanas*, and the national catch from the sum of all districts.

Assumptions

- *Beels* are randomly selected within each *thana* each year.

Weaknesses of the sampling design/survey procedures

- *Beels* are not randomly selected in each *thana* each year.
- The existing frame does not include sampling strata for stocked/non-stocked or seasonal/perennial *beels* . Catch estimates are therefore likely to be imprecise.
- Some *thanas* are not sampled.
- Standard errors for the catch estimates can not be estimated because only one *beel* per size category is sampled.
- Superfluous information is collected and the majority of data processing is done manually.
- Fishing often takes place throughout the year, and also by subsistence fishermen who, in spite of taking a large proportion of the catch, are not included in the sampling survey. *Beel* catches are therefore likely to be underestimated.

6.2.2.4 The baor Fisheries Survey

This survey is designed to give monthly estimates of the numbers and cost of stocked fingerlings, and the catch weight and value by species.

Frame Survey

The majority of *baors* are located in six districts in the south-west region of the country: Jhenaidah, Jessore, Magura, Kuhstia, Chuadanga and Faridpur. Based upon field data collected under the original frame survey of 1982/83, all *baors* were categorised according to their productivity:

- Highly productive (Production > 250 kg ha⁻¹ y⁻¹)
- Moderately productive (Production > 70 and < 250 kg ha⁻¹ y⁻¹)
- Poorly productive (Production < 70 kg ha⁻¹ y⁻¹)

Boars are also categorised according to management authority, that is, Government or private.

Sampling procedures

All six government managed *baors* are selected and surveyed. For the private category, one *baor* is randomly selected for sampling from each productivity strata within each of the six districts, giving a total of 18 *baors*.

At each boar, government officers (in the case of government managed *baors*) or the District Fishery Survey Officer (FSO) (in the case of privately managed *baors*) sample fishing unit landings (cultured and wild species) twice per month at 15 day intervals. The sampled catch by species are summed and then raised in proportion to the number of fishing units sampled relative to the total number of fishing units operating on the sample day (Form BA -2). The results of the two sampling days are then summarised in Form BA-3, together with details of the fishing effort (fishing units, numbers of fishermen and boats), and the numbers of fingerlings and value of each species stocked during the month. Recorded catches over the two sampling days are raised by a factor of 15 to give the estimated total catch of each species for the month. Each month this information is summarised on Form BA-1 by the Fisheries Survey Officer (FSO).

Estimation Procedures

The sampling forms are sent to the FRSS unit in Dhaka once per year where the following processing takes place manually.

Let \hat{Y}_{ih} be the total sampled annual district catch of species *i*, in *baor* productivity stratum *h*. The estimated annual catch of species *i* within each district is:

$$\hat{Y}_i = \sum N_h \hat{Y}_{ih}$$

where N_h is the number of *baors* in the *h* th stratum within the district. The estimated total catch from all boars is then \hat{Y}_i summed across all six districts.

For government managed *baors*, the estimated total annual catch of each species is the sum of the estimated total annual catch of each *baor*.

Assumptions

- Privately managed *baors* are randomly selected from the three productivity strata within each district.
- The two monthly sampling days are randomly selected within each month.
- Fishing units are randomly selected for catch sampling

Weaknesses of the sampling design/survey procedures

- For privately managed *baors*, only one *baor* is sampled within each productivity strata and therefore the estimate will be imprecise and no standard errors can be calculated.
- The two sampling days within each month are not randomly selected.

6.2.2.5 Kaptai Lake Survey

The Kaptai Lake Survey has been designed to provide (monthly) total catch by species and gear type by lake sub area and corresponding fishing effort (numbers of fishing units³).

Frame Survey

The Lake is divided into four fishing areas: Shubolang, Kattali, Burirghat and Kaptai. Within each fishing area, two villages were randomly selected for routine monitoring on two fixed days each month separated by a 15 day interval (Form KF1).

Sampling Procedure

The survey comprises two main components: (i) a catch rate survey and (ii) a fishing unit survey. These are conducted each month at the selected villages by an FSO. At each village, the FSO estimates the numbers of units operating each gear type and the average number of days each unit fished with that gear type during the previous 15 days by interviewing one or two knowledgeable fishermen (Form KF2). For each fishing gear type used, a maximum of five fishing units are then randomly selected to sample catch rates (catch [numbers and weight] by species per day), effort (numbers of fishermen in unit) and unit price of each species from one of the following sources: (i) the fishing boat, (ii) the landing site or (iii) interview with the head fishermen (Form KF3). During the same sampling day, the FSO also records the total number of fishing units operating different gear types in each Lake sub-area (Form KF4).

Estimation Procedures

For each lake sub-area and fishing gear type, the total daily catch by species on each sampling day and at each village is estimated by raising the sample total (total of the up to five samples) by the ratio of the number of fishing units in operation during the sampling day to the number of units sampled. The estimates for each day and village are then summed and divided by the total number of fishing units operating at the two villages on the two sampling days to give an average daily catch rate per fishing unit by gear type and species for the survey month (Form KF5). This figure is multiplied by the average number of fishing gear unit days at the two villages (Form KF2) to give the total monthly catch of each species for each sub area and gear type (Form KF6).

³A fishing unit is defined as a minimum unit necessary for operating a particular gear type comprising a fishing boat, fishing gear, and the fishermen.

Assumptions

- The two villages are randomly selected within each lake sub-area.
- The two monthly sampling days are randomly selected within each month.
- Fishing units are randomly selected for catch sampling

Weaknesses of the sampling design/survey procedures

- Only one village is randomly selected within each month
- The two sampling days within each month are not randomly selected.
- Effort estimation depends upon a very long (15 day) recall period.
- Calculations are made manually.

6.2.2.6 The Sunderbans Survey

The survey provides information on the total monthly weight and value of Hilsa, other fish, large and small shrimp and dried fish caught from the Sunderbans.

Sampling Procedure

The fisheries in the Sunderbans are monitored by the Department of Forestry at the Divisional Forestry Office in Kulna, four Range Offices and at 14 forestry stations. Vessels fishing within the Sunderbans are required to report their catches to a station office before leaving. The total monthly weight and value of Hilsa, other fish, large and small shrimp and dried fish recorded at the stations are summarised in form (Form-Sun-F-1) by the Divisional Forestry Officer in Kulna and returned to the Department of Fisheries.

6.2.2.6 The Pond Aquaculture Survey

The pond aquaculture survey is designed to collect catch data by species for estimating the average catch per unit area by district and pond type (cultured, culturable and derelict).

Frame Survey

One village was selected from each district on the basis that it is representative of an average village with respect to fish culture practices. For each village, five ponds within each pond type category were randomly selected for monthly sampling (Form - PF 1) from a list of 50 ponds. If the village contained fewer than five ponds within a particular category, additional ponds were selected from the adjacent village.

Sampling Procedure

The owners of the fifteen ponds in each village are interviewed by the District FSO on the same day for each month for information on the numbers and value of species stocked, operating costs (weight and cost of fertilizer and feed, maintenance and harvesting costs and rent), and harvesting data (numbers and weight by species, and fishing method and effort) (Form - PF3). The 'condition' of each pond including information regarding the ownership, management, area, and culture methods is also monitored once per year (Form - PF2). Sampling forms submitted to the Department of Fisheries each year by 15th July.

Estimation Procedures

Let $y = \sum y_i$ and $x = \sum x_i$, $i = 1, 2, \dots, 5$ be the total catch for the species and area respectively. The estimated total catch for the cluster of 50 ponds in a month is given by

$$Y = N1. y / 5$$

where $N1$ is the number of ponds of a particular type in the cluster of 50 ponds in the village. Similarly

$$X = N1. x / 5$$

is the estimated area of the ponds a particular type in the cluster of 50 ponds in the village. The estimated catch per unit area is

$$CPUA = Y / X = y / x$$

The estimated total catch for the district is

$$Y_D = N_D Y$$

where N_D is the number of clusters of 50 ponds in the district estimated by dividing the total number of ponds in the district by 50.

Assumptions

- Villages and ponds are randomly selected.

Weaknesses of the sampling design/survey procedures

- Villages are not randomly selected, and because only one village is selected for sampling, standard errors cannot be estimated.
- Sample sizes are small and the frame survey requires updating as the number, area and type of culture ponds has changed since the original survey.

6.2.2.7 The Shrimp Farm Survey

The Shrimp Farm Survey is restricted to the greater Kulna and Chittangong districts where the majority of shrimp farming occurs. The survey aims to provide estimates of shrimp production (catch and CPUA) by species and district.

Frame Survey

Five *thanas* from a total of 19 in the greater Kulna District, and 3 *thanas* from a total of 13 from the Greater Chittangong District were selected for sampling on the basis of their representativeness and accessibility. Four shrimp farms were then also purposively selected from each *thana* according to the same criteria. The total area of waterbodies under shrimp cultivation was estimated under the original country-wide frame survey undertaken between 1985 and 1989.

Sampling Procedures

Each selected farm is surveyed annually by the FSO for information on the farm area, ownership, management, culture practices, physical and biological features, fertilization, feeding etc (Form SF1). The FSO also records the weight of shrimp and fish harvested from each farm on four days each month which are purposively selected around the time of full and new moons (SF2). Towards the end of the

production season, the FSO will visit each farm to interview the owner/manager for a summary of the monthly harvest weight and value of each species (Form SF3).

Estimation Procedures

Assuming that *thana*, farm and sampling dates are randomly selected, let Y_{ijk} be the catch of shrimp (or fish) on the K th day of the j th farm in the i th *thana*, then

$$Y_{ij} = D \frac{\sum y_{ijk}}{d}$$

is the estimated monthly catch of the j th farm and the i th *thana* where D is the number of days in the month and $d = 4$ sampling days. The monthly estimated catch for the i th *thana* is

$$Y_i = N_i \frac{\sum Y_{ij}}{4}$$

where N_i is the total number of shrimp farms in the i th *thana*. The estimated catch for the district is given by

$$Y = N \frac{\sum Y_i}{n}$$

where N is the total number of *thanas* in the district and $n = 5$ or 3 for the Kulna and Chittagong districts, respectively.

For the calculation of the estimated area under shrimp farms, let X_{ij} be the area of the j th farm in the i th *thana*. Then

$$X_i = N_i \frac{\sum X_{ij}}{4}$$

is the area of shrimp farms in the i th *thana* and

$$X = N \frac{\sum X_i}{n}$$

is the total area of shrimp farms in the district.

Assumptions

- *Thanas*, farms and dates are randomly selected

Weaknesses of the sampling design/survey procedures

- *Thanas*, shrimp farms and sampling dates are selected purposively. As a result, geographical and temporal extrapolations are not valid.

- Shrimps are now farmed in many other districts not included in the survey and therefore production is underestimated.
- Farms are not stratified by their size, leading to high variance around the estimates.

6.2.2.8 Other Culture-Based Systems

Pen, cage, and rice fish culture systems are not monitored under the existing FRSS. Production from these systems may be inadvertently included under the Floodplain Fisheries Survey (see above).

6.2.2.9 The Fish Market Price Survey

The Directorate of Agriculture and Marketing (DAM) collects price data for eight species of fish and three sizes of shrimp from 70 wholesale markets throughout Bangladesh on a daily basis. This information is published in the Bangladesh Bureau of Statistics.

6.2.3 The Database and Data Structures

For the reasons described in Chapter 5 no electronic copies, or descriptions the FRSS database were made available by the DoF. It is believed that data are stored and processed with DBase software using IBM compatible computers. The following extracts of the database were obtained in Microsoft Access format from the Fisheries Management Support Office, Dhaka:

River Fisheries Survey

The data are held in six tables. *RiverFrameBoats* contains the numbers and types of boats operating from the villages along the banks of the principle, major and minor rivers recorded during the original frame survey. The *VillageCode* table contains the rivers and villages from each district selected for sampling from the original frame survey (RF1). The sampled catch and effort data are held in the *RiverCatch* table which contains codes for the sampled river, village, gear, species, catch in weight from samples 1-5, prices, numbers of fishing and sampled units, and the date recorded using the RF2 and RF3 forms. The remaining three tables are 'look-up' tables for the gear, river and species codes. The extracts cover sampled data from only 19 of the 64 districts for the period 1994-1990. The structures of each table and field descriptions are given Annex 6.

The Floodplain (Subsistence) Fisheries Survey

The data are held in four main tables corresponding to the four survey recording forms. FRSS_S1 contains information relating to the 100 households selected for sampling in each district including fishermen type, habitats fished, and months of the year fished. Data are available for 45 of the 71 villages selected under the original frame survey.

FRSS_S2 contains the sampled catch and effort data recorded on Form SF2 for subsistence fishing activities obtained by interview. Each row of the table represents the catch (by species) and effort data for each sampled household for the sampling month. A number of fields exists that are not required for estimating the total catch or for reporting purposes including the numbers and types of fishers in the household and details of the gears employed and the habitats fished.

FRSS_S3 contains the synonymous information for the commercial households and structured in the same way FRSS_2. Superfluous information for producing the required output includes details of the gears employed, habitats fished, average catch and numbers of fishing boats and catchers.

FRSS_S4 contains the information recorded in Form SF4 from direct observations of the fishing activities in each village and by sub-sampling landings of up to six subsistence fishers. Each row contains the data sampled from each fisher for each month and village.

FRSVIL is a look-up tables for village codes and corresponding district names. The *RuralHouseholds* table contains the number of households in each district used to extrapolate catches from district to national level. The structures of each table and field descriptions are given Annex 6.

7. *Community Objectives, Data and Information Requirements.*

7.1 *Introduction*

In much of the development literature the term “community” has come to represent some idealised, unified and homogenous group where solidarity and consensus to prevail (see Leach *et al*, 1998). With a recognition of increasing mobility, cultural diversity and range of livelihoods within society there has been a re-appraisal of the community as the social unit. In this review the community is tentatively taken to represent a territorially defined group where inclusion is based purely on residence (Friedmann, 1992). Members of the community may interact regularly but may have quite different social and economic roles. Rationalising fisher motivation and behaviour can be problematic for the researcher and there are limits to inferring objectives from observable practice. A review of local practice may indicate what is being targeted, and the strategies deployed, but not why. In addition, any one management behaviour may be consistent with an array of quite different explanatory models (Hilborn & Walters, 1992).

Community objective and fisheries co-management

Incorporating local perspective into national policy may be problematic and there is likely to be some conflict between national and community objectives. In moving towards co-management the number of consulted stakeholders and the diversity of opposing goals is likely to increase. In this respect, parallels exist between the co-management process and integrated coastal zone management (ICZM) where numerous stakeholders are co-ordinated from local to national level. Christie & White (1997) consider ICZM a cyclical process of assessment, planning, management and monitoring where policy-makers will collaborate with inter-disciplinary researchers, NGOs and preferably community representatives. Fisheries co-management could operate on a similar model whereby linkages between the participating institutions would communicate feedback or advice concerning current practice.

With respect to fisheries co-management in the development context, a FIMS could be used to monitor community-based programmes and provide feedback regarding project performance. If lessons are to be learned from the numerous community-based programmes and acknowledged in national policy, then government could have a central role and responsibility to communicate the strengths and limitations of the various approaches. Horizontal linkage and knowledge sharing between programmes and NGOs cannot be assumed.

Methodology

For each main waterbody and fishery type, community management objectives and management evaluation criteria (data requirements) were identified and summarised from review of the grey literature, semi-structured interviews with the key organisations and institutes involved and from rural field appraisals where necessary. Common and unique criteria were identified. Emphasis was given to identifying objectives and criteria relevant to management at the local level, rather than those to meet management responsibilities nationally. In establishing data requirements and management objectives for a prospective co-management FIMS the existing community-based and co-management projects were reviewed with respect to monitoring, evaluation and the nature and role of community participation. However, the NGOs involved in these projects represent local concerns and needs according to their own skills and field of expertise so that project performance may be gauged on quite

different sets of information and indicators of success or failure. The major current and proposed community-based fisheries projects were identified (see Table 3). Together the projects operate over the entire range of water body type (floodplain, river, *baor*, *beel*, khal and ponds) and reflect the diversity of local management practice with regards stakeholder characteristics, fishing activity and access arrangements (Table 4).

The existing co-management arrangements and community projects in Bangladesh are routinely monitored to determine local biological and socio-economic trends within the fishery but the exact type and quality of data collected depends on the nature of the co-management relationship and the objectives of the project. The co-management projects in Bangladesh are broadly of two types; those that aim to increase production through credit and technological input and those that attempt to engender collective decision-making through secured tenure and community organisation. Both approaches are somewhat experimental and government and NGOs are obliged to monitor project performance in meeting pre-defined outputs and staff performance as determined by the sponsor or project design. In examining the reports, experiences and survey methodologies of the projects that are collaborative and participatory in approach a more reliable proxy of community objective may be achieved. Data relevant to internal monitoring and data required to monitor community expressed objectives are sometimes collected separately (see section on CARE) or the distinction may be implicit from an additional attitudinal survey and participatory appraisal.

This approach aims to utilise the skills and experiences of NGOs that have worked collaboratively with stakeholders from all of the waterbody types nationwide and within communities fishing under a range of access arrangements. The reviews of ongoing and forthcoming projects (Sections 7.2 & 7.3) were compiled from interview and grey literature review (Annex 7 for minutes of interviews). Field visits to non-project areas were designed to augment and cross-check the findings of this review (Section 7.4). Baseline and ongoing surveys within these community-based or co-management projects may identify local priorities, community objectives and the relevant data requirements and sampling strategies to monitor performance. The techniques and findings of the NGOs involved in community development and consultation were reviewed through semi-structured interview with staff and representative project evaluation and community monitoring data sets were obtained where possible. This information was combined with project reports and any existing feedback to list all documented and anecdotal local requirements.

The selection of NGO projects for review attempted to depict representative community objectives and monitoring strategies across the range of water body types currently managed within community-based projects. The review of community objectives and monitoring was designed to indicate the validity of assigning common objectives according to resource and management type and the common themes and compatibility of the various approaches to survey. The monitoring and evaluation approach within Community Based Fisheries Management Project (I & II) is of particular interest because a consistent survey methodology has been designed by ICLARM to monitor the river, baor and beel project sites. This system was reviewed to determine how strategies are tailored to resource type and the approach and capacity of the participating NGOs. Prospective arrangements for community monitoring within the Fourth Fisheries Project and MACH (both starting July, 1999), and the linkages between the NGOs and DoF are still to be agreed (see later).

Table 3 Ongoing and proposed community-based fisheries projects in Bangladesh.

