Better Options for IFM: Uptake Promotion
NRSP Project R8306

Final Technical Report
Annex F

Training Module on

Integrated Floodplain Management: Options and Approaches

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Time	*Topic*	*Facilitator*
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10:00-10:30	Tea Break	
10:30-11:30	**Session 2.** Understanding Floodplain Resources System and Production Dynamics	
11:30-13:00	**Session 3.** Present Status of the Floodplain Resources, Systems understanding of the Problem and Need for Integrated Management	
13:00-14:00	Lunch	
14:00-14:30	**Session 4**. Better Options for Integrated Floodplain Management	
14:30-14:45	Tea Break	
14:45-16:45	**Session 5.** Fishing Effort Control	
16:45-17:00	Open discussion and closing of the day	

Day Two

Time	*Topic*	*Facilitator*
9:00-9:30	Recapitulation of previous days activities	
9:30-13:00	**Session 6.** Crop Diversification in Floodplains	
10:30-11:30	Tea Break (within the session)	
13:00-14:00	Lunch	
14:00-14:45	**Session 7.** Sluice Gate Management	
14:45-15:30	**Session 8.** Land Retirement	
15:30-15:45	Tea Break	
15:45-17:00	**Session 9**. Habitat Degradation: Problems, Issues, and Participatory Habitat Restoration	
17:00-17:15	Open discussion and closing of day two	

Day Three

Time	*Topic*	*Facilitator*
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16:00-16:15	Tea Break	
16:15-16:45	Post Test	
16:45-17:15	Review of the expectations, open discussion and closing of the training	

Training Module
Integrated Floodplain Management: Methods and Approaches

Background

The livelihoods of Bangladeshi people, especially the rural poor living around floodplain beels, are largely dependent on floodplain resources. Their nutrition, incomes, and other day-to-day needs are fulfilled by the nearby floodplain *beels*. Semi-natural diverse floodplains are highly productive ecosystems providing important benefits that exceed the productivity of intensive agricultural systems. These benefits, sometimes described as 'goods and services', include the functions of groundwater recharge, pollution abetment, soil fertility. Wetland products include fish, fuel wood, wild plants for food, and fodder. Wetlands are also an important aesthetic component of the landscape. Floodplains have many other uses and benefits that are essential to communities, and industrial and agricultural activities. Thus, floodplains are multiple resource systems with many different types of users and multiple stakeholders

Agriculturalists view the floodplains as rice production fields. The fisheries sector sees floodplains as fish production grounds. Overall, the national emphasis has been to produce more rice ignoring other benefits and products thus converting natural wetlands into rice fields. To the community dwelling in and around a floodplain it is their livelihood not just a rice field. Floodplains provide many products and services that have been utilized by many people in rural communities for generations. Wetlands also are significant for the local and regional environment, including for biodiversity conservation.

The diverse resource system and the stakeholders' indicate an integrated management of these resources. This training "Integrated Floodplain Management: Methods and Approaches" is expected to help people in this regard.

Aim of this Training Module

The aim of the training is to educate the targeted participants both cognitively and emotionally as to the importance of IFM, consensus building, and institutionalization, in IFM. This will prepare them in planning programmes, motivating stakeholders, and institutionalizing IFM through consensus building among stakeholders.

Target Participants

NGO staff, government officials of different levels working with Department of Fisheries (DOF), Department of Agricultural Extension (DAE), Water Development Board (BWDB), and Local Government Engineering Department (LGED) who are involved in facilitation of floodplain resources systems management programmes. At the resource level, CBO members, and leaseholders – are all target participants of this training.

Specific Objectives of the Training

After completion of the training on this module, the participants will be able to describe and explain:

i. what integrated floodplain management is, its components and importance;
ii. systems implications of boro rice, crop diversification and its benefits to cultivation in floodplains;
iii. fishing effort control and its methods with justification;
iv. The need and ways of fish friendly management of sluice gates, watershed management, and land retirement as part of IFM.
v. Importance and process of consensus building among the stakeholders;
vi. The importance and process of institutionalization in sustainable IFM.

Duration of the Training

An estimated duration for this training is three full days.

The Training module

The training module covers eleven technical sessions along with an introductory session with a pre-test, a post-test and open discussion session at the end. Each of the 11 technical sessions presented here with a session guide followed by resource materials for the users, the prospective facilitators. The session guides describes how to conduct the sessions, what materials required and what methods can be followed, while resource materials will provide updated information on the topic. A sample pre and posttest questioner is also furnished here with.

Equipments and Logistics

1. OHP/Multimedia projector
2. Computer
3. Transparency sheets
4. VIPP board, pin
5. VIPP cards
6. White board
7. Flipchart board
8. Markers
9. Flipchart papers/ large papers
10. Adhesive tap
11. Handout for the participants
12. Pen, notepad, training folder, name tag for the participants

Topics and Sessions

1. Introduction of the Subject, Expectations of the Participants and Pretest
2. Understanding Floodplain Resources System
3. Present Status of the Floodplain Resources, Use Pattern and Need for Integrated Management
4. Components of IFM
5. Fishing Effort Control
6. Crop Diversification
7. Sluice Gate Management
8. Land Retirement
9. Habitat Restoration
10. Watershed Management
11. Consensus Building Among Stakeholders
12. Institutional Approach in IFM
13. Post Test
14. Open Discussion and Closing of Training

Session 1. Pre-test, Expectations of the Participants and Introduction of the Subject and Objective of the Training

Objectives:	Attending this session participants • present knowledge on integrated floodplain management will be tested to identify gaps; • will inform their expectations from this training; • will be able to tell about the training subjects and the objectives.
Time:	1 hour.
Methods:	Answering preset question on the training, brainstorming, and writing on VIPP cards, presentation, and discussion.
Resource Materials:	Question and answer sheets, VIPP cards, slides/OHP sheets, training schedule.
Equipment:	White board, VIPP cards and board, Multimedia projector, markers, adhesive tap, board pin.
Process:	Step 1. Questionnaire and answer sheets will be supplied to all participants; they will answer the questions based on their present knowledge. After answering, all the answer sheets will be collected examined by the facilitators afterwards to determine gaps in knowledge of the participants. Step 2. All the participants will be supplied with a VIPP card to write their expectation from this training on that. Each participant will be requested to write one expectation. After collection, the facilitator will read out all the expectations for all the participants. The VVIP cards with expectations will be hanged in the training room. Step 3. The facilitator will introduce the training subject broadly and the training objectives.
Notes for Facilitator:	This session is planned to know the present knowledge of the participants on floodplain resources and their integrated uses, their expectations from this training, and to inform them of the training objective and the sessions of the training in relation to their knowledge level and expectations. A post-test will be required to test the change in knowledge after training.

Session 2. Understanding Floodplain Resources System and Production Dynamics

Objectives:	After attending this session, participants will able to describe and explain the physical and biological resources of floodplain systems of Bangladesh.
Time:	1 hour.
Methods:	Presentation, discussion, question answer through brainstorming.
Resource Materials:	OHP/multimedia slides, Handout: “Floodplain Resources System in Bangladesh,”.
Equipments:	OHP/multimedia projector, White board, Easel board, Flip chart paper, Marker.
Process:	Facilitator will present physical and biological resources systems of floodplains of Bangladesh. During the presentation he will create scope for discussion through question asking and brainstorming in a participatory way.
Notes for Facilitators:	This session is planned to widen participants’ knowledge on various physical and biological floodplain resources, highlighting the integration among them. In the existing situation people tend see the resources with a sectoral view and tends to focus on the sectoral activities. That is why a systems understanding of the resource base and all sorts of activities is important for sustainable management. That is termed here as integrated floodplain management.

Understanding Floodplain Resources System and Production Dynamics

Floodplains are generally highly productive ecosystems, providing many important benefits. These benefits, sometimes described as 'goods and services', may be floodplain functions (e.g. groundwater recharge, soil fertility), uses of the wetland or its products (e.g. fishing, wood collection or research site) or attributes of the wetland (e.g. aesthetic component of the landscape). Many of the benefits provided are essential to communities, and to industrial and agricultural activities. Floodplains are extremely productive systems and may exceed the productivity of intensive agricultural systems.

Most professionals suggest all inland water areas except the big rivers are floodplains irrespective of their temporal dimension. So the floodplain habitats can be identified are beel, haor, baor, small rivers and canals with associated vast seasonally flooded lands used mainly as rice fields.

Perhaps the most important of all the common property resources of the floodplains are the floodwaters themselves. They enable the fundamental process of land formation itself to occur and also bring great benefits that underpin the fishery and agro-ecology and economy of the entire country.