Project	Organisations	Aims	Funding	Time Frame	Activities	Means of Verification	Resource Type	Location	Fishery type	Community Involvement
Grameen Motsho Foundation Project	Grameen Bank, Proshika, BRAC	Poverty alleviation through credit provision and security of tenure	Grameen Bank, DFID	1986-	Leaseholding from DoF, aquaculture, alternative activities, market training	Project reports and database	Reservoirs, water tanks	Countrywide	Culture	Labour input, maintenance, training
INTERFISH 2	CARE, DFID, small NGO's	Improve farmer incomes and environment	DFID	1995-2002	Integrated rice field production, rice-fish cultivation, soil management	Project reports and database	Rice fields	Rangpur, Jessore, Bogra, Naogaon	Culture	Process-orientated training
INTERFISH 3	CARE, DFID, small NGO's	Develop INTERFISH2 experience over wider range and with IPM	DFID	1999-2004	Integrated rice field production, rice-fish cultivation, soil management, IPM	Project reports and database	Rice fields	Rangpur, Jessore, Bogra, Naogaon and extended area	Culture	Process-orientated training
CAGES	CARE, DFID, small NGO's	Poverty alleviation through aquaculture expansion	DFID	1995-2000	Training in cage cultivation (women and NGO staff), credit provision	Project baseline and monitoring reports, case studies	Open waterbodies rivers	Barisal, Comilla, Doukhandi, Jessore, Sylhet, Kapti	Culture	Training
GOLDA	CARE, DFID, small NGO's	Improve socio-economic condition of prawn cultivators	DFID	1996-2001	Integration of prawn, fish culture and horticulture, training in financial management	Project baseline and monitoring reports, case studies	Deep water rice fields	Bagerhat, Khulna, Bairsal	Culture	Training in financial management and aquaculture management
Northwest Fisheries Extension Phase 2	DFID, DoF	Improve economic security of poor farmers through improved DoF extension capabilities	DFID	1996-2000	Training, provision of low-input technologies and quality broodstock	Project monitoring reports and reviews	Rice fish, pond, cage and canal	Dinajpur, Rangpur, Nilphamari, Kurigram, Thakurgaon, Panchagar, Gaibandha, Lalmonirhat	Culture	Training and workshops with local fishers and staff
Fisheries Training and Extension Phase 2	DFID, DoF	Improve economic security of poor farmers through improved DoF extension capabilities	DFID	1997-2001	Increase DoF staff's communication and technical skills in promoting	Project monitoring reports	ponds	Faridpur, Rajshgali, Comilla	Culture	Nil
Oxbow Lakes Project II	DoF, BRAC, DTA	Sustainable management via transfer of culture-based boars to genuine fisher groups	IFAD, DANIDA	1991-1997 cont'd. on	Transfer leasehold of 23 boars to DoF, organisation of local management groups	Biological and economic quarterly reports	boars	Jessore, Jhenaidah, Chuadanga, Faridpur, Kushtia	Enhanced	Credit provision, monitoring and maintenance
Community Based Fisheries Management and Habitat Restoration Project	CNRS, Proshika	Improved fishery through habitat enhancement	Ford Foundation	1994-1998	Awareness building, khal and beel restoration, fisher group monitoring	Project reports and ongoing local survey	Khals, beels	Dhaleswari, river and Singharagi beel	Capture	Socio-economic and biological monitoring, education, role in project committee

Project	Organisations	Aims	Funding	Time Frame	Activities	Means of Verification	Resource Type	Location	Fishery type	Community Involvement
Sustainable Environment Management Programme	IUCN, BCAS, NACOM, CNRS and other NGOs for non-fisheries	Sustainable rural livelihoods	UNDP, Ministry of Environment	1998-2003	25 project, 2 of which are wetland related		Fisheries related baors	Aricah, Gopalgy, Tangail	Capture	
Bangladesh Environment Management Programme		Sustainable rural livelihoods	CIDA	1999-2004			Baors		Capture	
Community Based Fisheries Management Project	DoF, ICLARM, BRAC, Proshika, Caritas and other NGOs	Sustainable and equitable floodplain management, testing of various GO-NGO-fisher collaborators	Ford Foundation	1996-1999	Provision of alternative employment, protection of natural recruitment, promote equitable distribution, consensus building, credit provision	ICLARM technical reports, DoF Field Researcher Reports	River, beels and baors	Jessore, Tangail, Narail, Faridpur, Narsinghdi, Pabna, Manikganj, Kishorganj, Bhola, Bbarai, Netrakona, Dinajpur, Rangpur	Capture, enhanced	Alternative employment, literacy courses, fisher representation

Forthcoming Projects

Community Based Fisheries Management Project 2	DoF, ICLARM, BRAC, Proshika, Caritas and other NGOs	As above, project extension from discrete sites to wider floodplain areas	DFID	1999-2004	As above, access rights to rivers, integration of efforts at beel/river systems	As above	River, beels and baors	Additional sites to be identified	Capture, enhanced	As above
Management of Aquatic Ecosystems through Community Husbandry	GOB, USAID, Winrock International, Caritas, CNRS, BCAS	Sustainable community-based management over floodplain system (agriculture and fisheries)	USAID	1999-	Awareness building with communities & local government, habitat restoration, management group formation	External and internal monitoring of project performance indicators	Floodplain system (openwater, river, beels and khals)	Sylhet	Capture	Skills training, participatory establishment of sanctuaries and resource use zones, education
Fourth Fisheries Project	DFID, World Bank, FAO, DoF, various NGOs	Sustainably increase fish and shrimp production for consumption and export by 100%	DFID, World Bank, FAO, DoF, various NGOs	1999-2004	Creation of 40 beel/floodplain, 50 fish sanctuary managing committees, floodplain stocking, habitat rehabilitation	Project monitoring reports and reviews	Floodplain, river, beel, canal, coastal/freshwater aquaculture	Countrywide	Open, enhanced culture	Monitoring, local representation, aquaculture

Table 4 Matrix of major inland fisheries community-based projects by fishery type (waterbody / capture, culture or enhanced).

Project	NGO or Institution	River		Floodplain			Beel		Haor	Baor	Pond	
		Capt.	Cult.	Capt.	Cult.	Enhan.	Capt.	Enhan.	Capt.	Enhan.	Shrimp & Gher	Finfish
Oxbow Lakes	BRAC									✓		
Grameen	Grameen									✓	✓	✓
INTERFISH 2	CARE				✓							
INTERFISH 3	CARE				✓							
CAGES	CARE		✓									
GOLDA	CARE										✓	
Community Based Fisheries Management Project (1&2)	BRAC						✓	✓		✓		
	Caritas	✓					✓	✓				
	Proshika	✓										
	Banchte Shekha						✓					
	CRED		✓									
MACH	Caritas	✓		✓			✓		✓			
	CARS	✓		✓			✓		✓			
	BCAS	✓		✓			✓		✓			
Fourth Fisheries	to be identified	✓				✓	✓	✓			✓	✓

7.2. *Community-Based Fisheries Projects in Bangladesh*

7.2.1 *The Oxbow Lakes Projects (1991-)*

The Oxbow Lakes Project II (1991-1997) aimed to formalise the local management of 23 selected baors through securing long-term leaseholds from the Government of Bangladesh and devolving exclusive management rights to legally recognised Lake Management Groups (LMGs). The baors have now been successfully transferred from the Ministry of Land to the Department of Fisheries (DoF) for a period of 50 years.

The project was originally a joint initiative between the Ministry of Fisheries and Livestock and the Bangladesh Rural Advancement Committee (BRAC) with the International Fund for Agricultural Development (IFAD) and DANIDA providing funding and technical support. Between 25-300 fishers from villages surrounding each baor are granted the right to harvest and culture fish, either as members of Lake Fishing Teams (LFTs) or members of Fish Farming Groups (FFGs) who cultivate specially dug or screened sections of the baor. The LFTs and FFGs are democratically represented by the LMGs. Credit for fingerling stocking is provided by BRAC but all decisions regarding stocking densities, timing and species composition are made by the fishers themselves through the LFTs. The DoF perform a central role in co-ordinating the project through the Project Implementation Unit (PIU) and with the logistic support of the 5 District and 11 Thana Fisheries Officers that represent the project area. An annual lease fee is collected from the baor fishers by the Thana Fishery Officers and prospective licensees are screened by the DoF and BRAC. Project beneficiaries must fit the "Three OLP II Criteria of Poverty" - annual income of Tk. 10,000 or less, landholding of 0.5 acre or less and participation in fishing or pond maintenance activities.

Since the completion of OLP II in 1997, BRAC and the DoF have maintained their respective roles in credit provision and technical support and the long-term leasehold and surviving legislative arrangements for LMGs have effectively sustained the project. The sustainability of this arrangement very much depends on the security of use rights but these should now be secure for another 50 years (see Apu *et al.*, 1997). DANIDA will finish their involvement with OLP in 2000 but the project will continue with provisional funding by the World Development Programme.

BRAC are currently using their experience of baor fisheries to expand to additional sites outside the national OLP programme. Originally 17 baors were renovated and de-weeded but the resulting increase in auction value of these sites meant that BRAC were out-bid by powerful local interests. Only 8 of these baors are now operated by BRAC but the NGO is currently negotiating preferential leasing arrangements with the MoL (M. Hossain, pers. com.).

Monitoring

Continuous monitoring at the local level is the responsibility of literate members of the Lake Fishing Team Committee through the maintenance of Baor Record Books (Apu & Middendorp, 1997). All details regarding stocking activities, harvesting, cash flows, accounts and the minutes of meetings must be recorded by the LFTs who, in turn, are supervised in record keeping by BRAC Programme Assistants. The DoF accumulate data from the Baor Record Books to compile and publish quarterly economic and biological reviews of the project sites through the PIU (see Annex 8 for example data). Further socio-economic and biological studies have been conducted by DTA (DANIDA Technical Assistance) through the auditing of LFT balance sheets and the lakeside collection of length-frequency

data at five of the project sites. Data on fingerling stocking, fish harvesting and fisher licensing is also collected by the District and Thana Fisheries officers. BRAC Programme Assistants also collect technical data such as rainfall, temperature, water depth and Secchi disk depth from each of the baors.

7.2.2 The Community Based Fisheries Management Project (1995-1999)

The Community Based Fisheries Management (CBFM) project was a joint initiative between the DoF, ICLARM and several NGOs including BRAC, Caritas and Proshika, with funding provided by the Ford Foundation. The project was developed in response to the limitations of the NFMP and was an acknowledgement that current leasing and licensing arrangements were unlikely to benefit genuine fishers or ameliorate overfishing (Shelly & Alam *in press*). The CBFM was significant in that it was a serious attempt by the DoF to consider the potential value of various GO-NGO-fisher linkages and to experiment with co-management models over a range of water body types. Unlike the Oxbow Lakes Projects and what the DoF referred to as the "techno-socio-economic" approach, the CBFM attempted to secure local access rights and encourage local management and initiative through community development. The approach was not production orientated, but sought to empower communities and provide equitable access to the fishery and to alternative employment and income sources.

The main responsibility of the DoF was to ensure the hand over of the proposed project sites at 28 *beels*, *baors* and rivers from the Ministry of Land to the Ministry of Fisheries and Livestock (see Figure 16). The DoF also had a key role in co-ordinating meetings and supporting community-led initiatives through their District and Thana Fisheries Officers, Field Assistants and Field Researchers. The DoF conducted baseline and continuous fishing and household surveys to monitor project performance. The survey format was devised by ICLARM (see below).

During the planning stages of 1995 the precise roles of BRAC, Caritas and Proshika were agreed according to their previous experiences in fisheries projects and community development. The key role of the NGOs was to target the poorest households at the project sites (those with less than 50 decimals of land, for instance) and to assist in community organisation and the development of alternative income generating activities.

BRAC adapted their experiences from the Oxbow Lake Projects to identify and organise poor fishers and non-fishers into management committees capable of dictating stocking and funding arrangements for the enhancement of 2 *beel* and 2 *baor* sites. This sometimes involved reforming existing fisher co-operative societies to make management more inclusive and transparent. BRAC provided credit at low interest rates and was active in supportive activities including sanitation, education and health work.

Caritas operated at 4 *beel* project sites and one river site and worked to establish fisher groups at the village level and their representation at Beel Management Committees. In open *beels*, the establishment of sanctuaries and closed seasons was encouraged while in closed beels credit was provided for stocking and new gear. The Caritas approach emphasised community empowerment and the importance of sustained organisation and self-finance on project completion. The active participation in the development of the fishery was encouraged through the formation of savings accounts, awareness raising and the provision of training programmes for group coordination within each fisher group.

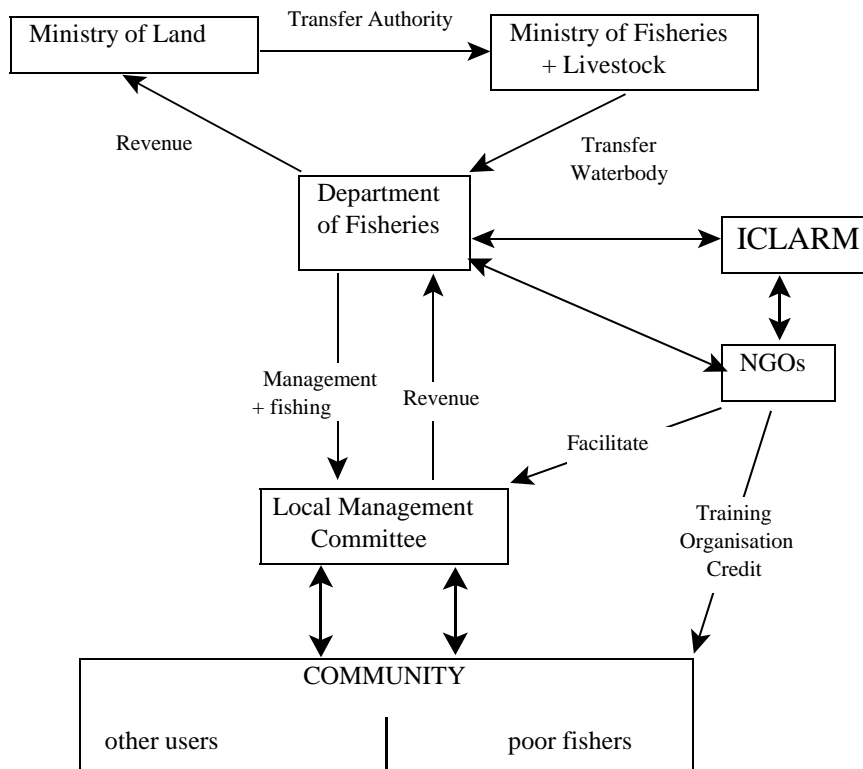


Figure 16. Schematic representation of institutional linkage within CBFM (after Thompson and Hossain, 1997).

Proshika worked exclusively at the flowing river sites and focussed on organising traditional fishing groups and providing training and favourable credit schemes for fishery and non-fishery investment. Proshika's work was complicated by the effectively open access nature of the flowing rivers following a government ruling in 1995 abolishing the previous leasing system which led to complex local power struggles and conflicts of interest. Despite these problems Proshika managed to raise conservation awareness and diversify fishing-related activity through support to secondary activities such as processing and fish drying initiatives. In 1998 Proshika helped establish River Management Committees to democratically represent fisher and other stakeholder concerns at the project sites.

ICLARM provided an essential co-ordinatory role in the extensive baseline and ongoing monitoring and evaluation that was central to the CBFM project. All survey design and analysis was the responsibility (or rather became the responsibility) of ICLARM with DoF and NGO staff providing assistance in data collection and survey logistics (Hossain, pers. com.). Subsidiary responsibilities included the organisation of workshops, field meetings and dissemination of the project's principal findings (see *Outputs and Feedback* below). ICLARM was also responsible for recruiting and providing grants to three smaller NGOs - CRED, Banchte Shekha and Bazi.

Monitoring

The CBFM surveys were designed by ICLARM in collaboration with participating NGOs and DoF field staff. For the initial surveys of 1996, key indicators were selected according to NGO experience but these were adapted and modified after testing and further discussion. The surveys covered the original 15 project sites and included the additional 5 sites as they were added to CBFM.

Household Baseline Survey

The household baseline surveys of 1996 were carried out by DoF Field Assistants under the supervision of DoF Field Researchers and Scientific Officers in conjunction with ICLARM staff. The previous experience of the participating NGOs was considered in selecting appropriate indicators for impact assessment. Female NGO staff worked with the Field Assistants to complete aspects of the survey specific to women.

The survey combined standard socio-economic indicators with additional fishery related information that might determine the cultural or economic significance of fishing to that household. This latter category included attitudinal questions regarding the role of women in fishing, the existing NGO support and issues of access, for instance.

The households at each project waterbody were classified as NGO-organised (consisting mainly of professional fishers but some subsistence fishers in certain sites) or non-NGO-organised (mainly subsistence fishers). The NGO-organised group were expected to take a dominant role in CBFM activities and to derive the greatest benefits from the project. It was hoped that non-NGO-organised groups would be included and gain from CBFM initiatives but it was acknowledged these groups may be excluded from some project benefits or activities. A sample size of 60 randomly selected households per category per site was considered adequate to provide required levels of confidence. The baseline survey also incorporated the first cycle of a quarterly catch and effort analysis designed to record in detail the fishing activity of the previous day and week.

A large component of this initial survey was designed to receive input from fishers regarding their views on the current status of the fishery, its management, and their requirements for management change. A decline in fish stocks was widely recognised and generally attributed to destructive gears, too many fishers (especially in rivers), or reduced water area (especially in beels). Fishers and their wives were also asked what impact they felt they had on management decisions locally and what measures would be needed for better fisheries management. A large majority of both beel and river fishers believed they had little or no influence on management while stocking was identified a priority by all fishers. Beel fishers emphasised the need for embankment maintenance while gear controls were widely requested in rivers.

In recognising the variation between communities, NGO activity and the waterbodies themselves, ICLARM prepared analyses and reports of the baseline surveys on a site by site basis. The NGOs attempted to target the poorer households and this was confirmed in the baseline survey where project participants were on average poorer than the rest of the community. (see Annex 9 for questionnaire format).

Survey of Women

In parallel with the baseline survey an additional survey of women in the same sample households was carried out. Female NGO staff or locally recruited women conducted interviews to identify the role played by women in household income (including fishing and non-fishing related activities), decision-making and perceptions of fisheries management issues and of NGO involvement. (see Annex 9 for questionnaire format). At some sites women were found to make a significant contribution to expenditure saving through fish related activities and were often involved in household decision-making

regarding fishing activity. Women's perceptions of management issues and requirements for the fishery corresponded very closely to those of the male fishers themselves.

Household Fishing Survey

The sample households of the baseline survey are visited on a quarterly basis to determine changing fishing strategies (and other economic activities) and fish consumption on a seasonal basis. Respondents are asked to recall in detail this type of information for the previous day and more generally over the last week.

ICLARM established a year long household survey at four of the project sites (two closed beels, one seasonal beel and one river). Local students were trained as enumerators to collect data from half the sample households for one week per month. Fish consumption was recorded by weighing fish each morning and evening before cooking. Subsistence fishing by the women or children of these households is also recorded by recall. (see Annex 9 for questionnaire format)

Catch Assessment Survey

A gear census is taken at least twice a month at each project site and at adjacent fisheries during the monsoon and interviews are conducted with one quarter of the fishers using each gear type. Information is collected on the total time spent fishing, the number of fishers adopting that gear and the variety of species targeted. The total catch by species is recorded from each respondent by weighing.

If night fishing is locally significant an early morning survey records catches before they reach surrounding markets. Subsistence night fishing is likely to be under recorded, however. The survey is being used to develop a detailed estimate of total catch and effort from each gear type throughout the year and between waterbodies (see Annex 9 for questionnaire format).

Fish Markets

For each project waterbody the two principal fish markets are surveyed twice weekly for the amount traded by species, species unit value and the number and types of trader. This survey provides an indication of relative abundance and diversity of fish species and also records current prices of other basic foodstuffs (see Annex 9 for questionnaire format).

Impact Monitoring Survey

All households covered in the baseline survey were approached again one year later to detect any changes attributable to project activities. The survey was designed to compare project performance between the sites with regards fisher perception of management issues such as increasing or decreasing fishing rights, support for NGOs and attitudinal feedback regarding management issues in general. Changes in household assets and economic reliance on the fishery was also emphasised (see Annex 8 for questionnaire format).

Process Documentation and Community Meetings

Quarterly co-ordination meetings were held at all of the project sites. The DoF, ICLARM and the site NGO were represented and the entire community (fishers, middlemen, farmers) were welcome to attend. The community was encouraged to offer their opinion of current project activities, their benefits and problems and suggestions for the forthcoming period. The communities were asked to comment on feedback of baseline survey and monitoring (see below) and report on any changes to access and

catches and the possible reasons. At monthly co-ordination meetings the community together with Thana and District Fisheries Officers review current issues and the minutes. The CBFM monitoring strategy is outlined in Table 5.

Table 5 Data requirements and target respondents of the CBFM baseline and ongoing monitoring programme.

Survey	Timing/coverage	Target respondents	Data
Household Baseline	Once (1996 or 1997) / all sites	60 sample NGO and 60 non-NGO households	Family, income, property, economic activity
Women Baseline	Once (1996 or 1997) / all sites	Women of 60 sample NGO and 60 non-NGO households	Role in fishing, decision-making, livelihood needs
Household Fishing	Winter, summer, monsoon / all sites	60 sample NGO and 60 non-NGO households	Catch and effort by location, consumption by species, other animal protein, other activity
Catch/Effort	Twice monthly / all sites	Active fishers	No. of gears, catch by gear, total catch
Fsh Market	Twice monthly / all sites	1-2 local markets per site	Market price by species, quantity, staple food prices
Household Impact	Annual / all sites	60 sample NGO and 60 non-NGO households	Changing assets, fishing access, perception
Process Documentation	Once monthly / all sites	NGO/DoF coordination meetings	Key events, decisions, conflicts
Community Discussion	Quarterly / all sites	All community	Minutes

Outputs and Feedback

The CBFM project was designed to be transparent and inclusive of local fishers and the nature of the monitoring programme reflects this. The surveys incorporate local perceptions of management problems and potential solutions as suggested by fishers themselves. The experimental remit of the project - to devise and test alternative GO-NGO-fisher relationships across the range of waterbody types - demanded an adaptive and responsive approach, especially where local capacity building was slow and consensus lacking (eg. the river sites).