Loss of wetlands will remove these benefits. This is not to put a case for 'development *vs.* conservation', but simply to state that maintenance of wetlands as functioning ecosystems will often ensure that important contributions to development are maintained.

Floodplain Habitats

Bangladesh is a floodplain of three major river systems – the Ganges the Brahmaputra and the Meghna. The country is literally crisscrossed by around 250 large and small rivers; there are thousands of haor, baor, beel, khal etc. along the floodplains of these rivers. The vast water bodies along with their diverse fauna and flora present a unique highly productive floodplain ecosystem.

Floodplain ecosystems are influenced by the prevailing hydrological regime. The spatial and temporal variation in water depth, flow patterns and water quality, as well as the frequency and duration of inundation, are often the most important factors determining the ecological character of a floodplain, which influences fisheries production, fertility of land and production of many other aquatic resources and agriculture.

Floodplain habitats are a. tributaries and distributaries; d. canals; e. beel, haor, baor; f. seasonally flooded areas – inundated rice fields; g. river scour holes and deep part of a beel including kuas/pagers.

All the major rivers flow into the Bay of Bengal. At the confluence of the rivers, fresh water mixes with seawater producing brackish water that forms a distinct estuarine zone.
The richness in inland open water fisheries yield and species diversity in Bangladesh is due to its high diversity of habitats, microhabitats, and seasonal features along with hydrological features. Natural system of replenishment of varieties of fish species in the open waters is possible due to the combined effect of hydrology and habitat diversity over the seasons.

Fish behaviour and their use pattern of habitats are sharply different between dry and wet seasons. This difference influences fish lifecycle including growth – they use almost every diverse habitat type in completing their lifecycle; on the other hand this difference determines fishing practices and efforts.

Features of floodplain habitats in Bangladesh

1. The floodplains in Bangladesh present a very rich and diverse fishery comprising over 300 species of finfish and shellfish.

2. Diverse habitat systems and complex hydrological regimes having strong seasonal dimensions provide opportunities for the entire fish communities and other biota to renew and replenish annually and thereby contribute to sustain the yield and diversity of species in the this open waters.

3. The hydrological regime has a vital role in maintenance and sustenance of the inland fisheries production in typical flooded river basins. Seasonal contraction and expansion of water regime is the characteristic feature of the flooded river basin, which determine the fisheries production through providing opportunities for performing various biological functions of fish.

4. Diversity of habitats is also another major contributor in having a robust inland fisheries yield and ichthyo-diversity, which provide diverse microhabitats essential for various fish species to complete their natural biological cycles.

5. Strong seasonal changes in the hydrological regime in the flooded river basins resulted in changes in the qualitative and quantitative dimensions of wetland habitats over the seasons.

The fish communities also adjust and adapt their life cycles in accordance with the changing hydrological cycles and so with the changing habitat features. People living at the ecosystem level who are the users of the flooded basins for either fishing or farming also determine their fishing and farming strategy and actions with the changing hydrological regimes over the seasons.

Table 1: Broad-based Classification of Floodplain Ecosystems Habitats.

Habitat types	Seasonal features	Dry season status	Wet season status
Major or Primary Rivers	Perennial	Mostly isolated but linked with secondary rivers, may have link with some tertiary rivers	May become flooded over bank and get connected with wider complex floodplain habitats
Secondary Rivers	Mostly perennial	Lost connection with floodplain complex but linked with rivers	Flooded over bank and connected with floodplain complex
Tertiary Rivers	Mostly seasonal	Lost connection with floodplain and poorly linked or no link with river systems, beds are often cultivated (seed beds & boro rice)	Flooded over bank and connected with floodplain complex linked with river systems
Khals	Mostly seasonal	Isolated from floodplain and having poor or no link with rivers, beds cultivated (seed bed and boro rice)	Flooded and connected with rivers and floodplain beels
Beels	Mostly perennial	Become smaller, isolated from khals and rivers, cropland and fallow	Flooded and connected with rivers, khals and adjacent flooded lands
Haors	Mostly seasonal	Most part becomes dry, crop lands, grassland or fallow except for beels within haors.	Flooded and connected with rivers, khals and adjacent flooded lands