Community participation was ensured through local workshops and field meetings, which were open to project participants and all other stakeholders and interested parties, and ICLARM ensured the dissemination of the project's principal findings and feedback to the communities via quarterly newsletters and fisher's calendars published in Bangla (see Annex 9). These outputs contained news and updates on project activities locally and across the country.

In addition to the workshops and publications, ICLARM staff hold informal feedback sessions during quarterly meetings with the fishers where simple trends in the fishery are presented. Fisheries performance over time is presented graphically, including total catch by gear type, catch per person per

hour (seine net), average market price by species and total number of gears used (Manjur Kadir, ICLARM pers. com.). At four of the sites pie charts are used to present trends in fish consumption patterns and where fish sanctuaries have been established graphs are used to inform fishers of impacts on the stock or catch. Fishers tended to be most interested in trends in average catch or catch composition but were unaware of other potential outputs from ICLARM's data collection.

It is hoped that future initiatives at some of the project sites may involve the local fishers themselves in the collection of simple data to help make management decisions i.e. water depth to dictate when to open or close sluice gates, or fish catch details to dictate closed seasons or sanctuaries (CBFM Case Study of Goakhola-Hatiara Beel, 1998).

7.2.3 The Community Based Fisheries Management Project - Phase 2

From July 1999 a second phase to CBFM will attempt to extend the scope and institutional impact of the project. The five year DFID-supported project will build on the lessons learnt and experience gained from the existing 19 sites and will target approximately 45 additional waterbodies and wetland fisheries potentially reaching over 12,000 fishers and 70,000 beneficiary households. A greater coverage of projects sites will better represent the diversity of inland fisheries but the emphasis of CBFM-2 will not be the accumulation of additional discrete project sites but the linkages between them within the floodplain system generally. Connected waterbodies will receive special attention in an attempt to produce benefits over a meaningful geographic spread through complementary management in adjacent areas. In addition to credit provision, training and community development there will be an emphasis on long-term prospects for institutional change, administrative improvements and potential legal frameworks that will enable local conflict resolution and security of tenure. The Bangladesh Environmental Lawyer's Association (BELA) will conduct a special study of legal issues in fisheries and wetland management and this will be used in combination with general monitoring and evaluation to advocate policy and legal change. The second phase will also build upon previous attempts to inform appropriate policy for the adoption of co-management models at Thana and district levels.

The emphasis on a holistic approach and the synergy to be gained from knowledge-sharing is also extended to the NGO and project level where the CBFM is intending to collaborate with the Fourth Fisheries and MACH projects. The Fourth Fisheries Project Final Report refers to the use of community participation in its large scale enhancements but without reference to credit provision or community management institutions and the CBFM aims to contribute to what is seen as void in this project's activities. The CBFM also seeks to augment and learn from the activities of MACH which will similarly target beneficiaries across complete wetland systems.

The long-term project aim is to benefit all inland fishing communities through the adoption of new national policy based on the project's findings, and the in-depth monitoring and evaluation of the previous phase will be extended to help disseminate the benefits of a CBFM approach. The project will develop indicators of empowerment and institutional stability and will extend attitudinal survey to incorporate the changing understanding of management impacts, poverty reduction and views on new management arrangements generally. CBFM-2 will build upon final year impact evaluation of the previous project and will undertake equivalent baseline reviews of all new project areas. It is hoped that extensive impact evaluation in the final year will provide evidence of the suitability of the CBFM approach and that an additional impact assessment will be conducted three years after project completion to test the long-term sustainability of the approach. CBFM-2 will again draw on the

community management interventions of restoration, sanctuary establishment and stocking but the onus will be on endogenous management choices and community project ownership through participation.

ICLARM will continue in their role as GoB-NGO facilitator but it is hoped that the larger NGOs will forge their own links with government to extend project activities beyond the five year span of CBFM-2. A key aspect to CBFM-2 will be extending the links with GoB and a movement towards changing systems of tenure. The MoL will be expected to waive competitive leasing arrangements at certain sites and to hand over management responsibility entirely to the DoF. In an attempt to prevent the open access nature of the flowing rivers CBFM-2 will propose that the MoL devolve territorial use rights to adjacent villages that will create local management rules and raise revenue through specially created river management committees. The furthest reaching and most encouraging proposal builds on the legal precedent set by the OLP-II and would pressurise government to confirm 50 year leaseholds to those community projects shown to be functioning independently and equitably.

7.2.4 CARE-Bangladesh Projects

7.2.4.1 Cage Aquaculture for Greater Economic Security (CAGES)

The CAGES project was initiated by CARE Bangladesh in 1995 to improve the socio-economic condition of 11,000 landless and marginal rural households through provision of new and appropriate technology and the training of local NGOs in the administration of public and private waterbodies. The project built on previous encouraging trials by CARE with cage-culture by women and sought to provide participatory skills to 60 NGOs at a training centre near Dhaka. Distinct technology development programmes were established for sites at an open floodplain, a river and within a flood control scheme, and the scale and replication of activities was ensured to provide statistically valid appraisal. As with other CARE programmes an environmental monitoring component was designed to reveal negative impacts of the project, particularly with regards to water flow and quality. A Social Monitoring Officer was responsible for updating information on access arrangements at the study sites and in documenting the socio-economic impact of the project. Baseline, mid-term and final project surveys were conducted to guide the project and to assess achievement of goals.

7.2.4.2 Greater Options for Local Development through Aquaculture (GOLDA)

In the early 1990's the newly developed gher-based system of integrated rice cropping and fish cultivation was gaining in popularity but lacking technical assistance was leaving many owners vulnerable to debt. The GOLDA project (1996-2001) aims to provide support to the male and female members of approximately 15,000 gher-farming households of southwestern Bangladesh through technical assistance and training. The package of assistance includes training in dyke cropping, pest management, feed production and financial planning, and CARE's experience in participatory learning methods has been adapted and used to train small groups of men or women in the specially formed "farmer field schools" (see below). Target beneficiaries are those households already converted to gher but owning less than 2 acres of land.

In line with CARE's other ongoing projects, a monitoring and evaluation component will review impact through an initial baseline survey, mid-term review and post-project report. In 1997 an Environmental Monitoring System was adopted to detect early any negative impacts of the project and gher farming activities in general. Previous surveys had emphasised the collection of large amounts of data but the interpretation and dissemination of the findings had been poor or non-existent. The Environmental

Monitoring System was developed around the principle of the Information Cycle and the collection, collation, evaluation and dissemination to the local community (see Figure 17).

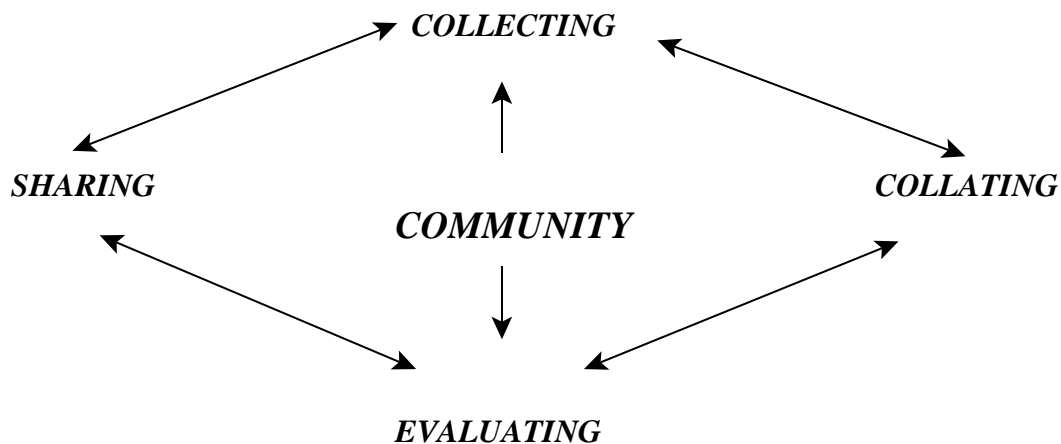


Figure 17. The Environmental Monitoring Cycle (source: GOLDA - an Environmental Monitoring System, 1997).

Data such as land use, rainfall and other environmental parameters are collected independently by field officers but the community has an integral role in providing details of household decision making, ecological mapping and seasonal trends in farming practise through participatory rural appraisal. Field Workers are enlisted to take these discussion groups and further data collection is undertaken by Community Monitors elected by the fishers to collect and disseminate information to their respective villages. The Community Monitors are trained in randomly sampling fishers, compiling questionnaires and obtaining simple catch and effort information but initial trials suggest that support from Field Workers is needed to ensure regular and reliable monitoring.

7.2.4.3 Integrated Rice-Fish (INTERFISH)

The INTERFISH project was initiated in 1993 with the objective of training farmers in integrated rice field production in Jessore and Rangpur Districts. The project adopts a community education approach to Integrated Pest Management, rice field ecology and the impacts of pesticide use with the onus on pest management rather than control. Interested farmers are trained in the techniques of rice fish cultivation for both irrigated and rain-fed sites, including the maintenance of fish seed for stocking and use of appropriate technological inputs. Local training courses (or Participatory Action Learning modules) are facilitated by field trainers and CARE have extended INTERFISH activities in technical training with 40 local NGOs. While the results of INTERFISH activities have been excellent locally there was no uptake and spread through non-project areas of the country. The expansion phase from 1995-2000 was initiated to involve 14,400 male and 12,800 female participants in project activities, including dyke cropping with vegetables and trees and soil enhancement practises.

As with the other CARE projects the INTERFISH monitoring programme depends on augmenting conventional data-gathering approaches with participatory monitoring and in-depth interview to better understand how the project differentially impacts individuals and particularly to gauge the extent and social significance of extended input by women.

Participatory Monitoring and Evaluation (PME)

CARE have adopted the Farmer Field School (FFS) model of project extension and evaluation whereby community members as project participants receive intensive training and attention at the local level and feedback and monitoring flows centrally via *thana* and district staff to project co-ordinators in Dhaka (Figure 18). The field trainers represent the bottom rung of this ladder and are the interface between local participants and the project infrastructure itself. The field trainers are responsible for six farmer field schools, each receiving intensive training, feedback and attention and consisting of either 25 male or 15 female participants.

Within this hierarchical framework CARE developed a Participatory Monitoring and Evaluation (PME) strategy for data collection and analysis. The consultative nature of this approach was developed to address what was seen as a void in the more conventional quantitative methods of project evaluation. The purely quantitative approach failed to reveal the local relevance of the data due to lacking social or cultural information to frame its context and significance. Local perceptions and aspirations were to some extent unaccounted for. PME augments the collection of quantitative information such as crop production or fish yield with background information on practice details and tenure arrangements, for instance. The qualitative information is collated and tallied according to its distribution across pre-defined categories and bands (Khan, pers. com.). CARE either use set criteria for socio-economic indicators as devised by external consultants (as within the NOPEST project, for example) or operate “negotiated indicators” where project beneficiaries provide some input to identifying relevant proxies of project success or failure, as in the INTERFISH project (Table 6). This PME is adopted pre-project for baseline survey, mid-project and at project completion.

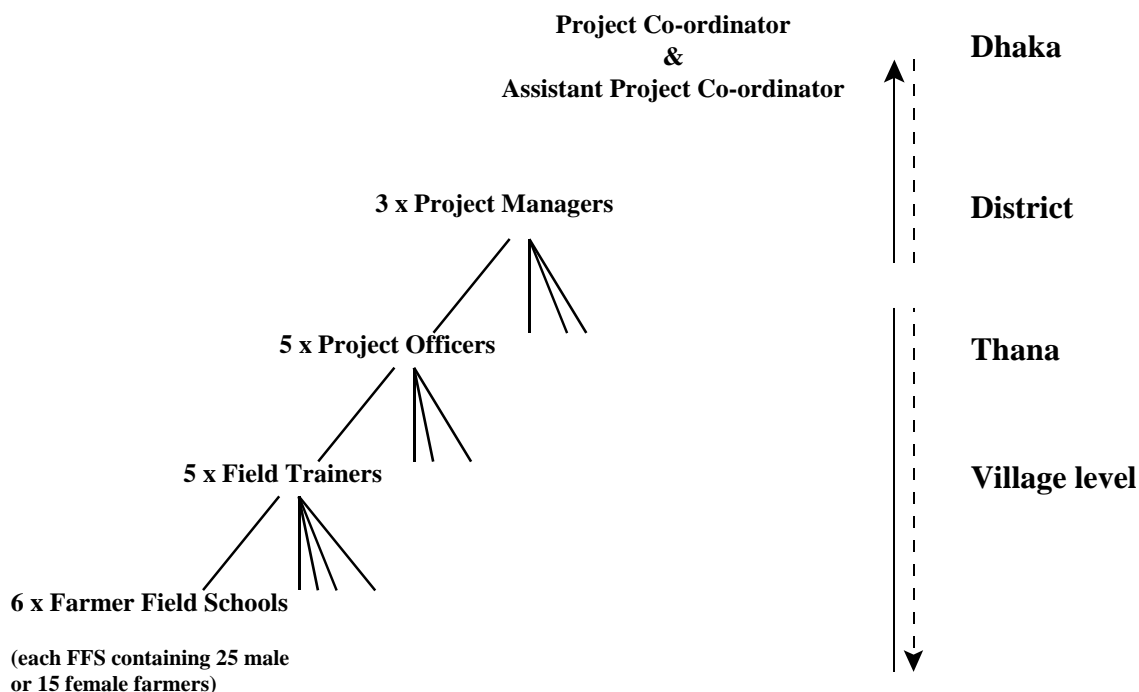


Figure 18. The Farmer field School (FFS) as applied to NOPEST.

Table 6. CARE project performance indicators. (sources: Implementing and designing participatory monitoring evaluation in CAGES (Roy, 1997) and NOPEST, April-May, 1998).

Fish Production Indicators (CAGES)	Socio-economic Indicators (NOPEST)
Cage size	Family size
Net type	Total cultivated land (or mortgage)
Species stocked	Status of house (repairing ability)
Feeding types	Main household income source
Growth curve by species	Main expenditures
Number stocked by species	Frequency of fish consumption
Size of fish caught by species	Frequency of vegetable consumption
Duration of production	Gender sensitivity (decision making roles)
Number of fish lost	-
Number of fish harvested by species	-
Cost (materials, fish, feed)	-

The quantitative component of CARE's PME is largely to meet the project log frames and this internal monitoring provides a strong incentive to maintain the flow of data from the field to the Project Co-ordinators. However, there have been problems with the efficiency with which data moves along this chain and an Advisory Group has been established to regulate the quality of data collected by Field Trainers. The verification and cross-checking of data at various points along the chain had previously delayed data collection to the extent that on arrival to the Project Co-ordinator the information was sometimes a year old (Khan, pers. com.).

In recognition of the parallel themes and objectives of their ongoing projects, CARE are about to undertake a comprehensive review and evaluation of current monitoring strategies (Khan, pers. com.). The aim is to identify common procedures of the various methodologies for the efficient linkage between projects and to streamline data transfer from the field to the project co-ordinators. It is also hoped to rationalise the system by identifying and separating more fully the collection of information needed to meet donor requirements from that needed to meet community requirements.

Output and Feedback

Discussion with staff at CARE revealed a strong commitment to community involvement in the collection process and a recognition of the importance of data being preserved at the local level and effectively remaining under local ownership. It was argued that farmers or fishers were more likely to see and to receive the benefits of project involvement if data collection and project activities were participatory in nature. The involvement of local people in ongoing activities such as monitoring can impart a degree of local ownership and increase the local stake in the future success of a project.

There was some dissatisfaction with the flow of information (especially flows from the co-ordinators to the field) but CARE are addressing these problems and investigating internalising information cycles at a more local level. The morale and incentive for the data collection staff themselves needs to be improved if good quality information is to be gathered and disseminated properly. The NOPEST (New Options for Pest Management) and INTERFISH projects are currently developing software for local data entry and output presentation which is hoped to inspire Field Trainers as much as project beneficiaries.

The CARE databases are arranged to handle and present distinct outputs as required by donors and presented in the log frames, and to present information seen to be pertinent to communities as the projects progress. Most of the eight ongoing CARE projects must produce biannual monitoring reports. The GOLDA project data is maintained on Access and all other projects are on SPSS.

7.3 *Forthcoming Community-based Fisheries Projects*

7.3.1 *The Fourth Fisheries Project (1999-2004)*

The Fourth Fisheries Project is a nationwide production oriented initiative that will adopt stocking, habitat enhancement and aquaculture programmes and incorporate institutional review of DoF and its linkages with NGOs. The main objectives of the project are:

- to increase fish production in open and closed waters
- to increase shrimp production by aquaculture to increase foreign exchange earnings and especially to promote production by groups of small farmers
- to increase protein supply for the people
- to expand employment opportunity and increase income for fisher folk
- to develop manpower skills in both the public and private sector
- to develop the capacity of the Department of Fisheries for smooth implementation of fieldwork

(Project Concept Paper, Department of Fisheries, July 1998)

The project places great emphasis on the role to be played by local communities and contracted NGOs and consultants while retaining a supervisory role for DoF at thana and district level. The approach for open-water development will be an integrated one of floodplain stocking, re-excavation of canals and beels and the establishment of fish sanctuaries and fish passes.

Floodplain stocking will be organised and funded by the government with some local participation and training, but it is expected that funding and decision making will be the responsibility of the communities within four years (Final Report). The stocking programme will aim to be self-sustaining through increased community investment from 10% in year one to 100% community funding from the fourth year. Initially target areas will be taken from those sites previously stocked under the Third Fisheries Project where baseline catch data are available but the programme will extend across minor floodplains and within one large floodplain that will function as a pilot for potential cross-community linkage. NGOs will play a key role in selecting participants and in developing local credit management skills and communities will be expected to pay leaseholds to establish exclusive use rights over the waterbodies. The arrangement is likely to depend on the security and exclusivity of access and consequently the DoF

may need to ensure jalmohal rights for a period of up to 10 years to make this attractive to local communities (Rahman, 1998).

The exact processes of community development and organisation and the NGOs to be involved are not yet established but it can be assumed that fisher groups will play some role in the monitoring and record keeping activities that should be an integral part of stocking exercises. IFADEP (Integrated Food Assisted Development Programme) have developed one potential model for community participation whereby beneficiary groups will contain several literate members to operate revolving funds and accounts, maintain site books and to effectively communicate progress to other group members (Rahman, *ibid.*). In addition, a centrally managed monitoring component is planned which would collect socio-economic and production data from 10 selected community stocked sites and 5 publicly stocked sites. The survey will be conducted by consultants (yet to be identified) and would include baseline and post-stocking assessment of income level, fisher status, access arrangements and biological and physical characteristics of the waterbodies (Rahman, *pers. com.*).

The habitat restoration component will be monitored by consultants, with experts in fisheries biology, economics, hydrology and sociology. Surveys will be conducted at 20 representative sites prior to intervention and impact assessment will review incremental fish production, species diversity, income levels of fishers and environmental impacts as the project progresses. The World Bank will fund the majority of the enhancement activities with DFID providing technical support and the GEF and GoB financing the hilsa management and conservation programme.

7.3.2 Management of Aquatic Ecosystems through Community Husbandry

MACH is a community-based programme of habitat enhancement and awareness building that will aim to incorporate local and national government, schools and youth groups to develop prospects for co-management across an entire floodplain system. The approach will be to involve local stakeholders in decision making via specially formed management groups and to provide training in relevant group skills such as monitoring and environmental problem solving. The project will emphasise the potential benefits of conservation and re-excavation of waterbodies such as khals and beels together with habitat regeneration through tree planting.

In 1998 the sponsor USAID and the Ministry of Fisheries and Livestock selected a proposal by Winrock International that incorporated the NGOs Caritas, CNRS and BCAS. The MoFL selected two sites in Sylhet District in 1999 and baseline surveys of the areas will shortly be carried out. An approach and methodology for this baseline and follow-up monitoring is currently being developed between the project partners (Collis, *pers. comm.*). MACH will incorporate two approaches to ongoing monitoring - project monitoring of key performance indicators by MACH and external groups, and community-based monitoring primarily developed to reinforce the link between the environment and the action of resource users. The outputs of both systems will be specially formulated for feedback to local communities through MACH field personnel and at locally organised workshops. The exact type of information that may be pertinent to local communities, however, has yet to be identified but MACH intend to combine all project data on a single GIS database that will incorporate temporal and spatial data for project NGOs, policy makers and the communities themselves.

The MACH project briefing suggests that horizontal linkage will be encouraged and information might be shared with other NGO or GoB bodies involved in related activities. Local workshops for project

feedback and debate will be open to local and nation policy makers.

7.4 *Field Survey*

7.4.1 *Fieldwork Approach*

The number of waterbody types in Bangladesh, their diversity of access arrangements and social and economic characters, constrains an in-depth review of community objectives. This field survey was designed to examine two obviously contrasting waterbodies and their management requirements to identify common or unique features and to demonstrate the potential range of requirements for a co-management FIMS. The findings were used to cross-check NGO comments on community objectives revealed through interview.

NGOs will have their own agenda and project objectives are normally identified *a priori* by sponsors, but even where projects are participatory in nature the presence of an outside interest in that community (eg. the prospect of investment) will distort any conclusions on that community's immediate requirements. Local fisheries functioning in isolation, without the offer of credit provision or the benefits of a democratic Beel Management Committee, for example, are likely to communicate different priorities. The interest expressed by a NGO or the establishment of a project will influence the dialogue and dynamic between fishers and project staff. This field survey of non-project fisheries was designed to avoid sites with a history of NGO involvement and automatic and routine feedback from respondents.

It would be predicted that discrete or easily demarcated waterbodies lend themselves better to collective management and investment. The experiences of NGOs in group formation within the CBFM reflected this and the management activities available to these waterbodies, such as the stocking of perennial beels, might tend to rely on the same sets of data for performance monitoring from site to site. Data requirements and management needs for floodplains and rivers, which are essentially *de jure* open access, will be harder to identify and may be less consistent (Thompson, pers.com.). This field survey reviewed one closed beel and one river system to compare and contrast fisher perspectives and management requirements. The perceived contrast was based on the fundamental resource characteristics of each waterbody i.e. a closed beel may allow exclusivity of access, sustained benefit from long-term management etc. while flowing rivers in Bangladesh are now essentially open access and the resource is obviously mobile and ephemeral.

Potential sites for field review were identified from a FMS database of beels studied under the Third Fisheries Project. These beels had been stocked until 1996 and detailed socio-economic profiles were available for the surrounding villages. The information available for each village included; the absolute number of fisher households (full-time, part-time, casual), the absolute number of fishers using each gear, the distribution of income, land ownership and total population (see Annex 10). Gobarchapa Beel in Bogra District was selected for its proximity to a river system (the Bangali River, a tributary of the Jamuna) and to surrounding beel sites. Agriculture provided the largest income for the majority of households in these villages but 10% of households were reliant on subsistence fishing, mainly by gill net. A map of the field site was produced to target specific villages accessible by road (Annex 11). The outline, approach and design of the field visit was discussed in detail with Kanailal Debnath (Project Enumerator) who had previous experience of individual and group participatory appraisal (see Annex 12 for Field Guidance Notes).

7.4.2 *Ascertaining community objective*

Semi-structured interview with key NGO staff revealed that those projects currently operating as co-management arrangements treat the role and input of community in quite different ways. Where the relevance of identifying community objective was acknowledged there were few suggestions as to what these objectives might be beyond the primary concerns of income and nutrition.

As an integral part of the CBFM baseline survey, ICLARM have catalogued what are seen as the fishers' priority management requirements at each of the nineteen project sites. Both fishers and their wives in participating and non-participating households were interviewed in an attempt to fully depict fisher perspectives on management needs. Respondents were not prompted but identified priorities through open discussion. The distribution of the 18 identified management requirements between waterbody types is presented in Table 7.

Table 7 Distribution of fisher management requirements by CBFM water body. (*management needs for baor sites were those documented in 1998 case study reviews - comprehensive survey findings at the two baors are yet to be compiled - Thompson, pers. com.).

Requirement	Baor*	Beel	River
sanctuary		✓	✓
closed season		✓	
gear ban		✓	
re-excavation	✓	✓	✓
stocking	✓	✓	✓
guarding		✓	✓
pen-stocking			✓
training		✓	
embankment		✓	✓
increase catches	✓	✓	✓
stop illegal fishing			✓
stop katha			✓
access		✓	✓
sluice gate		✓	
conservation			✓
community rights		✓	
unite fishers		✓	
keep law & order		✓	✓

During CBFM training workshops for ICLARM staff, typical community management requirements (or outputs) were reduced to their desired effects on the fishery (Table 8). Another way to represent fisher requirement may be to identify the means by which the desired requirement impacts the fishery i.e. the type of management tool in operation. The 18 basic requirements identified by fishers in the CBFM survey correspond to 5 fundamental management tools - stocking, habitat restoration, effort control, reserve or sanctuary establishment and access reform.

The way that these management tools impact the fishery may reveal or imply the ultimate objective of the fishers. If this is the case then fisher management requirements may provide a proxy for ascertaining primary management objectives (from interview with numerous NGO staff these primary objectives never appeared to be identified or researched).

Table 8. Indicators of basic activities of Goakhola-Hatiara Beel management plan and their expected effects. Source: CBFM Case Study of Goakhola-Hatiara Beel (Thompson *et al*, 1998).

Output	Effect
Formation of Beel Management Committee	Change in participation in decision making process
Number of BMC meetings held	Change in access control by the fishers
More water in beel and ditches	Increase in natural fish production and catches
Fish sanctuaries established and protected	Increase in natural fish production and catches
Number of people fishing maintained	Sustainable and higher incomes
Availability of fish in market	Increased fish consumption
Tubewells and water sealed latrines constructed	Improved health and reduced incidence of disease

A tentative attempt to reduce the various management requirements to objectives revealed a limited number of desired impacts and outcomes at the fishery (Table 9).

Field Study Methodology

The methodology and approach used was based upon the techniques and recommendations developed within the extensive participatory appraisal literature (see IDS website, <http://www.ids.ac.uk/eldis/pr/>). Conversation was guided through semi-structured interview and open questions within the dialogue method of appraisal (Kassam, 1998). Rural appraisal can reveal pressing management requirements and management suggestions can help initiate interactive discussion about management issues and objectives in general.

Table 9. CBFM fisher requirements and implied management tools and objectives. YPR - Yield-per-recruit.

Requirement	Management Control					Objective
	Stocking	Restoration	Effort Control	Reserve	Access Change	
Sanctuary				✓		Protect spawning stock
Closed season			✓			Protect spawning stock
Gear ban			✓			Limit small fish catch, increase YPR
Re-excavation		✓				Improve movement of migratory fish, increase natural recruitment
Stocking	✓					Increase population, augment natural recruitment
Guarding			✓			Limit capture, fair distribution
Pen-stocking	✓					Increases production
Embankment		✓				Retain standing water
Reduce illegal fishing			✓			Protect spawning stock, limit small fish capture
Stop katha			✓			Limit capture, fair distribution
Sluice gate		✓				Improve movement of migratory fish, increase natural recruitment
Conservation		✓	✓	✓		Protect spawning stock, maintain biodiversity
Community ownership					✓	Encourage investment, conflict reduction
Access					✓	Encourage investment, conflict reduction
Maintain law and order			✓			Protect spawning stock, conflict reduction
Unite fishers			?		?	Conflict reduction
Increase catches						Increase production
Training						Skills/awareness building

A questionnaire format was used to standardise the team's approach and output from each interview (Annex 13). This was used as guidance and was completed by the team during interview. Any identified management requirements were discussed with the fisher to identify what that requirement would do, how it would benefit the fishery and how this benefit could be observed. Fisher (or community) objectives can be derived directly from the expected or desired impact on the fishery.

Additional information was collected to profile the individual respondents and the community and fisheries that they operate within. Details on fishing method, seasonality, location and access arrangements were collected from each respondent. Fishers ranked their influence on local management decisions and the degree to which the community are unified and can co-operate. Other information collected included details of past projects or interventions and the historic and present nature of conflict.

7.4.3 Field Study Results

Although stocked under the Third Fisheries Project, Gobarchapa Beel was completely dry and obviously not perennial. Initial exchanges with local fishers confirmed that the beel had not been perennial for 30 years. This fundamental mistake by the DoF may generously be attributed to this beel being the largest in the area after the monsoon and as depicted on most maps.

One fisher was interviewed at the neighbouring village of Sujaitpur before the field team travelled to Nagarpara, a nearby village in Balua thana where fishers prosecute Lohajang Beel all year round.

Lohajang Beel is unstocked and perennial. Ten fishers took part in group discussion and were interviewed separately at their homes. Local fishers identified Chack Nandanpur in Sonatola thana as a village where the fishers were entirely dependent on the Bangali River.

Six fishers in Chack Nandanpur were available to take part in discussions and were interviewed separately and in private. Again, discussions at Chack Nandanpur revealed a fourth site at Hashraj village in Madhupur thana where fishers depend on Satbila Beel, a perennial and stocked beel.

The team interviewed five fishers at Hashraj and spent considerable time discussing access and ownership issues at Satbila Beel - by far the most complicated of the four sites. For the purposes of the field review these sites represented a diversity of waterbodies and contrasting management arrangements within a manageable area. See Annex 13 for all completed survey forms.

Field Site Profiles:

Gobarchapa beel, Sujaitpur village

Gobarchapa is a seasonal beel several hundred metres from Sujaitpur where about half the beel fishers live. Although the beel has not been perennial for 30 years the fishers still emphasised the need for further stocking. This probably results from the DoF's previous stocking activity at the beel under the Third Fisheries Project until 1996 (see below). The fishers of Sujaitpur succeeded in securing the leasehold in 1999 with a bid of 40,000 Taka through the local committee. In other years fishers must pay approximately 200 Taka each to the leaseholder to fish the beel.

Lohajanj beel, Nagarpara village

Lohajanj Beel is a perennial waterbody fished year round by fishers from adjacent villages but particularly Nagarpara. Although the water level was quite high many fishers were concerned that surrounding landowners were de-watering the beel through pond digging or irrigation (uncertain or declining water supply was a common problem identified by fishers in all field sites including Bangali River). Nagarpara has its own fishers committee.

Bangali River, Chack Nandanpur village

The village of Chack Nandanpur is within one kilometre of the Bangali River which runs parallel to the Jamuna River and joins it 20 kilometres to the south. The village is represented by a local committee which has rights to a 5 kilometre stretch that constitutes the nearest jalmohal. However, these rights are not exclusive and in addition fishing outside this jalmohal incurs a charge to each fisher.

The Bangali River used to be perennial but a flood control scheme towards the Jamuna has seriously disrupted the hydrology and, according to some local fishers, the biology of the river. In the dry season water is retained in only a limited number of perennial stretches.

Satbila Beel, Hashraj village

Satbila *beel* is a perennial beel fished by people from Hashraj, members of the local committee and by leaseholders living up to 10 kilometres from the beel. Access arrangements were complicated by the digging of a separate stocked area in the centre of the beel which appears as a pond surrounded by the greater body of the beel in the dry season. Only the leaseholders have access to this section who in turn collect fees from fishers using the surrounding beel. Fishers pay per day and according to gear type. Most fishers felt that the beel should be for local access only and not for richer fishers travelling from outside. There was wide disapproval that two of the leaseholding party were members of the local co-operative and enjoyed exclusive fishing rights to the stocked pond. Epizootic Ulcerative Syndrome (EUS) was identified as a serious problem at Satbila by several of the fishers.

7.4.4 Limitations

Despite efforts to review waterbodies that did not fall under current community or co-management projects it became obvious that the field team could not work independently from the previous influence of DoF during the Third Fisheries Project and that the emphasis that fishers placed on stocking in at least one of the sites must largely reflect the activities during this period. The project objectives were made clear but some of the fisher responses may have revealed “desires” rather than “requirements”. It is difficult to avoid automatic or “shopping-list” feedback from respondents in rural appraisal (Kobe, pers. com.).

On arrival at Gobarchapa *Beel* the field team decided to change emphasis and identify potential sites with guidance from fishers. The original intention in reviewing two contrasting waterbodies was to compare the types of management requirements and objectives identified by local communities. On discovering Gobarchapa to be seasonal, however, the contrast to the river system was not as great as expected and management opportunities were seen to be limited by similar constraints (i.e. there was less incentive to delay harvesting or to stock an ephemeral waterbody). In identifying additional sites a wide range of waterbodies and their access arrangements were surveyed but the significance of feedback could not be related to the socio-economic character of the villages (socio-economic profiles were unavailable for the villages sampled). All villages were identified as important centres of fishing

activity but the precise contribution to local economic activity was unclear.

Certain requirements appear in conjunction with supportive management measures so that many fisher responses were linked. Well established requirements such as stocking, for example, often appeared with a suite of other management needs such as guarding and embankment building. Similarly, requests for exclusive access were followed with gear bans, closed seasons and the establishment of sanctuaries. Several fishers identified the need for exclusive access rights as a precursor to long term investment in conservation measures or changes in fishing and marketing behaviour.

The team had some difficulty in communicating the desired breakdown of responses i.e. from “requirements” to “what this requirement does” to “benefits to the fishery” and “how would this be seen as successful?”. This may be because the benefits to the fishery are seen as implicit by the fisher or because the causal link between their application and impacts on the fishery are not considered, are seen as irrelevant or seen as obvious (where respondents could not be drawn to explain the way management requirements impact the fishery or for what purpose, increased yield could always be implied). If the management goal is ultimately one of increased catch and is universal, this might explain why fishers sometimes failed to make the links between management measure, the impact on the fishery and the benefits accrued. Unfortunately, many fisher responses were incomplete in this respect.

7.4.5 Findings

The feedback received from the respondents revealed a great range in the degree to which management issues are considered between members of the fishing communities. Some respondents listed a wide range of management tools and readily conceded that they may be interdependent to be effective (e.g. seasonally reduced fishing and water conservation in conjunction with stocking). Several fishers emphasised the economic pressure to fish and the need for alternative income generating opportunities if certain management strategies were to be viable. The best considered responses were generally from slightly older fishers still actively involved in fishing, sometimes holding a position on the local committee. The youngest respondents often had difficulty in suggesting management requirements and objectives. There was a considerable overlap between the management requirements identified by ICLARM within the CBFM surveys (Table 7) and those found from this survey. Fisher responses corresponded to 15 fundamental requirements (Table 10).

There was a slight lack of considered feedback and management suggestions at the river site of Chack Nandanpur village which may reflect the limits to initiative within a *de facto* open access regime or perhaps the relative insignificance of fishing as an economic activity to that village. Unfortunately, socio-economic profiles were not available for any of the villages that were surveyed.

For each of the management requirements identified, the management tool implied and the intended objectives were ranked. Where multiple objectives are expressed for one management measure the modal response was taken as the primary objective (see Table 11).

In ascertaining management objective, fishers were encouraged to explain the potential impacts of any management proposals and how this would benefit the fishery. Ultimately this revealed the aspects of the fishery that fishers wanted to target e.g. timing of catch, value, size and number of fish caught (see Table 12). These objectives were identified by the fishers who were not prompted. Where information was lacking objective was not inferred.

Table 10. Local management requirements identified through discussion (respondents identified between 1 and 5 requirements each).

Management Requirement	Gobarchapa Beel (seasonal)	Lohajang Beel (perennial)	Satbila Beel (perennial/stocked)	Bangali River (5 km Jalmohal)
no. respondents	1	10	5	6
stocking	1	10	5	
fairer access		3	4	4
gear ban/closed season		7	3	4
sanctuaries (katha)		2	4	
re-excavation				1
guarding		5		
co-operation	1	1		
stop irrigation		1		
pit/pond digging	1	8	1	
more katha		4		
alternative incomes			2	
raise embankments		5		
return small fish				1
control fish disease			1	
remove dam/add sluice				5

These objectives are obviously interrelated but fishers were often quite explicit about which management requirement would achieve which objective. Stocking was obviously intended to increase catches but where stocking with guarding was desired the emphasis was on fish growth rather than recruitment, for example. Larger catch was the primary objective at each of the four sites but some requirements were specifically intended to increase catch at some stage in the future or the following year (e.g. leaving 2-3 *katha* unfished for 2 months). Most of the fishermen at each of the field sites were represented by a local committee responsible for collecting revenue and bidding for the waterbody leasehold. They are not strictly co-operatives in that almost all fishing, marketing and investment decisions seemed to be determined by the individual acting in isolation.

Table 11. Management requirements and objectives identified by fishers at project sites. “Main objective” is the modal response given for that requirement, “other objectives” were quoted less often. * objective not explicit but inferred through interview.

Requirement	Management Tool					Main Objective	Other Objectives
	stocking	restoration	effort control	reserve	access change		
Stocking	✓					↑ available stock	↑ income ↑ size
Fairer access					✓	↑ fish to locals	↓ costs ↑ consvtn
Gear ban/closed season			✓			↑ size	↑ fish ↑ income
Sanctuaries				✓		↑ fish next year	
Re-excavation		✓				↑ available stock*	
Guarding			✓			↑ size	↑ price
Co-operation					✓	↑ price for all	↑ equity ↓ conflict
Stop irrigation		✓				↑ conservation	
Pit/pond digging				✓		↑ available stock	↑ income ↑ size
More katha				✓		↑ fish next year	
Alternative incomes			✓			↑ allow/reserve ban	
Raise embankments		✓				↑ available stock	↑ size
Return small fish			✓			↑ size	
Control fish disease		✓				↑ available stock	
Remove dam/add sluice		✓				↑ available stock	↑ migration eggs/fry

Table 12. Management objective by project site as expressed by fisher respondents. The emphasis on larger catch in the perennial beels reflects the desire for stocking at these sites. Not all respondents expressed objectives for the fishery but many quoted several.

Management Objective	Gorbarchapa Beel (seasonal)	Lohajang Beel (perennial)	Satbila Beel (perennial/stocked)	Bangali River (5km Jalmohal)
larger catch	1	10	7	3
larger catch of big fish	1	5		1
larger catch next year		4		1
better income (price)		3	1	
less conflict	1			

Many respondents acknowledged the lack of decision-making within these committees but they are likely to be constrained both by the ephemeral and mobile nature of the resource and by the lacking legal capacity to enforce rules. Fishers at each of the waterbodies generally thought they had little influence in any management decisions that were made.

According to respondents there is a high degree of unity within each village. However, some conflict was apparent at Satbila Beel where local leaseholders were excluding fishers from certain areas of water and there were stronger indications of conflict with leaseholders from outside the area. Fishers at Chack Nandanpaur complained of destructive practice and lack of regulation by the muslim fishers at Bangali River (all villages surveyed were Hindu).

7.4.6 Summary

This field component was designed to add to and complement the input provided by NGOs through interview. The sample was not designed to be statistically rigid but was an attempt to directly contact fishers from a wide range of waterbody types and accompanying management and access arrangements. Through open discussion within the group context and with individuals, common concerns and options for management were identified directly from fishers.

The findings mirrored the experiences of ICLARM in the baseline CBFM surveys and may help explain the difficulty and apparent reluctance NGOs have to consider fundamental community objective. It was much easier to elucidate management requirements than to explain their overall purpose and intended impact on the local fishery.

One reason may be the problem the survey team had communicating the desired output and linking this structure to the predominant view of the fishery at the local level. In other words, the survey team and

the fishers may have quite different “cognised models” of the functioning of the fishery (see Christie & White, 1997).

Stocking was a priority requirement of nearly all beel fishers and as mentioned this may relate to the impact and influence of stocking programmes under the Third Fisheries Project. Satbila Beel was the only site currently being stocked and access to this section was restricted to private investors. The emphasis on stocking was predominantly the desire to increase catches as quickly as possible but several fishers expressed the accompanying need to control effort in the short term. In fact, effort control through gear ban and closure was the next most quoted requirement and was usually linked with the desire for stocking. Fishers of the Bangali River also emphasised the need for effort control to protect broodstock and this reflected their concern of overfishing by newcomers and their inability to prevent access to outsiders. The emphasis on access change at Bangali River and at Satbila Beel corresponds to what was seen as infringement by other users and unfair exclusion, respectively.