Habitat types	Seasonal features	Dry season status	Wet season status
Flooded Lands	Seasonal	Dry, crop land grassland and fallow	Flooded and merged with vast sheet of water in the basin
Baors	Perennial	Isolated, edges under crop cultivation (boro rice, seed beds)	Isolated, some are linked with flooded lands or beels
Kuas/Pagars	Mostly perennial	Isolated, not under cultivation often pumped out to dry for fishing	Flooded and merged with vast sheet of water in the basin

Hydrology, Habitats and Fish Biological Functions

Ecosystems Considerations for management

- Habitat quality and quantity
- Seasonality
- Connectedness
- Fish biological functions
- Human practices

Hydrology in the flooded river basins is the major factor for sustaining fisheries production, maintaining biodiversity and determining fishing practices. Therefore, the hydrology has great influence on inland capture fisheries production and thus governs the whole system. There are annual changes in the hydrological regime. In the monsoon season, a huge volume of floodwater from vast watershed in the upper riparian areas drains through Bangladesh to the Bay of Bengal through around 700 rivers.

The extent of monsoon floodwater varies between years due to various reasons: intensity and volume of monsoon rains, amount, and timing of snow melt in the Himalayan hills. These annual hydrological regimes determine the spatial and temporal aspects of wetland habitats in terms of hectare-months of water and accordingly changes in fisheries production occur between years, both in terms of quality (composition) and quantity.

Therefore, habitats alone cannot determine the fishery rather all these are highly depended and influenced by the annual hydrological regimes. In low flooding year, many habitats in relatively higher elevated basins could not adequately support the fish to perform their biological functions in full, although the habitats are comparatively in good shape. On the other hand, in high flood year higher fish production is experienced due to increased spatial and temporal habitat area in terms of hectare-months, which allow fish to perform their biological functions more successfully than in a dryer year.

Fish life cycles in the typical floodplains like in Bangladesh are adjusted to the annual hydrological features and fish accordingly move out to various habitats at different times of the year in order to complete their life cycles. Therefore, any changes in hydrology affect the habitats (quality and quantity) and eventually in the fisheries production.

Wetland habitats including microhabitats are essential for the sustenance of fisheries production and biodiversity. Fish and other aquatic biota require suitable habitats for performing their various biological functions and unless these habitat requirements are met, fish cannot perform their biological functions. For example, Major Carps (*rui, catla, mrigel*) require flooded basins in the upper riparian areas of major rivers with current and rainfall for spawning. These species will not spawn if they do not get suitable habitats. It is seen that adults of these species remain in abundance in tertiary rivers in the lower riparian areas or in

beels but they do not spawn there. In culture ponds, eggs develop in the gonad of major carps in the early monsoon but are absorbed in the late monsoon as they do get suitable spawning habitats in ponds.

The ease of fish movement among the habitat is also a determining factor of the habitat. In addition to habitat types, water depth range, vegetation and its type are also a part of habitat diversity.

Hydrological regimes of floodplains are one of the major factors sustaining fisheries production, maintaining biodiversity and determining fishing practices. There are annual changes in the hydrological regimes; a huge volume of floodwater is a feature of monsoon season. This annual hydrological regime determines the spatial and temporal aspects of wetland habitats in terms of hectare-months and accordingly changes the fisheries production. In a high flood year higher fish production is observed.

Table 2: Hydrological Seasons, Fish Habitat Features and Fish Biological Functions

Seasons/ Months	Habitat Quantity	Habitat Quality	Fish Biological Functions	Fishing Practices	Remarks
1. Dry Season (December-February)	Habitats become isolated, lowest spatial water area, lowest depth, many wetlands become dry	Highest pollution concentration, low temperature, bad water quality, many wetlands can not support fish	All biological functions of fish reduced, fish take refuge in rivers, river pools, and perennial beels	Fishing intensity peaks, perennial wetlands pumped out to dry for fishing, most wetlands are fished out	Fish become vulnerable or exposed to natural and fishing mortality
2. Pre/Early-Monsoon (March-May)	Water area starts to expand spatially with the onset of rain	Water quality improves with rising water volume and temperatures	Biological functions initiate, fish perform longitudinal (long distance) and lateral (short distance) migrations for spawning and feeding	Less fishing intensity. Fishing in beel edges with less harmful gears but fishing in khals cause destruction due to catching of migrating fish	Sensitive time for fish migration, fish productivity and diversity depends on successful migration
3. Monsoon (June-August)	Spatial and depth parameters of wetland reached the highest, huge area under water, all sorts of floodplain habitats get integrated	Best water quality with rich fish food, huge area for spawning, feeding and growth	All biological functions of fish (migration, spawning, nursing, feeding, growth, etc.) peaks	Fishing peaks in flooded areas with various gears, open access fishing with few exceptions, use of harmful gears like *kona jal, current jal* peaked	Best time for the entire fish community for natural replenishment, however, harmful gears cause damage to fishery
4. Late/post Monsoon (September-November)	Spatial water area rapidly decreases, different wetland habitats become isolated	Water quality still remains good,	Fish migrate to their dry season refuge areas like perennial beels and rivers	Fishing peaks in khals during their return migration, beel, river fishing continues	Sustained natural fish production depends on successful return migration to their refuge areas.