The physical management of the waterbody through embankment raising, katha building and pit-digging represented a large proportion of identified management requirements. Pit-digging was quoted particularly often at Lohajang Beel (where water conservation seemed a higher priority) with the principal objective to conserve broodstock.

7.5 FIMS Data Requirements

The type of monitoring obviously reflects the project purpose and goals. The community-based projects emphasising community development, local initiative and access issues rely on different strategies (and within CBFM, different NGOs) from site to site. It would be argued that if capacity-building is to be locally sensitive and relevant the process cannot be a blue-print one. The emphasis here is on continuous process documentation, often with the community providing a key role in record-keeping (Table 13).

Table 13. Monitored fishery attribute by community-based project. (CARE monitor these attributes through the Environmental System within NOPEST and through survey of the INTERFISH project; ICLARM monitor all CBFM sites on a quarterly basis with combined questionnaire and process documentation; the DoF have commissioned special household studies and routinely monitor stocking, catching, marketing and physical characters).

Attribute	CARE projects	CBFM	Oxbow Lakes
Fishing activity	Continuous	Continuous	Continuous
Market	Continuous	Continuous	Continuous
Waterbody physical	Continuous	Continuous	Continuous
Waterbody management	Continuous	Continuous	Continuous
Household social	Continuous	Continuous	Special studies
Household economic	Continuous	Continuous	Special studies

Within the Oxbow Lakes projects the DoF and BRAC have provided a different type of package of assistance to fishers. The procedure is relatively standardised with fishers, DoF and BRAC personnel performing set functions from site to site and the emphasis is purely on credit provision, stocking and group-based recording.

The work of ICLARM in documenting community management requirements emphasises the different objectives between waterbodies and even from fisher to fisher. This complexity was borne out by the short field review conducted by the project team. However, although projects such as those of ICLARM and CARE are participatory in nature the documentation and monitoring process is almost completely uniform. In fact, CARE are actively seeking ways in which to standardise the appraisal and evaluation of each of the 8 ongoing projects. The types of information collected are consistent between sites although the pressing management needs may differ considerably. Even between projects the types of data collected are consistent (Table 14). Routine monitoring includes the collection of basic catch and effort information, market price and household income and expenditure (this latter is especially significant in baseline survey).

NGOs have an obvious requirement for meaningful amounts of data collected in a standardised format in order to meet donor requirements and to document what are still the very experimental processes of developing community-based or co-management arrangements. There is an acknowledgement that more time should be spent in ascertaining community management objectives from those NGOs operating in a participatory and consultative way (Thompson, pers. com.). However, where attitudinal information and local input is being sought it seems to be collected in addition to, or separately from, information on project performance indicators. Some NGO staff expressed reservations over the use of project indicators without reference to a cultural and socio-economic setting. The need to avoid these indicators becoming project goals has probably driven the initiatives towards participatory monitoring and process documentation.

Table 14. Data type collected by community-management projects. (source: GOLDA - Project, Baseline Field Survey, 1998; ICLARM survey questionnaires; Oxbow Lakes Small Scale Fishermen Project, Progress Report No. 11, 1997)

Data Type	CBFM	CARE projects	Oxbow Lakes
Catch - gear, spp., wt.	✓	✓	✓
Effort - duration, gear	✓	✓	✗
Sales - %, price	✓	✓	✓
Other livelihoods	✓	✓	✗
Income/expenditure	✓	✓	✗
Diet	✓	✗	✗

In acknowledging the social and economic complexity of the role of fisheries in Bangladesh, projects such as CBFM and those initiated by CARE attempt to augment biological and catch information with a detailed understanding of community perspective, conflict and economic dependence on the resource. These projects do not assume a purely technical approach to catch enhancement but examine existing socio-economic problems within fishing regions in a holistic manner (see Table 3). As a result, many programmes target beneficiaries or activities that may be seen as peripheral to the fishery. NGOs may allocate significant resources and time to developing related or alternative income generating activity and in facilitating local group formation and decision-making. Within the CBFM, for example, direct expenditure on fishing-related activities represented only 36% of project funding to communities (ICLARM, 1998). The performance of these activities is monitored by set socio-economic indicators or through attitudinal questionnaire and feedback from the community in question.

Local management requirements as identified by this survey (Table 10) and attitudinal survey by ICLARM reveal a suite of interdependent measures. A central precursor to many of these management requirements (often identified explicitly by fishers) is security of access or changing use rights. Activities such as stocking, the establishment of gear bans, closures and sanctuaries require the ability to grant or withdraw the right to fish. The community-based projects operating in Bangladesh treat issues of access as central to the success and effectiveness of programme activities and long-term fisheries management in general. Access issues are especially critical to the poorest stakeholders and with respect to those fisheries difficult or impossible to physically delimit such as rivers or open floodplains.

Access Arrangements

Changes in access rights and the distribution of the benefits derived from fishing activities may be harder to quantify than direct fishery outputs. Access to leaseholders may be legally defined but *de facto* access rights may feature several layers of informal and short-term arrangements as found during this field survey, for instance.

To record changes in access arrangements attitudinal feedback from representative fishers must be sought. Where projects are “action oriented”, progress and change is documented as a component part of ongoing monitoring responsibilities. All activities and progress at each of the CBFM project sites are currently monitored through “process documentation” (see Section 7.2). Local DoF Field Assistants are required to maintain local diaries or record books detailing current activities, events and issues arising at the waterbody in question. Any physical changes to the waterbody that may affect access or introduce conflict (such as new linkages with surrounding waterbodies or khals) are recorded and all local meetings are gauged for levels of co-operation, conflict and general group dynamics.

Certain aspects of contemporary management arrangements, access issues and conflict are best understood and documented with reference to qualitative and attitudinal information derived from individual interview. Information pertinent to equity of access and to revealing changing access arrangements may also be recovered from household survey (see Annex 8 for CBFM Household Survey format). Within the CBFM it is intended that PRA techniques will be used by NGO staff to better understand past and present fisheries-related issues difficult to monitor through formal survey. A broad profile of present and recent access arrangements should be collated if the significance of local use rights to the community and to the prospects of project activities is to be properly understood (Table 15). Incorporating the expertise and monitoring programmes of the various NGOs involved in community-based projects would provide access to detailed present and historic socio-economic

information. Monitoring these projects would ensure efficient coverage of fishers.

Stocking Programmes

Fisheries enhancement through stocking programmes initiated by government, NGOs or private groups has represented a significant component of local management activities nationwide and this emphasis will be extended with the Fourth Fisheries Project. This field survey and attitudinal review by ICLARM revealed stocking as a principle management requirement of fishers operating at closed or semi-closed waterbodies and is perceived as a direct method to achieve the primary objective of increased catch.

The approach to monitoring within the Oxbow Lakes project, and to an extent by the Beel and Baor Management Committees within CBFM, has demonstrated that consistent and set data requirements may be suitable for programme monitoring at each project site. Fisher groups within these projects are encouraged to develop management skills and to maintain biological and economic records of stocking activities essential to charting the progress (or otherwise) of the project.

Table 15. Performance indicators and data requirements to monitor access rights.

Performance Indicator	Data Requirement	Source
Previous year fishing rights	Location, gears permitted	Socio-economic questionnaire (household survey with CBFM)
Nature of restriction	By season, gear type, quantity, fee payment	Socio-economic questionnaire (household survey with CBFM)
Fee collecting body	Union Parishad, middleman, fisher society etc.	Socio-economic questionnaire (household survey with CBFM)
Fee payment	Total value (Tk or % etc.)	Socio-economic questionnaire (household survey with CBFM)
Current fishing rights	Changing access arrangements to: i) respondent; ii) others	Process documentation by NGO or additional questionnaire
perceived problems, inequity	Problems, potential solutions	Process documentation by NGO or additional questionnaire, monthly records, management group records, diaries etc.

The NGO Caritas document project activities at the Hamil Beel site according to "fishery (catch)/economic" performance and to "social impact" performance (see Alam *et al*, 1997). With respect to "fishery/economic" performance at Hamil Beel, ICLARM and Caritas monitored the pattern of stocking and catches. The Beel Management Committee records total fingerling number, size range and capital outlay by stocked species. Total catches are recorded by size, weight and market value (representative data and recording format is provided in Annex 14).

Caritas recognise that the relevance or extent of social impacts are more difficult to gauge and combine 5 indicators to review project performance with respect to the community:

- 1.) Equitable harvesting - how do the fisher groups in question distribute access and proceeds?
- 2.) Repayment of stocking loan - how do individuals/groups meet repayment responsibilities?
- 3.) Repayment of boat and net loans - how do individuals/groups meet repayment responsibilities?
- 4.) Social participation - how are fishers/non-fishers included in the programme?
- 5.) Attitudinal change to stocking - how do fishers perceive the benefits/limits to the programme?

These indicators correspond directly to the management requirements identified by fishers within the baseline CBFM surveys conducted by ICLARM and as revealed by this field report. Equitable harvesting and social participation relate directly to issues of access and exclusion, while the ability to repay loans relates directly to an increased or more reliable income. Under the CBFM the data to monitor these aspects of stocking projects would be available from Management Committee records and process documentation as co-ordinated by ICLARM (Table 15). It is intended that stocking programmes within the Fourth Fisheries Project will be documented in a similar way by local management groups as in the Oxbow Lakes Project.

Indicators such as these might be applied to waterbodies such as closed beels where stocking is suitable and where stocking activity is monitored either by an external agency or local management group. The type of information required to monitor progress will be consistent between sites. The data types shown in Table 16 would allow outputs such as productivity (kg/ha) and net returns on investment over time.

Table 16. Performance indicators and data requirements for stocking programmes (developed from: social and economic profitability of community-based fisheries management: a case study from Hamil Beel. Alam *et al* 1997)

Performance Indicator	Data Requirements	Source
Fishery (stocking & catch)	Stocking by species: size range, number, cost; catch by species: size range, number, weight	Beel Management Committee, fisher co-operatives or lease holding group
Economic (revenue)	Weight and value by species (Tk/kg)	Beel Management Committee, fisher co-operatives or lease holding group
Loan Repayment (stocking, nets, boats)	Loan undertaken by individual/group; loan repayment by individual/group	Donor NGO or GO body
Equity of Harvesting	Group organisation, sales arrangements	Beel Management Committee, fisher co-operatives or lease holding group
Social Participation	Distribution of benefits: allocation of benefits/duties, provision of alms	Process documentation by NGO

Sanctuary and Restoration Programmes

In each of the waterbodies surveyed the need to limit and regulate the timing of effort was identified as a management priority by many of the fishers interviewed. The impetus to restrict effort may be manifold. At the river site it was intended to limit the activity of unwanted newcomers to the fishery but at all sites, fishers identified effort control as an essential requirement to support habitat restoration or the establishment of sanctuaries. Seasonal closure or gear restrictions were understood to protect young or breeding fish in each of the waterbodies (see Annex 13). The need for feedback to communicate the success or shortcomings of local habitat, sanctuary and katha initiatives is paramount if communities or NGOs are to learn lessons from experience elsewhere and adopt those schemes best suited to each community and location.

The Centre for Natural Resource Studies (CNRS) emphasise the need to provide “before and after” information to participants on the Community-Based Fisheries Management and Habitat Restoration Project (Rahman, pers. com.). CNRS projects recommend regular information sharing sessions open to participating households and the general community, so that project activities and results can be effectively disseminated. Species and catch listings are circulated to demonstrate the success of khal restoration at Dhaleswari River, Tangail district, for example. Within CBFM, ICLARM are currently presenting catch information to demonstrate the benefits of sanctuary establishment at rivers and beels (see Section 7.2).

Monitoring of gear restriction, katha and sanctuary schemes should combine details of project activities or management change with data regarding the targeted fishery attribute - principally total catch and distribution of catch by species (fishers will desire increased landings of certain species according to location, (Rahman, pers. com.)). Revenue generation is the primary management objective (not conservation) and should be monitored overtime in response to community or project activities (Table 17). Because some restrictive measures were proposed to control access of certain fisher groups (specifically muslim fishers at Bangali River) the distributional effects of activities should be documented.

Table 17 Performance indicators and data requirements for gear ban/habitat restoration.

Performance Indicator	Data Requirements	Source
Fishery (catch)	By species, total catch length/frequency, weight, gear type	Management Committee (NGO or Fisher co-operative) or NGO catch survey
Economic (revenue)	Fisher income by species	Management Committee (NGO or Fisher co-operative) or NGO income/expenditure survey
Equity of Harvesting	Distribution of benefits - income/catch by ethnicity or user group	Management Committee (NGO or Fisher co-operative) or NGO attitudinal survey

Current activities/access arrangements	Project activities - nature of intervention (restoration, katha etc. and location) effort restriction - seasonality, location, gear type, fisher group	Management Committee (NGO or Fisher co-operative) or NGO process documentation
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7.6 *Synthesis*

Community management requirements were shown to be diverse and interrelated but monitoring access arrangements and enhancement initiatives (stocking or the establishment of sanctuaries or katha) would ensure the coverage of most local primary concerns and objectives as identified through this survey and by ICLARM. Some data requirements may be more relevant to specific waterbody types than others but the physical and social complexity of fisheries within Bangladesh precludes a blue-print approach. Rather, data requirements for each site will depend on those management measures currently in operation or seen as priority by community, NGO or government.

The ICLARM surveys of CBFM are designed to compare project performance over time on a site-by-site basis whilst acknowledging the diversity and variation between regions, fishing communities and NGO activities. In this respect it provides a useful model on which to frame national monitoring of community-based and co-managed fisheries programmes.

NGO databases and local records would provide nodal points for sampling large numbers of representative fisheries and fishers. If the fisheries of Bangladesh are to move towards co-management nationally, it is crucial that the experience and monitoring strategies of NGOs should be acknowledged and developed in the future.

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Annex 1

Fieldwork Itinerary (A.S.Halls)

Date	Activities
09/03/99	Depart LHR (BA145) 2225
10/03/99	Arrive Dhaka 1630 Taxi to accommodation (FMS Transit House)
11/03/99	0800 Meeting with Shahriar Hossain at FMS to arrange transport, accommodation and banking facilities. 0900 Exchanged traveller cheques at ANZ Bank. 1100 Meeting with CNRS (AH, RL, KD, Moklesur Rahman and Sachindra Halder [Director]) to introduce project and discuss field trip objectives. Discussed past, present and future CNRS projects. Agreed provisional field plans for following week. Collected requested literature and arranged next meeting (Monday 15 th). 1500 Returned to FMS to arrange meeting with CARE (Sunday 14 th). Obtained maps of Bangladesh and organogram of GOB DoF. Began searching for relevant literature on current and proposed community based capture fisheries projects. 1700 Began review of national management objectives and survey methodology.
12/03/99	Literature search at FMS. Review of environment and inland fisheries resources and project planning.
13/03/99	Literature search at FMS. Review of environment and inland fisheries resources and project planning.
14/03/99	0800 Meeting with Alan Tolvervey at FMS 1400 Meeting with Greg Chapman (CARE)
15/03/99	1000 Meeting with Mokammel Hossain (Director of Community-Based Fisheries Management Project) 1400 Meeting with Sylvie Desilles (Project Coordinator New Options for Pest Management (NOPEST) Project (CARE)). 1600 Review of national fisheries management.
16/03/99	0900 Meeting with Alan Tolvervey at FMS to discuss provisional FIMS design approach. 1100 Meeting with Goutam Chandra Dhar (GIS Programmer) FMS to examine FRSS data structures for floodplain sector and frame survey for marine sector. Collected catch statistics. 1200 Meeting with Moklesur Rhaman (CNRS) to establish community objectives and community management evaluation criteria. 1500 Meeting with Mokammel Hossain at ICLARM - failed to show. Spoke with Debashish Mazumder (ICLARM) to establish staff involved with the CBFM project and potential meeting dates. 1600 Review of national management.

17/03/99	0900 Literature review of national management and 4 th Fisheries project 1400 Meeting with Bill Collis (Chief of Party) MACH Project to discuss project data and collection systems in relation to community objectives.
18/03/99	1100 Meeting with Simon Bland, First Secretary, Fisheries, DFID to describe project objectives and field work approach and logistics. Discussions about FIMP project in relation to DFID and the GOB DoFL. 1200 Meeting with Mokslesur Rhaman (Consultant to DoFL and DFID [Fourth Fisheries Project]) to discuss 4 th Fisheries information/data collection in relation to existing FRSS. 1400 Meeting with Nassurudin Ahmed (Director of FRSS and 4 th Fisheries Project) to discuss 4 th Fisheries information/data collection in relation to existing FRSS and to seek FRSS data.
19/03/99	0800 Consolidated field work approach including required assumptions to achieve project activities.
20/03/99	0800 Description of merits of proposed co-management FIMS. Review of National fisheries management.
36239	0800 Review of National fisheries management. 1400 Meeting with Nasiruddin Ahmed and Banik (FRSS) to discuss collaboration/cooperation with the project.
36240	0800 Review of national fisheries management. 1000 Meeting with Alan Tollervey to discuss meeting with DoF 1200 Review of national fisheries management. 1500 Meeting with Gertjan de Graaf to obtain FRSS data for river fishery. 1600 Meeting with Alan Tollervey and Goutam to obtain further FRSS data.
36241	1000 Meeting with Mokammel Hossain (DOF) to discuss the CBFM project. 1400 Meeting with Faheem Khan (MIS Advisor, CARE) to discuss CARE's community-based management projects and to obtain relevant sampling data and software.
36242	1000 Meeting with Cratitas to determine details of CBFM project with respect to community objectives, data requirements, sampling methodology and feedback mechanisms. 1400 Meeting with Manjur Kadir (Fisheries Biologists) and Habish (Data analyst) at ICLARM to determine details of CBFM project with respect to community objectives, data requirements, sampling methodology and feedback mechanisms.
36243	1100 Meeting with Saleemul Huq and Nasimul Haque of BCAS to discuss Fourth Fisheries Project Proposal and MACH project 1300 Report writing.
36244	0800 Report writing
36245	0800 Report writing
36246	0800 Report writing
36247	0800 Report writing
36248	0800 Report writing

36249	0800 Report writing
36250	0800 Report writing 1600 Depart Dhaka
36251	0455 Arrive LHR

Annex 2

The National Fisheries Policy 1998

Annex 3

ANNEX 3 of the Fisheries Resource Management Support Project

TECHNICAL

Data Requirements

The information required to underpin fisheries management are varied and include requirements for fisheries, social, economic and biological data. The range and cost of data collection can quickly become both expensive and extensive and where resources are limited it is necessary to consider what are the minimum data required before management implementation can occur. Not all data have equal weighting, some data are essential whereas the lack of other data, although allowing refinement of management inputs, may not prevent the initiation of some management intervention.

Hierarchy of Data Collection

Fisheries and Biological Data

Type	Description		
Primary	Production	Capture	Weight Species composition Gear type
		Pond	Classification (area, depth etc) Species Weight
	Effort	Gear type	
		Vessel	
Economic	Sector	Input and Output costs	
Secondary	Habitat	Classification	Distribution (seasonal) Access
		Life history	Distribution Reproduction Migration
Tertiary	Biological		Fecundity Age Mortality

Social and Economic Data

Type	Description	
Primary	Community	Cultural setting Basic demography Organisation Economic setting
Secondary	Opportunities	Mobility Education Poverty Access
Tertiary	Perception	Attitude to resource exploitation Attitude to management intervention Links to GOs and NGOs

The project will seek to implement data collection on the most important data sets outlined above that are required to implement resource management.

Fisheries and biological data: To monitor a fishery it is essential to have estimates of both production and fishing effort and of the economic framework that the sector operates within. In the local setting production is required for both capture fisheries and for pond (and other “farmed” systems) production. Ideally capture fisheries require the weight of the catch by species and gear type. For production systems classification of the water body and the weight by species produced is also required. Fishing effort data is required for both vessels and gear type. Economic data should detail the investment involved in the input (ie the time invested and capital and recurrent costs of the fishing effort) and of the output (value of the catch).

If catch per unit effort adequately reflects stock abundance **(and there are problems with this assumption for flood plain fisheries)** then these data may provide the basis for management intervention.

It is more likely, however, that secondary data will also be required detailing the habitat fished and of some basic knowledge concerning the life history of the exploited fish populations. Habitat related data should indicate their spatial and temporal nature by habitat type and of the access fishing communities have to them. Such knowledge will allow abundance trends to be put into a wider geographical context and information on access rights will guide management approaches. Life history data relating to the distribution of the resource will also allow further perspectives to be gained from abundance data (eg species with limited distributions will require different approaches to management). Similarly data relating to reproduction (particularly fecundity) are also indicative of the species resilience to fishing pressure. Less fecund species (which also tend to have slow growth and low mortalities) are more at risk to over fishing. In a related way, reproductive behaviour related to migrations into restricted waters (eg from sea to rivers) may also place species at particular risk.

Tertiary data relating to producing estimates of life history parameters such as age and mortality allow for the refinement of simple production based models. The use of such data also implies considerable more sophistication in the underlying basic data and of the analyses to be performed. They also imply that a relatively regulatory framework exists based on the restriction of catches at certain sizes or of the control of fishing effort. As such,

these data are not considered essential for the development of fisheries management in Bangladesh at this stage.

Social and Economic Data: Before appropriate management approaches can be formulated it is essential to have a good understanding of the communities it will be implemented within and of the consequences it will have. To do this a broad understanding of the communities must be obtained that outline the cultural, social, economic and organisational settings. This broad framework will help outline the management approach. This approach will be further modified by considerations of the labour mobility of the fisherfolk within the community, which will be related to their access to resources, education and poverty levels. Finally, the perception of the user to the resource and its management and their links with public institutions will further modify management approaches. More importantly it will also determine the underpinning work required to develop links between the communities and the public sector and of developing educational and management training inputs to the community and public sector agency.

The project will support the sustainable provision, through the introduction of a statistically valid data collection programme, of information on **production, effort, economics and important social data**. These data will be augmented at the national scale by the data collected through the NPC. The analysis of remote sensed data and information from the Ministry of Lands will provide data on the **classification and distribution of water bodies and public access** to these. The project is not proposing to directly collect biological data but it will review available fisheries management literature. This will produce a clear understanding of what information is available and will help target future research initiatives. This will be of use to universities, the FRI and donors. It will also provide essential information in support of DFID's University Support Project by determining gaps in current resource management knowledge.

Related Projects

The project will build on and complement the work of a number of other DFID funded initiatives. Under DFID's centrally funded Renewable Natural Resources Research Programme (RNRRS) a Fisheries Management Science Programme initiative to develop a generic database for artisanal fisheries will be initiated in early 1998. One of the target countries is Bangladesh and this work will provide a database model that can be adapted for the purposes of this project. The FMSP project will be developed collaboratively with local partners and will contain many of the features required for the FRMS database.

The generic database will provide for the entry and classification of a wide range of fisheries, economic, social and biological data. It will be a PC based system operating under Windows NT. The underlying database software varies depending on the complexity of the data to be entered. The front end will utilise Access and a graphical interface to allow display and analysis of spatial data. The bespoke software will be fully menu driven and Windows functionality will be provided by Visual Basic. The generic model will reduce the development time for the FRMP database considerably and its design ensures that additional user requirements can be quickly incorporated.

FAP 17(II), when implemented, will provide many insights into the development of management initiatives, particularly within fisheries affected by drainage and irrigation schemes that have impacted the resource. Lessons learnt from this project will be important to formulating management training within the FRMP. Similarly, lessons learnt concerning community participation in management implementation within this project will provide important guidelines to be disseminated to a wider audience.

The FRMP will utilise both the experience gained in participatory approaches to community involvement (particularly the underlying training approaches used which are outlined in the Project Memorandum) developed within FTEP. Approaches to be utilised within the FRMP have many parallels to those to be implemented under FTEP(II) and, will likely use linkages and staff resources planned.

The literature review will provide an important summary on the existing state of knowledge of fisheries management within Bangladesh. More importantly it will identify gaps in current knowledge and will provide a future focus for research initiatives. This study will provide important information in support of the DFID funded University Support Programme and should provide the basis on which to target aspects of this programme. It will, for similar reasons, provide useful information for the FRI.

Training

Training inputs are an important element of the FRMP in improving the use of fisheries information for resource management. A detailed training needs analysis will be undertaken to plan a directed programme of inputs. This will not simply review current qualifications but will actively engage participants (through small workshops) in providing information on their understanding of data needs for resource management. This will serve not only to assess training needs but it will also initiate the training process by engaging participants in dialogue outlining what future data requirements may be.

The project will provide training inputs to address the capacity building requirements within MoFL and DoF. Training will cover the promotion of participatory approaches and the development of co-management initiatives. Training will also place particular emphasis on improving skills within FRSS in the data handling and analysis and in statistical methodology.

Data collection

The project memorandum has been developed to provide a least-cost but sustainable solution to the current problems. This solution requires that there will be no significant increase in the staffing levels within FRSS nor in their recurrent expenditure. The project will therefore investigate alternative methods of data collection to provide a statistically valid fisheries sector monitoring programme. **RISK**

The project will explore the role of Fishermen's Associations, secondary schools (through student participation), the collection of market information, participatory approaches and the role of NGOs in data collection. It will also explore how the FRSS may better target its existing sampling effort.

Fishermen's Associations are often formed to obtain government issue leases to water bodies and information relating to the water body and the lease arrangement will be compiled within the FIMS. The established links between the public sector and fishing communities will be investigated to test the data collection capacity of the existing arrangements.

Secondary schools, through the participation of students in data collection projects, may also be able to provide useful information. The benefit to the school system may be the development of a practical example to further the teaching of maths and/or of science. The distribution of secondary schools would provide representative coverage for the whole country.

Data on the quantities and value of fisheries products at selected markets have been collected by a number of projects as an alternative to the collection of production data. These

data have not been analysed to test how well market data mirrors production data (eg it does not account for subsistence catches) and this will be done by the project.

Participatory approaches will also be explored by the project to determine if they could be an effective mechanism of collecting data from fishing communities. DoF field staff will be trained to facilitate this role. In theory, the involvement of communities in the data collection (and dissemination) process will enhance their contact with the public sector and could form the basis for increased dialogue and the development of co-management. The benefit to the community, in theory, would be in the long-term sustainable utilisation of their resources. However, there will be no immediate link between the provision of data and improvements to the resource. Given the suspicion that many resource users have towards DoF field staff it may be difficult to develop such participatory approaches. The success of the initiative will depend heavily on the quality of the participation and on the content of the message delivered. **RISK**

The possibility of linking income generating activities (by augmenting existing NGO initiatives in this endeavour with project funds) within the communities targeted for data collection will be explored by the project on a trial basis.

The role of NGOs in data collection will also be explored. There are two possibilities; the contracting out of existing FRSS data collection services and involving NGOs in promoting participatory approaches. NGOs have a long history of community involvement but this is usually on a project basis and frequently involves the payment of communities for the provision of data. This is not commonly considered a participatory approach and would be of use to GoB if NGOs were able to provide the more cost effective data collection system. However, given the wide distribution of NGO activities within Bangladesh, and the possibility of training NGOs by the DoF field teams in participatory approaches, they may be able to provide an important facilitating link to include a wide range of communities within this programme. Both approaches will be explored by the project.

Annex 4

Marine Resources Assessment Group (MRAG Ltd)

C/o Fisheries Management Support (FMS)

Road 28

House 42

Gulshan, Dhaka.

21/03/99

Dr M.A.Matin
Director General, Fisheries Management and Administration, Dhaka
The Government of Bangladesh
Department of Fisheries

cc:

Dr Nassirudin Ahmed
Dr Rhakal Chandra Banik
Dr Abdul Latif Khan
Dr Anwar Hossain

RE: DFID Project: Information Systems for the Co-Management of Artisanal Fisheries

Dr Dr Matin

I would be most grateful if you and your staff at the DoF would kindly give consideration to the attached document which outlines details of a DFID funded project to develop a prototype Fisheries Information Management System (FIMS) for the inland fisheries of Bangladesh. I would like to emphasise that the benefits for the DoF and therefore the success of the project, rests heavily upon your willingness to collaborate.

Unfortunately, time is not on our side, so I would be very grateful for a prompt response regarding these matters.

Yours sincerely

Dr A.S. Halls

Senior Consultant

(MRAG Ltd)

DFID Project: Information Systems for the Co-Management of Artisanal Fisheries

Objectives of the Project

To enable better co-management and appropriate development of Bangladesh artisanal fisheries, by developing and testing a prototype fisheries information management system (FIMS).

Activities

With the assistance of NGO's (see below) and the Department of Fisheries:

- Describe community and Government of Bangladesh fishery management objectives.
- Describe existing and future data requirements (eg for the Fourth Fisheries Project) to meet the objectives.
- Develop guidelines for appropriate integrated frame survey and sampling methodologies.
- Develop prototype FIMS for Bangladesh.
- Provide training material and workshops in the use and application of the FIMS

The Department of Fisheries, Bangladesh

Benefits:

The project will:

- Provide the DoF with a prototype FIMS with training material and workshops.
- Provide a sound basis to attract donor aid to develop and implement an upgraded FRSS/FIMS

for the whole country.

- Help strengthen the institutional capacity of the DoF.
- Highlight the needs of the DoF to DFID and other donors.

Required Collaboration/Cooperation:

In order to deliver these benefits to the DoF we will need your assistance and cooperation. In particular we will need the following:

- The DoF's opinions regarding the existing FRSS/FIMS (questionnaire attached).
- Details of additional data and information that DoF think should be included in the prototype FIMS (eg socio-economic information about fishing communities, market data etc) (questionnaire attached).
- Details of the outputs DoF would like from the prototype FIMS eg catch by species and habitat, fishermen incomes by district, total revenue from shrimp farms etc and what format the information should be presented in eg tables, graphs etc. (questionnaire attached).
- Details of the frame surveys for the existing FRSS.
- Raw data from the FRSS database¹ to construct, test and demonstrate the prototype FIMS.

Please note: Any costs incurred by the DoF for this collaboration/cooperation will be refunded

¹.We are currently seeking the assistance of a large number of NGO's to help identify fishing community management objectives, data/information requirements and any raw data to include in the prototype FIMS.

Funding and Contact Information

Funding: UK Department for International Development (DFID)
Renewable Natural Resources Research Strategy (RNRRS)
Fisheries Management Science Programme (FMSP)
Project R7042

Consultants: **Bangladesh:**

Marine Resources Assessment Group (MRAG Ltd)
C/o Fisheries Management Support (FMS)
Road 28
House 42
Gulshan, Dhaka.

London:
47 Prince's Gate
London
SW7 2QA

Collaborators: **CARE, Bangladesh,**
65 Road No. 7/A,
Dhanmondi,
Dhaka 1209,
Bangladesh

Centre for Natural Resource Studies (CNRS),
3/14 Iqbal Road,
Ground Floor,
Block A Mohammadpur,
Dhaka - 1207,
Bangladesh

Q1. What are your opinions regarding the existing FRSS/FIMS ? Include details of required changes.

Name	Opinions of existing FRSS

Q2. What additional data and information should be included in a prototype FIMS (eg socio-economic information about fishing communities, market data etc) ?

Name	Additional data/information

Q3. What outputs would like from the prototype FIMS and in what format? (eg catch by species and habitat, fishermen incomes by district, total revenue from shrimp farms in tables, graphs etc.

Name	Required outputs/formats

Annex 5

FRSS Sampling Forms

FRSS Database Field Names and Descriptions



Annex 7

Interview Minutes - Bangladesh

11/3/99

Meeting with Moklesur Rahman, Director CNRS

MR outlined 8 significant national community-based management programmes.

1. Management of Aquatic ecosystems through Community Husbandry (MACH)

Funding by USAID. Recently started.

NGOs: BCAS, CNRS, Caritas

District: Tangail

Activities: comprehensive monitoring of baseline data by local groups.
this combined with project performance monitoring one database
dissemination to community through workshops

MACH will share data with DOF and NGOs

2. Sustainable Environment Management Programme (SEMP)

IUCN is the implementing and co-ordinating agency. Support from the Ministry of Environment and UNDP. Started November 1998. 5 year duration.

District: Aricha, Gopalganj

NGOs: BCAS (Aricha), NACOM (Gopalganj)

Activities: 25 projects totalling \$26 million, 2 of which are wetland projects

3. Bangladesh Environment Management Programme (BEMP)

Funded by CIDA. Recently started. Targeting haors with CNRS

4. Community Based Fisheries Management project I (CBFM I)

Funded by DOF, ICLARM June 1996 - June 1999

NGOs: BRAC, Proshika, Caritas

Activities: 16 projects, community monitoring, alternative livelihoods, local group management, local group tenure

5. Community Based Fisheries Management project II (CBFM II)

Funded by DOF and ICLARM. Will start in July 1999

NGOs/Activities as above

6. Fourth Fisheries Project

The World Bank is to finance most of the open water components and DFID the technical support. GEF and GOB will support the Hilsa fishery.

NGOs: various contracted to support beel-level committees

Activities: increase production in open/closed fisheries, increase shrimp production, expand employment opportunity/income, develop skills in public and private sector, develop capacity of DOF

7. GEF/UNDP

Project at one hoar

8. CNRS beel projects

Activities: khal restoration, community monitoring, community closures alternative gears, sanctuaries, environmental education for children and farmers

CONTACTS

Mokammell Hossain at DOF for CBFM

The Environmental GIS II project under FAP 16 is looking at the FRSS and improving it. House 49, Road 27, Banani

The Land Water Interface project (DFID) will run until November 1999. Julian Bar, Colin Bean (fisheries), Paul Silioe (anthropologist) and Paul Dixon are contacts.

They have been involved at Charan Beel and have carried out a one year consumption problem census. They need to know how much land is private before the do the excavation work.

Dr Ainum Nishut is country representative for IUCN and involved in SEMP.

14/11/99

Meeting with Anwar Hossain, Department of Fisheries

Mr Hossain called for an increase in manpower, sampling stations and training. There should be more sample stations in floodplains and beels especially. There is not the proper communication with the community. Socio-economic data and information on local elites, rice farmers etc would help DOF to better understand fisher behaviour and uptake.

There needs to be more detailed information about specific fish pass experiments on what species move and when.

Information should be sent back to the fieldworker at the local level.

The latest data available from the FRSS is for 1997. The system has not changed since its establishment in 1982.

The Fourth Fisheries Project will not consider information to the Thana level. A database should consider the different projects (beel stocking, khal excavation, shrimp farms and fish pass studies etc) under Fourth Fisheries.

Other information that should be collected:-

Biodiversity indicators (jalmohals may have as many as 260 spp.), productivity (fish will migrate from food poor ponds and rivers!) and physical and chemical parameters (pH, nutrient levels etc).

If there was to be a Dfid workshop the DG, the Project Director, 5 District, 5 Survey Officers and 4 Thana Officers should attend.

Nassirudin the Project Director (FRSS) will return from US soon. Baniq also works on FRSS.

14/3/99

Meeting with Greg Chapman, Deputy Co-ordinator CARE

Conversation regarding PRA and the action oriented techniques used by CARE for their projects. Very practical and visual demonstrations are used, such as aquarium displays of eutrophic and healthy prawn systems. The fishermen design their own training regime.

Arranged meeting with Sylvie Disclairs, project co-ordinator and PRA specialist.

15/3/99

Meeting with Mokammel Hossain, MD CBFM

Nationally, the Field Officers are disenchanted because they are posted permanently. There is data available through the FRSS but it is of no use.

The CBFM is based on a model developed by Fikret Berkes. Field Assistants help ICLARM in the field. The NGOs provide the credit and training. Within the CBFM, DOF do detailed surveys and case studies.

Production on some bodies has increased from 10, 000 tonnes to 36, 000 tonnes.

The interview was cut short because Morkamel had a pressing meeting to attend! It was agreed to meet at ICLARM 3pm the next day.

15/3/99 Meeting with Sylvie Desilles, project co-ordinator and PRA expert

An outline of the PRA and community development work adopted by CARE especially that used by INTERFISH IPM projects. Originally researchers would go to the project sites and fill in local feedback on to the log frame. Now CARE use a PRA consultant. It is difficult to communicate and the usual solutions like drawing and mapping are not very useful because people have problems drawing. Instead visual and tactile cues are used that encourage discussion and debate eg. wooden fish representing large, medium and small catches.

The process is repeated one year later to test the management activity and to review how it succeeded or failed.

In Mymensingh and elsewhere the fishermen had devised their own sampling methodology and apparatus. The community decide what to do for the next year.

The sorts of objectives of the project sites are the same as those outside the project sites because other communities have adopted similar techniques.

The primary objective is food! CAGE have worked with nutritionists etc. who survey "what have you eaten and when?" Proxy measures of project success can be used, such as a record of how much cooking fuel is burned.

There is an Eid-ul-Azha from March 26th to April 1st!

16/3/99 Conversation with Alan Tollervay, FMS

Our approach to the project, our views on the institutional capacity and objectives of DOF were outlined. Dr Tollervay mentioned Mokhelsur Rahman (2) who works with Nassirudin on the 4th Fisheries Project. There will be a data-base system developed for this project shortly.

Ingrid Geveres at EGIS is developing a national management model based on FAP.

Felix Marttin might be worth contacting at the Compartmentalization Pilot Project at Tangail.

BRAC still operate the Oxbow lakes.

Interview with Mokhlesur Rahman, CNRS

CNRS hired enumerators under FAP16, under CBFM they were local enumerators. Proshika are good at using groups to monitor simple information.

CNRS were also involved with LWI and left questionnaires at the households. Very simple data was collected this way. They were also developing a form of PRA that they would like to develop further. They are not involved in community monitoring, it's data collection.

CNRS monitor species diversity, fish consumption (fish caught and fish bought) and carry out catch surveys. They use educational videos to explain the benefits of habitat restoration. Local fishermen claim that stocking reduces species diversity and the amount of fish available to the poorer fishermen with push-nets.

Group-organisation is Proshika's responsibility.

In haor the community request may be for more vegetation and CNRS have been involved in tree planting. More vegetation attracts valuable species like climbing perch and *Heteropneustes fossilis*.

Community concerns are access to water and the problem of siltation. The community identified which bagher (ditches) needed excavating and they did it. They also raised the issue of a ban and argued for some control of fishing and that certain nets should be burned. They identify which ditches are significant.

The fishermen want more fish all year round especially large catfish and carps. They get this after excavation. They also like *Macrobrachium* spp.

Total catch is the most important. They can monitor what they catch and when but a systematic monitoring system would be very useful.

Dr. Ainum Nishat at IUCN would be good to talk to.

CBFM1 was funded by the Ford Foundation. DOF and ICLARM offered technical support with BRAC, Caritas, CRED and BS. BELA, FemCom and CNRS provided additional services. CNRS worked with CRED, Caritas and BS. CBFM1 was single sites but CBFM2 will be a whole floodplain.

The first year will be a baseline study, working with 40 co-ops in Tangail and looking to strengthen them.

17/3/99 Meeting with Bill Collis, Project Director - MACH

Nasral Islam will be worth talking to at DOF he will be a director soon. DOF have selected the sites (Hail Hoar and Kondail Kor(?) in Tangail) and will be doing PRA to ascertain objectives. Professional fishermen want a consistent supply of high revenue fish.

ICLARM should co-ordinate the sampling by NGOs. Dr. Joun Soussan of Leeds is interested in this information sharing. CNRS do too much gear survey. Socio-economic household surveys are more useful.

ICLARM questionnaires under CBFM were obtained on disc - Household Survey (winter) and Impact Monitoring (monsoon).

18/3/99 Meeting with Simon Bland, High Commission

There was a DANIDA funded initiative to affect institutional change within DoF. 15-20 foreign consultants were based at their building but it soon became clear this would not work. There was then a plan to adapt FRSS (FIMP) but this too got shelved. It was argued that DoF should change the way they access and process information. When asked why they wanted more information the reply was 'information is power'. Why can't they use NGOs and communities?

Institutional strengthening is subtly built into the 4th Fisheries Project (it's not the remit of World Bank). Two of the consultants are institution builders.

16/3/99 Meeting with Mokleuseur Rahman, consultant to DIFD, FFP

He designed the DoF monitoring of the Oxbow lake project. FRSS has to be re-designed. This is easier than editing it. FRSS needs to incorporate management aspects, whether the resource is private or common property etc. 6 of the 23 oxbow lakes are monitored under FRSS. His database for the oxbowlakes incorporates - management, leader selection process, production, institutional arrangements, education etc. BRAC were hired for the socio-economic survey and DoF did some household surveys.