Source: Rahman, M. 2004.

Fish migration and growth

Open water fish are broadly categorized into two groups: white fish, that reside primarily in flowing waters such as rivers; and black fish that primarily reside in static waters such as lakes and beels. White fish typically migrate upstream into floodplains, beels, haors through connectivity's during spawning season. Black fish on the other hand spawn and remain in the same lake or beel.

Daget (1960) described two types of river fish migrations in Bangladesh: i. longitudinal migration within the river channel and ii. lateral migration to and from floodplains. Welcome (1975) mentioned that each type of migration requires a different type of behaviour and probably different sets of physical stimuli. A gradual rise in the river water in different areas of the country usually starts from late February or early March (pre-monsoon). The process of sexual maturation and staging migration and movement for breeding activity occur in this pre-monsoon period when the air and water temperatures rise. During the early monsoon (April-May), almost all species of fish are seen with ripe or ripening gonads. For the major carp species of Bangladesh, the upper reaches of the Brahmaputra in the Assam Hills, the Ganges below Farakka and upper Barak region are the major breeding areas according to Tsai and Ali (1985).

Some species of prawn and fish require brackish/saline water to spawn; they migrate downstream to estuarine and coastal environments. The juvenile's then undertake upstream migration through the rivers to reach the food rich floodplains to feed and grow until recession of flood. The growing prawns, like the carps, move back into the flowing river habitat with the receding waters. The opposite of prawn is Hilsha, a fish that lives in marine environment in the Bay of Bengal but migrates into the fresh water habitats in the upstream of the river system to breed.

Maintaining ecosystem functions

- ☺ Protection of ecosystem components
- ☺ Restoration of degraded ecosystem components
- ☺ Preservation of ecosystem components
- ☺ Wise use of ecosystem resources

Session 3. Present Status of the Floodplain Resources, Systems Understanding of the Problem and Need for Integrated Management

Objectives:	After attending this session participants will be able to describe and explain: i. the present status and use pattern of the floodplain resources of Bangladesh and related issues; ii. the need for an integrated approach for management of these resources.
Time:	1 hour 30 minutes.
Methods:	Presentation, discussion, small group work.
Resource Materials:	Slide/OHP sheets, Handout: "Present Status of the Floodplain Resources, Use Pattern and Need for Integrated Management".
Equipments:	OHP/Multimedia projector, White board, Flipchart board, Flipchart paper, Marker, Adhesive tap.
Process:	Step 1. Facilitator will initiate the discussion by introducing the topic and make a presentation on present status and uses of the floodplain resources of the country. Step 2. After that the facilitator will invite the participants for a group work on "why integrated floodplain management is necessary". He will divide the participants in small groups. The group will select a leader who will present the group findings. Facilitator will conclude the session.
Notes for Facilitators:	This session will specify the issues and difficulties of a sectoral approach while the resource system it self is integrated. How the sectoral approach in use pattern is responsible for the degradation of the resources. And why the integrated approach is urgently needed.

Present Status of the Floodplain Resources, Systems Understanding of the Problem and Need for Integrated Management

From our experiences and observations we know that the floodplain habitats are degrading, production of fisheries has declined in quantity, species diversity and big size fish in catch over a period of time. DoF information shows a rapid increase in culture fisheries; in relation, present official status of the open water capture fisheries is declining.