The Fourth Fisheries Project will be participatory but this is difficult to monitor. The Final report by Allam should have some information on this. The workshop reports identified what stakeholders thought important. DoF will have very little role in data collection, baseline and ongoing survey will be done by the NGOs. We have identified suitable indicators but that will be change in consultation with the NGOs as the project runs.

DoF will analyse(!) the data and feedback through DoF Officers. There will be a biodiversity component. The indicators for this are yet to be decided. The design of monitoring will start in July.

The main differences between the waterbodies is in the type of management. BRAC and BIBS have information on nutrition and management indicators (see log frame). These will be used in 4th Fisheries.

16/3/99 Meeting with Nassirudin - Director, Fourth Fisheries (DoF)

FRSS is not statistically viable. Hopefully DFID will Take up the FIMP once fourth Fisheries has started. It will then incorporate information from all projects.

73. the sampling area needs changing
74. collection by water body and gear type
75. market surveys
76. officers need training/more manpower
77. the water areas need remapping through siltation

Artisanal fishing has increased as much as 100 times.

If the resources were available then socio-economic data could be added.

78. access
79. per capita income
80. graphic and tabular output
81. market information
82. not household info.

The way NGOs and DoF will monitor together on 4th Fisheries has only been documented in Bangla. There will be a social expert on 4th Fisheries who will incorporate this type of info.

There will be an expert to standardise NGO monitoring.

Data is not kept after entry. Write to DG for permission to see this.

21/3/99 Meeting with Nassirudin Director, Fourth Fisheries (DoF) and Beniq, FRSS Officer

The purpose of the project was outlined and a circular outlining our requirements from DoF was left.

Beniq repeated that the FRSS needs more manpower. If it was to be re-designed it needs to be considered where the resources are to come from.

Nasirrudin was reluctant to become involved in the project because it might jeopardise the FRMS project.

23/3/99 Meeting with Mokkal Hossain, Director CBFM

CBFM2 will be up to 60 water bodies but there is no scope for improving manpower written into the plan. ICLARM is responsible for designing data requirements, DoF collect it. Women are surveyed for consumption by ICLARM. There is one officer for biology and one for socio-economics at ICLARM. DoF do not have the capacity to store data. There is a need to train Thana officers to use data.

The CBFM should be incorporated into the FRSS. The community should do the sampling and hand it over to the Thana officer because this project will not last forever.

23/3/99 Meeting with Fahim Khan, Database administrator, CARE

Fahim is trying to draw together common themes from the 8 projects at CARE and link the approaches. We had quantitative monitoring and evaluation but this did not capture perceptions so we devised a Participatory Monitoring and Evaluation approach.

CARE uses the farmer Field School model. Project Co-ordinator - Assistant Project Co-ordinator - Project Manager at each district - 4 Technical and 1 project Officer at the Thana - 6 Field Trainers per Thana and each FT has 25 men or 15 women in a FFS.

Quantitative baseline M and E shows socio-economic setting. The indicators were produced by sociologists 5 or 10 years ago. The qualitative and participatory approach gives information on practise and production. CARE chose the indicators not the communities.

The quantitative system is there to meet the log frame. The GO INTERFISH project uses negotiated indicators. ME is for sample households, the participatory approach is for all households. Some information is difficult to obtain in a group context.

There is internal monitoring by taking information from each project at least once a season. There is a problem with the data getting to the Project Officer. My Advisory group is supposed to help this. Information goes up and never goes back! It takes one year for the data to go up because it has to be re-verified.

NOPEST and INTERFISH are developing software for the local level so that Field trainers can see the benefit of their work.

Participants work with us for 1.5 - 2 years and then the project is re-evaluated - post project survey.

GOLDA store information on Access, others use SPSS.

We try to get links with Department of Agriculture and environment because we want the work to continue when we finish.

In NOPEST there are 3 districts, 15 thanas in each, 5 FTs in each of these, and 6 schools per FT of 25 farmers.

Internal monitoring is taken from the original sample set.

With the PME the indicators are pre-defined. Indicators should not be unique between groups! Not that participatory but farmers can see the benefit of being involved. PME is used at baseline, review and post-project. The soft data is banded and a frequency is given. Perhaps the ME and PME should be linked so that individuals could be followed.

24/3/99 Meeting with Nazmul Alam, Programme Officer Caritas

CBFM2 will cover clusters of water bodies not just specific sites. There are 10 new sites including beels and open water. At the moment we have 4 beels and 1 river under CBFM.

We will also be involved with the coastal shrimp in 4th Fisheries and with the MACH project.

Community objectives - in Rajdhola Beel they closed 130 areas, they wanted 10-15 year lease and to have access to savings and literacy courses. Stocking is the main activity in the beels, conservation and sanctuaries in the open water. It is all done by the fishermen. They pay back interest free loans after harvest.

During our baseline surveys we reviewed the beneficiaries. The Beel Management Committee inform the groups under them of any changes. Feedback is through quarterly newsletters in Bangla and calendars.

The questionnaires are devised by ICLARM.

There is a monthly ecological one: air temp., water temp., secchi disc, depth, pH, oxygen, carbon dioxide, hardness, ammonium, nitrate etc.

There is a record sheet for stocking - fingerling status by spp. With respect to no. wt. and value sold etc.

There is an income and expenditure survey.

24/3/99 Meeting with Manjur Kadir , Biologist RA ICLARM

There are 3 household surveys per year and regular surveys of catch, gear and market data. It's moved from Access to SPSS and the output is graphs and tables. We look for trends that stand out.

Feedback - graphs are shown at quarterly meetings; Average total catch by gear, catch per person per hour with seine net, average market price per spp. and total no. of gears used.

People are most interested in average catch. They don't ask for other graphs but are interested in catch composition. We are going to show pie charts at 4 sites on trends in fish consumption.

In 1996 there was a baseline survey at each site. 60 fishing (NGO) and 60 non-fishing households were surveyed. After one year there is an impact survey. There is catch monitoring every week and twice monthly market surveys.

The "cycle" survey is every 4 months and is a household survey incorporating fishing patterns, where they fish and what they catch. We ask the community what their thoughts are and this is our target plan.

There is also a monthly co-ordination meeting between TFO and DFO with project headquarter people.

They don't need to see graphs, they know they are getting more fish and more money.

Through discussion a common objective is sanctuary creation. The River Management Committee will organise guarding the sanctuaries. The communities are 400-500 households.

In beels the concern is stocking and sanctuaries. The gear ban on monofilament nets and mosquito nets is DoF's responsibility. The community have decided close seasons in 5 sites! It may be in May or for as much as 3 months.

25/3/99 Meeting with Abdur Rahman, Co-ordinator, Proshika

The main objective is security of access. We find this through group awareness meeting. They also want training, to increase total catch, income, and conservation through bans and sanctuaries etc.

Non-flowing rivers are leased by the mahajan from the local Dept.of Land.

Proshika have Economic Development Workers who attend 15 local meetings per month. Local group members sit in a weekly meeting. There are 15-30 per group. They discuss problems, solutions etc.

EDWs report back to head office and are visited by Head Office staff.

In beels the concerns are stocking, and ownership.

With rivers the concerns are migration, security and control of access.

31/3/99 Meeting with Paul Thompson, Director ICLARM, Bangladesh

CBFM2 proposes the involvement of the MoL to agree territorial use rights for rivers. It is hoped to include the wider river/beel floodplain systems and try to co-ordinate initiatives between systems. More participation in data gathering should be encouraged.

The survey was designed through meeting and questionnaire but the DoF had an agenda to gather data. It was not going to gather very much participatory data.

ICLARM would have like an experiment to compare NGO approach accross waterbodies - unfortunately they only chose one waterbody type each.

Proshika do their own impact survey on CBFM.

ICLARM did not have to meet sponsor's requirements (Ford Foundation did not have them) like they will have to with DfID.

Case studies for the 19 study sites will be ready soon. We need to know what they want and see what we are doing or collecting is relevant. We did not introduce stocking to the beels - 6 of the 19 sites were stocked before we were involved. The requirements for the open beels need to be separated from the closed beels. You need to co-ordinate monitoring because you can correlate information on different stocking densities, fertiliser etc. Stocking requires standard types of information, it is difficult to identify what information floodplains would need. They have never had a history of monitoring anything.

You can use proxies to determine marginal income increase or decrease like house quality, education, food quality instead of fish meals. The advantage is that you can survey without interview. On top of this though you need to know about the underlying access arrangements. Culture-based fisheries always have good records of business and inputs.

Although we need to know what communities see as relevant, we are a research project.

There are cross visits of NGO staff between the sites.

4/4/99 Meeting with Mokkaram Hossain - Director of Fisheries, BRAC

BRAC run baseline surveys of socio-economic factors for OLP. If a survey is required it is designed by the Monitoring Department who cross-check the data. The Research and Evaluation Department monitor the socio-economics for the OLP. The Lake Management Group books are also scrutinised. BRAC produce 2 main reports to the DoF - a report detailing social change, training progress etc. and a report on credit formation and savings examined by an external auditor. Reports to the DoF are twice yearly or annual.

DANIDA will finish their involvement with OLP in 2000 and BRAC and DoF will continue with provisional funding from the WDP (World Development Programme).

BRAC also have 8 of their own baor sites. It was originally 17 but as they were de-weeded and rennovated their value went up and they are now out bided in the auction system of leasing. BRAC are trying to negotiate special arrangements with the MoL.

BRAC feedback is ultimately through training and motivation after the analysis. There is a difference between the data relevant to the community and that to the sponsor but sometimes it is indirectly relevant i.e. that which is used by the policy maker.

Community objective is ascertained by PRA.

Annex 8

Example OLP II Socio-economic and biological data (Source: Oxbow lakes Small Scale Fishermen Project: compilation of the quartely statostocal reports (No.1 to 21, 1991-1997). Department of Fisheries, Bangladesh.

Annex 9

CBFM Household Baseline Survey Questionnaire

Soure: ICLARM

Annex 10

Socio-Economic Data, Gobarchapa Beel.

Source: FMS

Annex 11

Map of Study Area



Annex 12

Field work Guidance Notes

Fisheries Information Management Systems for Co-management

Fieldwork Component - Guidance notes to Kanailal Debnath, enumerator

This component of the project was to add to and check the findings of the NGOs (particularly ICLARM) with regards to fisher objectives. The literature and the NGOs themselves are not specific about what fisher objectives are but they have identified some management changes and strategies seen as important by the fishers and it may be possible to assume objective from these management requirements.

Methodology Guidelines

In ICLARM's CBFM surveys the fishermen were asked what management changes should be made to improve the fishery. They identified the following :-

sanctuary	closed season	guarding
pen-stocking	training	embankment
gear ban	re-excavation	stocking
increase catches	stop illegal fishing	stop katha
access	sluice gate	conservation
unite fishers	community access	law and order

These types of management suggestions should be noted but should only be revealed through conversation, and fishers should not be prompted to discuss particular requirements.

Management Objectives

With the ICLARM results I converted the different management requirements of the fishers into 5 basic management tools or approaches: - Stocking, Restoration, Effort Control, Reserves and Co-operation / Access Issues. In turn, these have an ultimate impact on the resource or the way it is harvested. In the table below I suggested what these impacts are e.g. - "protect breeding stock", "allow movement of fish", "conflict reduction", "fair distribution" etc.

Requirement	Management Tool					Objective
	stocking	restoration	effort control	reserve	access change	
sanctuary				✓		protect brood stock
closed season			✓			protect brood stock
gear ban			✓			limit small fish catch
re-excavation		✓				movement of migratory fish
stocking	✓					increase production
guarding			✓			limit capture, fair distribution
pen-stocking	✓					increase production
embankment		✓				retain standing water
reduce illegal fishing			✓			protect brood stock, limit small fish catch
stop katha			✓			limit capture, fair distribution
sluice gate		✓				movement of migratory fish
conservation		✓	✓	✓		protect brood stock
community ownership					✓	encourage investment, conflict reduction
access					✓	encourage investment, conflict reduction
maintain law and order			✓			protect brood stock, conflict reduction
unite fishers			?		?	conflict reduction
increase catches						increase production
training						skills/awareness building

Fishers might identify management changes that should be made like stopping katha or banning certain gears. We need to collect these sorts of suggestions and we need to know why they are important to the fishers. What effect on the fishery will these suggestions have and why does the fisher think that this is a good idea? A completed questionnaire may have responses like the following;

1. What management requirements do you have?
 - i) stop katha
 - ii)
 - iii)
2. What would this requirement do?
 - i) stop overfishing
 - ii)
 - iii)
3. What would be the benefits to the fishery?
 - i) more fish for others
 - ii)
 - iii)
4. How would you know it worked?
 - i) more catch + fish meals
 - ii)
 - iii)

The responses we receive from fishers will need to be set within the context of local management arrangements as they stand. The last section of the questionnaire is to record fisher perception of personal input into decision-making and any additional background information regarding local issues, conflict, past interventions and especially access arrangements.

Questionnaire

date:

Site: _____

Fisher name/no: _____

Professional/subsistence?

details: _____

fishing time/seasons _____

location (and waterbodies types) _____

gear and target spp _____

rights to access/payments _____

NGO or fisher group representation _____

What management requirements do you have? (proposed requirements unless stated)

i) _____

ii) _____

iii) _____

What would this requirement do?

i) _____

ii) _____

iii) _____

What would be the benefit to the fishery?

i) _____

ii) _____

iii) _____

How would you know it worked?

i) _____

ii) _____

iii) _____

What is your influence in management decisions? (1-5 , none - full) _____

How united is the community ?(1-5, not - fully) _____

Additional comments on objectives (see notes):



Annex 13

Questionnaire

Questionnaire

Site: Gobarchapa Beel, Sujaitpur Village

Fisher name/no: Younus Ali Mondal / 1

professional/subsistence? professional

fishing time/seasons: 6 months, August - March

location (and waterbodies types): Gobarchapa Beel and Bangali River

gear and target spp: seine, gill net, hooks and traps / Chanda, Mola, Pseudotropus, Mystus spp.

rights to access/payments: this village owns the lease this year (40,000 Tk). If someone else does the fishers have to pay about 200 Tk each

NGO or fisher group representation: none

What is your influence in management decisions? (1-5 , none - full) _

How united is the community?(1-5, not - fully) _

Additional comments (see notes): _

What management requirements do you have? (proposed unless stated)

- i) stocking and blocking
- ii) pit digging
- iii) share marketing and catching and sell in one place - not work independently

What would this requirement do?

- i) increase the number of fish
- ii) increase fishing area/ retain fish
- iii) distribute benefits

What would be the benefit to the fishery?

- i) 6 months growth so quite big
- ii) it would allow fish to grow bigger
- iii) less conflict

How would you know it worked?

- i) catch more
- ii) catch more big fish
- iii) less conflict

Questionnaire

Site: Bangali River, Chack Nandanpur village

Fisher name/no: Direndia Das / 1

professional/subsistence? professional

fishing time/seasons: 8 months, July - March

location (and waterbodies types): Bangali River

gear and target spp: lift and cast net

rights to access/payments: access is free as a member of the fishing society, but others fish there too

NGO or fisher group representation: local co-op

What is your influence in management decisions? (1-5 , none - full) 2

How united is the community ?(1-5, not - fully) _

Additional comments (see notes): The co-op decide what gear type is to be used, there are no other management decisions

The DoF want fishers to stop in May-July, they cannot afford to.

What management requirements do you have? (proposed unless stated)

- i) access restricted to this co-op
- ii) return of some small fish
- iii) need bigger fish - higher price
need more fish in the dry season

What would this requirement do?

- i) allow thinking on conservation and management
- ii) allow small fish to grow
- iii) –

What would be the benefit to the fishery?

- i) give us more fish
- ii) catch more fish
- iii) –

How would you know it worked?

- i) –
- ii) catch more big fish
- iii) –

Questionnaire

Site: Bangali River, Chack Nandanpur village

Fisher name/no: Lalbahadar Das / 2

professional/subsistence? professional

fishing time/seasons: 6 months, July - December

location (and waterbodies types): Bangali River and surrounding khals

gear and target spp: lift and seine net, traps / Puti, Raik

rights to access/payments: access is free as a member of the fishing society, but has to pay outside this jalmohal

NGO or fisher group representation: local co-op

What is your influence in management decisions? (1-5 , none - full) 1

How united is the community?(1-5, not - fully) 4

Additional comments (see notes): The co-op is not very active. The respondent believed that conservation efforts would not be dispersed and would benefit his stretch most. The co-op leasing area is 5km with one communal katha.

What management requirements do you have? (proposed unless stated)

- i) remove dam
- ii) stop mosquito net and gill net
- iii) re-excavation of river (barely perennial anymore)
- iv) access should be exclusive to the co-op

What would this requirement do?

- i) more water in river would allow migration
- ii) stop catching of brood fish
- iii) –
- iv) –

What would be the benefit to the fishery?

- i) more fish available in the river
- ii) more fish next year
- iii) –
- iv) –

How would you know it worked?

- i) more fish caught
- ii) more fish caught in future

iii) _

iv) _

Questionnaire

Site: Bangali River, Chack Nandanpur village

Fisher name/no: Baidhynath Prodhan / 3

professional/subsistence? ex-professional, ex-secretary of co-op

fishing time/seasons:

location (and waterbodies types):

gear and target spp:

rights to access/payments:

NGO or fisher group representation: local co-op

What is your influence in management decisions? (1-5 , none - full) _

How united is the community?(1-5, not - fully) _

Additional comments (see notes): only some parts of the river are perennial now

What management requirements do you have? (proposed unless stated)

- i) remove dam
- ii) control access
- iii) stop seine and “saver” nets (they catch 99% of small fish, June-Sept)

What would this requirement do?

- i) allow migration from Jamuna, make Bangali deeper and allow overwintering
- ii) –
- iii) reduce catch of small fish

What would be the benefit to the fishery?

- i) –
- ii) –
- iii) bigger fish

How would you know it worked?

- i) –
- ii) –
- iii) –

Questionnaire

Site: Bangali River, Chack Nandanpur village

Fisher name/no: Madhusudan Das / 4

professional/subsistence? ex-professional

fishing time/seasons:

location (and waterbodies types):

gear and target spp:

rights to access/payments:

NGO or fisher group representation:

What is your influence in management decisions? (1-5 , none - full) 1

How united is the community?(1-5, not - fully) 4

Additional comments (see notes): only some parts of the river are perennial now.
respondent believes that Muslims fish 24 hrs a day. Sanctuary would not help carp stock - they don't breed here.

What management requirements do you have? (proposed unless stated)

- i)** legal action to stop Muslim fishers
- ii)** stop seine and fine mesh
- iii)** stop dam, put in sluice gate

What would this requirement do?

- i)** stop too much fishing
- ii)** stop catching fry when too small
- iii)** allow eggs to move from Jamuna

What would be the benefit to the fishery?

- i)** allow us to catch more
- ii)** allow fish to grow
- iii)** –

How would you know it worked?

- i)** catch more
- ii)** –
- iii)** –

Questionnaire

Site: Bangali River, Chack Nandanpur village

Fisher name/no: _ / 5

professional/subsistence? ex-professional

fishing time/seasons:

location (and waterbodies types):

gear and target spp:

rights to access/payments:

NGO or fisher group representation:

What is your influence in management decisions? (1-5 , none - full) _

How united is the community?(1-5, not - fully) _

Additional comments (see notes): Said “I can’t think of anything to improve the fishery - if you can, then do it!”

What management requirements do you have? (proposed unless stated)

i) remove dam

ii) –

iii) –

What would this requirement do?

i) allow movement of fingerlings

ii) –

iii) –

What would be the benefit to the fishery?

i) more fish in the jalmohal

ii) –

iii) –

How would you know it worked?

i) catch more

ii) –

iii) –

Questionnaire

Site: Bangali River, Chack Nandanpur village

Fisher name/no: Monindha Nath Das / 6

professional/subsistence? professional

fishing time/seasons: year round

location (and waterbodies types): Bangali River

gear and target spp: Lift and cast net / Mystus, Patius

rights to access/payments: free access

NGO or fisher group representation: member of co-op

What is your influence in management decisions? (1-5 , none - full) 2

How united is the community?(1-5, not - fully) 4

Additional comments (see notes): Co-op make few management decisions. On prompting on conservation he said “banning seine net would save small fish, sanctuary would maintain brood stock until spawning at rainy season. Construct 20 katha and leave 2 of them unfished.”