Present status of the floodplain production systems

Biological and productivity

- Overall 30-40% fish catch declined during 1975 – '76 to '89 – '90 period (DoF) (Tk50-100 Crore lost annually)
- Overall fish consumption declined 15% per capita, for the poorest the decline is 38% during '95 to 2000 period (BBS)
- Major carp and large catfish catch declined 50%. Healthy open water body production is 250 to 300 kg/ha, but some places found 51 to 160 kg/ha (MACH baseline). CBFM Project baseline is 45 – 125 Kg/ha.
- More than 20% of all fresh water fish species are in danger of extinction (IUCN).
- Recent fisheries sector review predicts 0.9 – 2.1% fall per year in inland capture fishery production.
- Flow reduction in major river systems is about 50% during the last 20 years (Water Board) due to barrages (in India), local extraction and other reasons leaving millions of ha open water area impacted.
- FCDI projects also damaged many open water bodies in the country, mainly converting wetlands into rice fields, disrupting connectivity and siltation, and ultimately producing drastically changed ecosystems. Impacts on wetlands can be caused by both human activities within them and because of the interconnectedness of the hydrological cycle, by activities take place within the wider catchments.

Issues related to floodplain resources

Issues related to physical and biological resources

1. Lack of dry season water in river, beel, khals (flow reduction, siltation, FCDI structures.
2. Boro rice cultivation during winter, its influence on the critical dry season aquatic habitats.
3. Loss of connectivity between beel-khal-river (roads, FCDI structure, siltation).
4. Sedimentation of beels, rivers and khals (loss of forest cover, lack of soil conservation measures).
5. Pollution (industrial, agricultural, domestic).
6. Destructive fishing practice and over fishing.
7. Due to overexploitation slow growing, late maturing species are being replaced by quick growing fast maturing ones.
8. Conversion of aquatic habitat (agriculture, urbanization, roads, industry).

Policy issues related to open water resources

1. Present leasing policy of the Jalmohals;
2. Lack of any national sanctuary policy;
3. Land use planning;
4. Difficulty to implement the Fish Act and need for review;
5. Lack of national and local resource planning and management – agriculture, water, industry, pollution.
6. Fisherman and wetland is not properly defined.

Watershed degradation

- Unsustainable cultivation in hill slopes
- Cutting of hills
- Loss of riparian vegetation cover
- Increased HYV boro cultivation
- Water abstraction/diversion

Results in a serious siltation down in the open water bodies.

Consequences of wetland degradation

1. Imbalance in nature;
2. Loss of habitat of many animals and plants thus loss of biodiversity;
3. Onset of desertification;
4. Low-lying areas will be inundated;
5. Water pollution – loss of natural recycling system;
6. Loss of common property renewable natural resource – reduced food and fodder, reduced livelihood security/safety net for the poor specially.

Why integrated management floodplains is important

- More than two-thirds of Bangladesh is wetlands
- Wetlands are rich in biodiversity, both plants and animals
- Over 80% of rural people depends on various wetland resources at varying degrees
- Poor receive about 50% of the direct benefits and share in many of the remaining benefits

Why community based management?

1. Resource users, who get the benefit, whose livelihood is dependent, should manage the resources.
2. Local people can use their knowledge and information about the resource.
3. Local people, users will be more interested in sustainable management and long-term use of resources if they have right over resources.

What are the problems of floodplain production system?

In Bangladesh floodplains are predominantly converted into rice fields, moreover, every year the Water Development Board constructs embankments and other structures so that farmers can bring perennial parts of a beel under rice cultivation, destroying the habitat for original aquatic life thus reducing resources production and other goods and services of wetlands. Excessive pressure on fisheries resources, and destructive fishing methods are another set of problem of the production system. These are coupled with upper watershed issues