What management requirements do you have? (proposed unless stated)

- i) remove dam
- ii) access only to co-op
- iii) –

What would this requirement do?

- i) increase migration from Jamuna
- ii) –
- iii) –

What would be the benefit to the fishery?

- i) –
- ii) –
- iii) –

How would you know it worked?

- i) –
- ii) –
- iii) –

Questionnaire

Site: Satbila Beel, Hashraj village

Fisher name/no: Khitish Das / 1

professional/subsistence? professional

fishing time/seasons: year round

location (and waterbodies types): Satbila Beel

gear and target spp: small seine net

rights to access/payments: 5 Tk per day to leaseholders (depends on size of gear)

NGO or fisher group representation: member of co-op

What is your influence in management decisions? (1-5 , none - full) _

How united is the community?(1-5, not - fully) 3

Additional comments (see notes): Access to the stocked pond in the centre of the beel is closed to the leaseholders. There are 30-40 katha. Originally only the co-op was allowed to bid. A non-fisher has the lease now and the fishers pay for access.

What management requirements do you have? (proposed unless stated)

- i)** should be free access
- ii)** epizootic infection should be controlled (75% infected)
- iii)** stock or stop fishing broodstock (can't afford to so need alternative employment)

- iv)** keep 2 or 3 katha unfished

What would this requirement do?

- i)** more could catch fish
- ii)** less disease
- iii)** less fishing all year
- iv)** keep some brood stock

What would be the benefit to the fishery?

- i)** –
- ii)** more and healthier fish
- iii)** more fish from breeding
- iv)** more fish from breeding

How would you know it worked?

- i)** –
- ii)** –
- iii)** –
- iv)** –

Questionnaire

Site: Satbila Beel, Hashraj village

Fisher name/no: Moni Das / 2

professional/subsistence? professional

fishing time/seasons: year round

location (and waterbodies types): Satbila Beel

gear and target spp: seine net and spear

rights to access/payments: 5 Tk per day to leaseholders (depends on size of gear)

NGO or fisher group representation: member of co-op

What is your influence in management decisions? (1-5 , none - full) _

How united is the community?(1-5, not - fully) _

Additional comments (see notes):

What management requirements do you have? (proposed unless stated)

- i) should be free access
- ii) stocking
- iii) –

What would this requirement do?

- i) save me money
- ii) more fish to catch
- iii) –

What would be the benefit to the fishery?

- i) –
- ii) more fish caught
- iii) –

How would you know it worked?

- i) –
- ii) more fish caught
- iii) –

Questionnaire

Site: Satbila Beel, Hashraj village

Fisher name/no: Dashoraj Sanker / 3

professional/subsistence? professional

fishing time/seasons: year round

location (and waterbodies types): Satbila Beel, Bangali River

gear and target spp: small seine net and spear

rights to access/payments: 5 Tk per day to leaseholders (depends on size of gear)

NGO or fisher group representation: member of co-op

What is your influence in management decisions? (1-5 , none - full) _

How united is the community?(1-5, not - fully) _

Additional comments (see notes): Katha as reserves would need alternative incomes.

What management requirements do you have? (proposed unless stated)

- i)** stocking
- ii)** access to co-op, ability to control fishery
- iii)** closed season for both stocked centre and periphery
- iv)** save 2-3 katha as reserve

What would this requirement do?

- i)** more fish to catch
- ii)** no access for outsiders
- iii)** save breeding fish
- iv)** save breeding fish

What would be the benefit to the fishery?

- i)** more fish
- ii)** –
- iii)** more fish next year
- iv)** more fish next year

How would you know it worked?

- i)** more fish caught
- ii)** –
- iii)** more fish caught
- iv)** more fish caught

Questionnaire

Site: Satbila Beel, Hashraj village

Fisher name/no: Ashoraj Das / 4

professional/subsistence? professional

fishing time/seasons: year round

location (and waterbodies types): Satbila Beel, Bangali River

gear and target spp: seine net and lift net

rights to access/payments: 5 Tk per day to leaseholders (depends on size of gear)

NGO or fisher group representation: member of co-op

What is your influence in management decisions? (1-5 , none - full) 2

How united is the community?(1-5, not - fully) 5

Additional comments (see notes): Katha as reserves would need alternative incomes. The leaseholders have asked everybody to stop fishing in June and July but we can't afford to. We need to have ownership before we can think of management (conservation).

What management requirements do you have? (proposed unless stated)

- i) fair access - the lease has been taken by outsiders
- ii) stocking with one exit blocked
- iii) keep some katha as sanctuary with alternative income
- iv) stop seine nets for one month

What would this requirement do?

- i) less payment (5-20 Tk at the moment)
- ii) more fish available
- iii) –
- iv) triple the amount of fish caught next month

What would be the benefit to the fishery?

- i) –
- ii) more fish to catch
- iii) –
- iv) more fish caught

How would you know it worked?

- i) –
- ii) more fish caught
- iii) –
- iv) triple the amount of fish caught

Questionnaire

Site: Satbila Beel, Hashraj village

Fisher name/no: Jiten Das / 5

professional/subsistence? professional

fishing time/seasons: year round

location (and waterbodies types): Kamarjani Beel

gear and target spp: seine net and lift net

rights to access/payments: he is the leaseholder to Satbila Beel

NGO or fisher group representation: _

What is your influence in management decisions? (1-5 , none - full) _

How united is the community ?(1-5, not - fully) _

Additional comments (see notes): The beel does not need more katha (there are 50-60) but some should be protected. Unfortunately people would steal during this period.

What management requirements do you have? (proposed unless stated)

- i) stocking and pit digging
- ii) 2 month gear ban
- iii) stop fishing at 2-3 katha

What would this requirement do?

- i) give larger fish
- ii) broodstock would be conserved
- iii) broodstock would be conserved

What would be the benefit to the fishery?

- i) larger catch
- ii) more offspring
- iii) increase the amount of fish next year

How would you know it worked?

- i) more money
- ii) –
- iii) larger catch

Questionnaire

Site: Lohajang Beel, Nagarpara village

Fisher name/no: Maklunda Pramarin / 1

professional/subsistence? professional

fishing time/seasons: 6- months, Oct- March

location (and waterbodies types): Lohajang Beel and cultivated ponds

gear and target spp: traps / shrimps, Puti, Colisla, Dalkina

rights to access/payments: pays a share of the total lease (varies from year to year)

NGO or fisher group representation: village co-op

What is your influence in management decisions? (1-5 , none - full) _

How united is the community ?(1-5, not - fully) _

Additional comments (see notes): The co-op makes no management decisions.

What management requirements do you have? (proposed unless stated)

- i) stocking
- ii) establish exclusive fishing rights
- iii) stop fishing for 3-4 months

What would this requirement do?

- i) produce more fish
- ii) keep fish for us
- iii) increase the size of fish

What would be the benefit to the fishery?

- i) –
- ii) –
- iii) greater value fish

How would you know it worked?

- i) more fish caught
- ii) more fish caught
- iii) larger fish caught

Questionnaire

Site: Lohajang Beel, Nagarpara village

Fisher name/no: Amulla Monda / 2

professional/subsistence? professional

fishing time/seasons: year round

location (and waterbodies types): Lohajang Beel, Goborchapa Beel, Kariapur

gear and target spp: seine net and traps

rights to access/payments: pays a share of the total lease (varies from year to year)

NGO or fisher group representation: village co-op

What is your influence in management decisions? (1-5 , none - full) _

How united is the community?(1-5, not - fully) 5

Additional comments (see notes):

What management requirements do you have? (proposed unless stated)

- i) dig a pond
- ii) stocking and fencing
- iii) guarding and co-operation

What would this requirement do?

- i) aggregate fish
- ii) keep fish and increase number of fish
- iii) increase fairness

What would be the benefit to the fishery?

- i) easier to catch
- ii) more fish to catch year round
- iii) –

How would you know it worked?

- i) more fish caught
- ii) more fish caught
- iii) better price for everyone

Questionnaire

Site: Lohajang Beel, Nagarpara village

Fisher name/no: Gabinda Pramanik / 3

professional/subsistence? professional

fishing time/seasons: year round

location (and waterbodies types): Lohajang Beel, Goborchapa Beel

gear and target spp: seine net / Pintius, Mystas

rights to access/payments: pays a share of the total lease (varies from year to year)

NGO or fisher group representation: village co-op

What is your influence in management decisions? (1-5 , none - full) 5

How united is the community?(1-5, not - fully) 5

Additional comments (see notes): respondent is the co-op secretary. There is a water problem with surrounding land owners digging ponds and draining the beel.

What management requirements do you have? (proposed unless stated)

- i) dig ponds and fence off / build up embankment
- ii) stocking and fencing
- iii) stop fishing for 3-4 months, co-ordinate fishing
- iv) freeze the lease for 3 years (it rises 25% each year)

What would this requirement do?

- i) increase the number of fish and produce land for cropping
- ii) increase the number of fish
- iii) increase size of fish
- iv) –

What would be the benefit to the fishery?

- i) greater catch and additional income from crops
- ii) –
- iii) fairer share and bigger harvest
- iv) –

How would you know it worked?

- i) –
- ii) whether stocking made money
- iii)
- iv) –

Questionnaire

Site: Lohajang Beel, Nagarpara village

Fisher name/no: Bhabesh Mondal / 4

professional/subsistence? professional

fishing time/seasons: year round

location (and waterbodies types): Lohajang Beel, Goborchapa Beel

gear and target spp: seine net, gill net, traps / Pintius, Mystus, Clarius

rights to access/payments: pays a share of the total lease (varies from year to year)

NGO or fisher group representation: village co-op

What is your influence in management decisions? (1-5 , none - full) 3

How united is the community?(1-5, not - fully) 5

Additional comments (see notes): respondent is the co-op president.

What management requirements do you have? (proposed unless stated)

- i) dig out to make perennial / build up embankment
- ii) stock
- iii) stop fishing for 3-4 months and have guarding

What would this requirement do?

- i) increase the size of fish
- ii) –
- iii) be able to select a time when fish price is high in the market

What would be the benefit to the fishery?

- i) allow big fish to be caught
- ii) –
- iii) better prices for catch

How would you know it worked?

- i) bigger fish caught
- ii) –
- iii) more money taken

Questionnaire

Site: Lohajang Beel, Nagarpara village

Fisher name/no: Ranjit Pramanik / 5

professional/subsistence? professional

fishing time/seasons: year round

location (and waterbodies types): Lohajang Beel, Goborchapa Beel, Lohagasa River

gear and target spp: seine net, traps

rights to access/payments: pays a share of the total lease (varies from year to year)

NGO or fisher group representation: village co-op

What is your influence in management decisions? (1-5 , none - full) 4

How united is the community?(1-5, not - fully) 5

Additional comments (see notes):

What management requirements do you have? (proposed unless stated)

- i)** stocking
- ii)** embankment
- iii)** stop irrigation
- iv)** digging

What would this requirement do?

- i)** give more fish
- ii)** retain water
- iii)** provide a perennial beel
- iv)** aggregate fish and stop loss of brood stock

What would be the benefit to the fishery?

- i)** more fish to catch
- ii)** fish longer (throughout year)
- iii)** conservation (prevent loss of brood stock)
- iv)** conservation of brood stock

How would you know it worked?

- i)** more fish caught
- ii)** –
- iii)** more fish caught next year
- iv)** more fish caught next year

Questionnaire

Site: Lohajang Beel, Nagarpara village

Fisher name/no: Dabesh Shanler / 6

professional/subsistence? professional

fishing time/seasons: year round

location (and waterbodies types): Lohajang Beel, Goborchapa Beel,

gear and target spp: seine net, traps / Puti, Calisha, Chauna

rights to access/payments: pays a share of the total lease (varies from year to year)

NGO or fisher group representation: village co-op

What is your influence in management decisions? (1-5 , none - full) 2

How united is the community?(1-5, not - fully) 5

Additional comments (see notes): others are monopolising water and fish by digging their own pits in surrounding land

What management requirements do you have? (proposed unless stated)

- i) proper rights of access
- ii) stocking, feeding and guarding for 3-4 months
- iii) digging
- iv) more katha and embankment

What would this requirement do?

- i) –
- ii) increase fish to be caught
- iii) keep fish in beel
- iv) –

What would be the benefit to the fishery?

- i) –
- ii) 5 Taka of fingerlings will provide 50 Taka of fish
- iii) more fish for next year
- iv) allow fish to breed

How would you know it worked?

- i) –
- ii) small fish will produce big fish
- iii) –
- iv) more fish caught next year

Questionnaire

Site: Lohajang Beel, Nagarpara village

Fisher name/no: Akhil Sarker / 7

professional/subsistence? professional

fishing time/seasons: year round

location (and waterbodies types): Lohajang Beel, Goborchapa Beel,

gear and target spp: seine net, gill net, traps

rights to access/payments: pays a share of the total lease (varies from year to year)

NGO or fisher group representation: village co-op

What is your influence in management decisions? (1-5 , none - full) 1

How united is the community?(1-5, not - fully) 5

Additional comments (see notes): 50% of katha catch goes to fisher and 50% to owner

What management requirements do you have? (proposed unless stated)

- i) embankment, stocking, and guarding for 6 months
- ii) digging and katha
- iii) –

What would this requirement do?

- i) stop fishing of stocked fish
- ii) retain fish
- iii) –

What would be the benefit to the fishery?

- i) allow fish to get bigger
- ii) fish will be kept in beel to be caught
- iii) –

How would you know it worked?

- i) more and larger fish caught
- ii) more and larger fish caught
- iii) –

Questionnaire

Site: Lohajang Beel, Nagarpara village

Fisher name/no: Budho Pramanisk / 8

professional/subsistence? professional

fishing time/seasons: 6 months (Aug-Jan), 6 months fish trading

location (and waterbodies types): Lohajang Beel, Goborchapa Beel,

gear and target spp: seine net / Mystus, Pantius

rights to access/payments: pays a share of the total lease (varies from year to year)

NGO or fisher group representation: village co-op

What is your influence in management decisions? (1-5 , none - full) 2

How united is the community?(1-5, not - fully) 5

Additional comments (see notes):

What management requirements do you have? (proposed unless stated)

- i) digging ponds and building embankment
- ii) stocking
- iii) stop fishing 3-4 months and guarding
- iv) katha and stop fishing 2 months
- v) large mesh for 3 months
- vi) access to other connecting ponds

What would this requirement do?

- i)
- ii)
- iii) increase fish size

What would be the benefit to the fishery?

- i) –
- ii) –
- iii) larger catch

How would you know it worked?

- i)
- ii)
- iii) bigger fish caught - half kilo fish would become 1 kilo fish

Questionnaire

Site: Lohajang Beel, Nagarpara village

Fisher name/no: Kartick Chandra Das / 9

professional/subsistence? professional

fishing time/seasons: all year round

location (and waterbodies types): Lohajang Beel, Goborchapa Beel,

gear and target spp: seine net, gill net, traps / shrimps, Pantius

rights to access/payments: pays a share of the total lease (varies from year to year)

NGO or fisher group representation: village co-op

What is your influence in management decisions? (1-5 , none - full) 2

How united is the community?(1-5, not - fully) 5

Additional comments (see notes):

What management requirements do you have? (proposed unless stated)

- i) embankment and stocking
- ii) dig out
- iii) no fishing in June and July
- iv) larger mesh

What would this requirement do?

- i) provide more fish
- ii) retain brood stock and let grow
- iii) less pressure on fish
- iv) less pressure on fish

What would be the benefit to the fishery?

- i) more to catch
- ii) larger fish and more young produced
- iii) more fish to catch
- iv) –

How would you know it worked?

- i) more fish caught
- ii) bigger fish caught
- iii) larger catches
- iv) –

Questionnaire

Site: Lohajang Beel, Nagarpara village

Fisher name/no: Dinesh Pramanik / 10

professional/subsistence? professional

fishing time/seasons: all year round

location (and waterbodies types): Lohajang Beel, Goborchapa Beel,

gear and target spp: seine net, cast net, traps / Pantius, Mystus, shrimp

rights to access/payments: pays a share of the total lease (varies from year to year)

NGO or fisher group representation: village co-op

What is your influence in management decisions? (1-5 , none - full) 2

How united is the community?(1-5, not - fully) 5

Additional comments (see notes): Respondent believes the fishers should sell together but at present they sell independently.

What management requirements do you have? (proposed unless stated)

- i) embankment
- ii) katha as a reserve (needs an embankment)
- iii) stocking and guarding for 3-4 months
- iv) large mesh for a selected period

What would this requirement do?

- i) increase fish entry from other private ponds
- ii) retain brood stock and let grow
- iii) allow stocked fish to grow
- iv) less pressure on fish

What would be the benefit to the fishery?

- i) more fish in beel
- ii) more fish next year
- iii) more and bigger fish
- iv) –

How would you know it worked?

- i) more fish caught
- ii) enough fish caught next year
- iii) more fish caught
- iv) –

Annex 14

Example Stocking Data
Source: Shelly & Alam (in press)

Table XX. Responses of meetings with staff of the DoF to determine additional information requirements and outputs for a co-management FIMS

Name	Position	Additional data and information	Required Outputs	Use of outputs
	DG			
Anwar Hossain	Director, Management and Revenue	Socio-economic data including local elites rice farmers etc; Biological productivity; Physical and chemical data (pH, nutrient levels); Environmental information; movements/migration of species through sluice gates	Social information; Natural productivity of waterbodies; Species richness; Fish growth rates;	Understand fishermen behaviour in terms of compliance with regulations; Determine stocking densities; Confirm that fish move from away from food poor rivers and ponds?
Nassirudin Ahmed	Director of FRSS and Fourth Fisheries Project.	Access rights; per capita income; catch by gear type; market information;	'needs of fishermen'	?

Increase fish production

1.1.83 Poverty alleviation by expanding employment opportunities and improving socio-economic conditions of fishers.

1.1.84 Fulfil the demand for animal protein.

1.1.85 Achieve economic growth through foreign exchange from fish exports.

1.1.86 Maintain ecological balance, conserve biodiversity, ensure public health and provide recreational facilities.

Fishery / Resource	Objectives	Management Instrument/Tool	Enforcement/ Management body	Predicted Information Requirements (Default Indicators)
All	36280	<p>1. Appropriate care in implementing activities such as FCD/I, agricultural, industrial, road and urban development projects.</p> <p>2. Legislation to control polluting activities and use of harmful chemicals and insecticides for agriculture.</p> <p>3. Fish Rules (and proposed amendments).</p> <p>4. Conservation of fish and shrimp breeding grounds.</p>	State/Communities	<p><u>Explanatory Variables / Inputs</u></p> <p>1. FCD/I, agricultural, industrial, road and urban development projects (State - by other departments??). 2. Environmental hydrology/pollution monitoring (State - by other departments??). 3. Fishing effort nos fishermen by habitat (State) 4. Number of gear types by habitat (State/Comms)</p> <p><u>Dependent Variables</u></p> <p>1. Total Fish Production (State) 2. Seasonal catch rates (CPUE) by main species, habitat and gear types (State) 3. Indicators of biodiversity (State) 4. Socio-economic criteria (State) 5. Fish exports, foreign exchange earnings, indicators of economic growth (State) 6. Nutrition/consumption indicators (State)</p>
<i>jalmohals</i>	36280	<p>1. Arrangements to ensure that genuine fishermen obtain access to <i>jalmohals</i></p> <p>2. Establishment of fish sanctuaries within <i>jalmohals</i></p>	State/Communities	<p><u>Explanatory Variables/ Inputs</u></p> <p>1. Details of sanctuary including relative area (State/Comms) 2. Fishing effort nos fishermen (State/Comms) 3. Number of gear types (State/Comms) 4. Levels of poaching (State/Comms) 5. Environmental monitoring (State/Comms) 6. Cost of licence/lease (State/Comms) 7. Register, of fishermen cooperatives?? see above by <i>jalmohal</i></p> <p><u>Dependent Variables</u></p> <p>1.Total production and revenue 2. Seasonal catch rates (CPUE) by main species and gear types (State/Comms). 3.</p>
<i>jalmohals</i>	36280	Conversion of entire <i>jalmohal</i> to fish sanctuary	DoF	