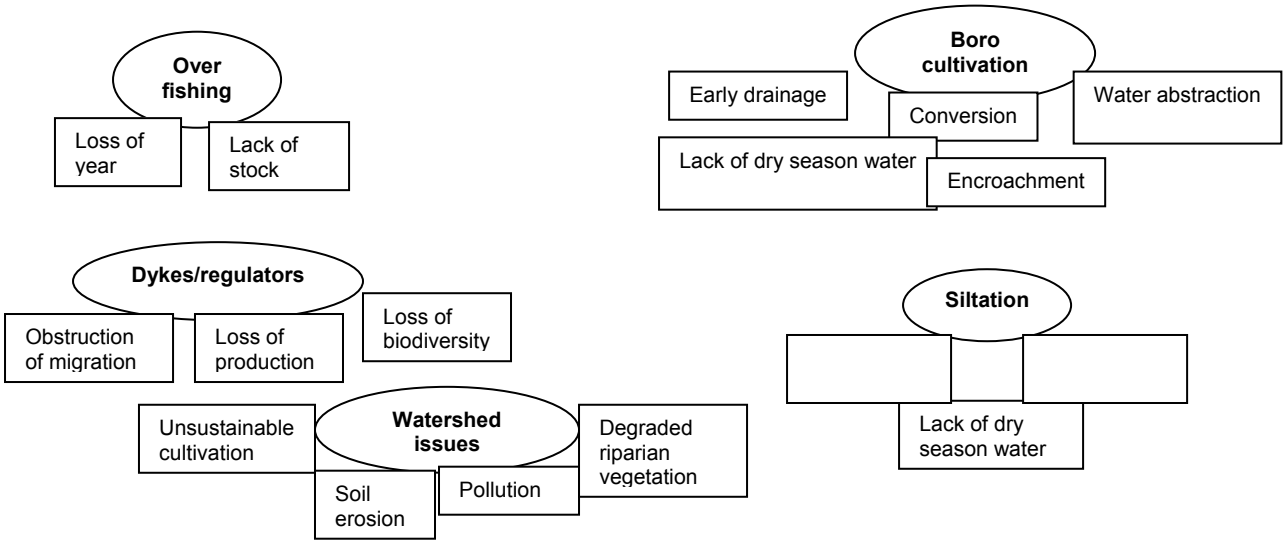
creating a threatened situation for the floodplains and wetlands benefits, and even their existence. These are the main problems or conflicting issues within floodplain production system in Bangladesh. Below the dimension of the problem and their impacts are discussed.

Understanding of an integrated view of the management problem related to Floodplain Resources

The broad constraints to improved floodplain resource in Bangladesh investigated were:

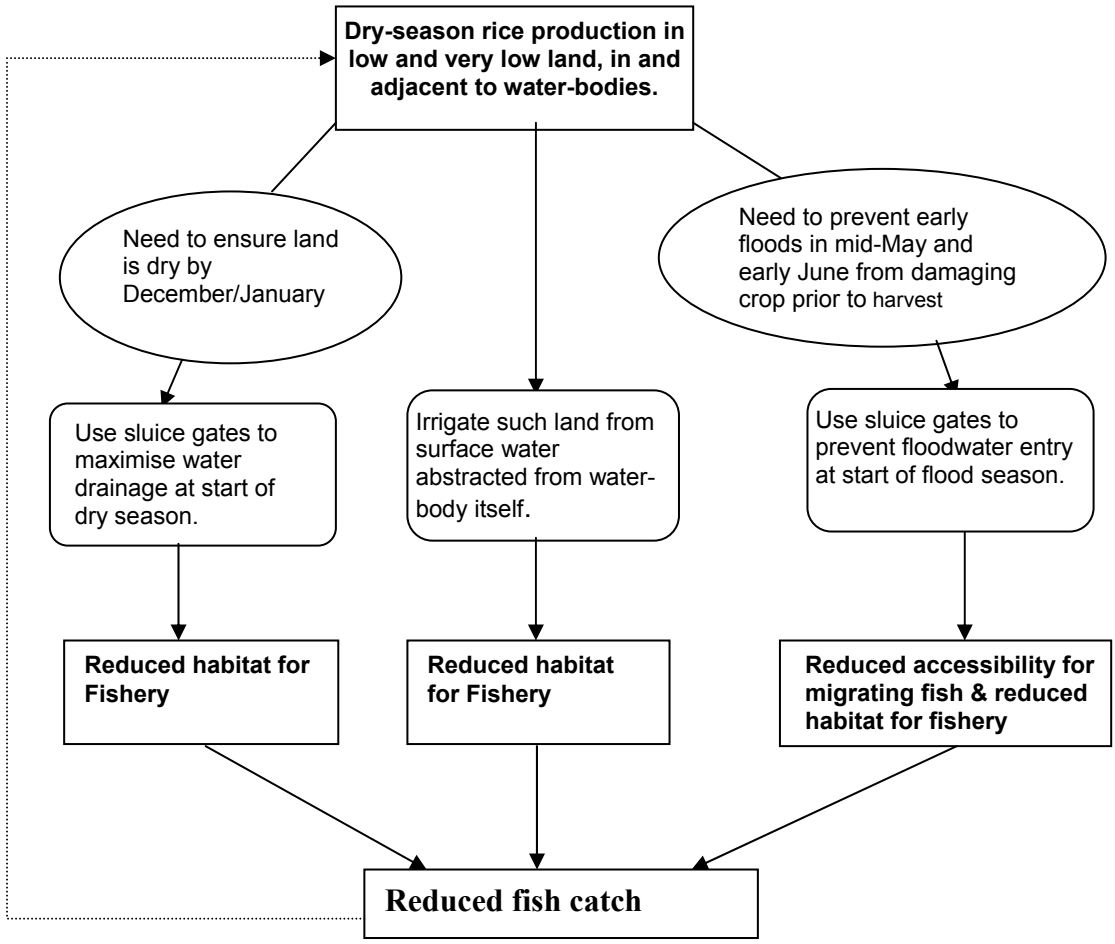
(i) Excessive effort levels in fishing leading to reduced fish productivity,
(ii) Reduced water levels (due to sluice gate management, both during the flood season and ahead of the dry season, and water abstraction for dry-season rice irrigation) leading to reduced fish productivity, and
(iii) Early flood arrival events damaging dry-season rice crops prior to harvest.

Figure 1 : Systems problems: Floodplain management



Collectively, these represent some of the major NR-related constraints in hydrologically modified floodplain sites. There are strong systems linkages binding at least some of these constraints. Understanding these linkages also provides a key to integrated floodplain management. This linkage is outlined in the diagram (Figure 1)

Figure 2: The systems implications of lowland winter rice production



Dry season rice production in the beel/very low lands thus lies at the heart of the problems studied here. Firstly, sluices are opened to maximise drainage out of the floodplain at the end of the flood season, so that lowland will sufficiently dry out for rice cultivation. Secondly, proximity to the water-body encourages the subsequent irrigation of such plots from the residual water in the water-body. Thirdly, low-lying rice plots are most susceptible to damage from early flooding prior to harvest, which leads to pressure being put on sluice gate authorities to keep gates closed in the early flood season.

Dry season water retention is key to the floodplain fishery, *i.e.*, the 'habitat effect' is strong in the dry season, and the drainage and irrigation aspects described above rapidly desiccate the habitat available to the fishery. Research results show that this 'habitat effect' is relatively low in the early flood season – *i.e.,* floodplain water level reduction due to early flood season sluice closure does not impact the fishery excessively. However, other work (Halls, *et. al.*,1998; DeGraaf *et. al.*, 1999) shows that there is nevertheless a 'migration effect', whereby migratory species and their developing larvae are blocked from entering the floodplain by the sluice gates. The net effect is reduced fish catch, upon which the poorest disproportionately depend.

An additional point needs to be noted. Once the trend for very low land dry season rice production is established, there is an impetus for accelerated deterioration of the fishery. As the water levels and the value of the fisheries decline, there is correspondingly less incentive to protect the water-bodies and the fisheries, both for the government and local communities. Weakened protection encourages further encroachment of farming interest on the water cover. Also, other trends are contributing to the perpetuation and acceleration of

the interlinked chain of problems described above. For instance, cheaper and more mobile LLPs are now available, and these are able to exploit even the shallower water-bodies in an economically viable way.

Somewhat separate from the interconnected issues specified above is the problem of excessive effort in the fisheries. This is inevitably the consequence of steady population growth in a poor, land-constrained economy. Yet even this aspect has a connection to the desiccation of water-bodies due to dry season rice production. Reduced water levels improve 'catchability' for even inexpensive, labour intensive gear. This is likely to encourage further effort in the fishery, at least in the short-run, further undermining the long-run productivity of the fishery.

Existing social power structures serve to enable these trends. A small number of large landowners may have disproportionate influence on the system. As FAP 17 (1994, page 54) notes in the context of the PIRDP, '*The closure of the sluices during the period from late Baishak (early May) to late Joisthya (early July) is reportedly aimed at protecting a small amount of boro in the lowest parts of the beel. According to local people, operating schedules are dictated by the fact that most of the boro land is owned (or occupied) by large and powerful landowners who are able to influence sluice gate operation'.* In contrast, professional fishers have low social standing and are disorganized, and hence are forced to accept and adapt to changes in the system rather than help shape it.

Water resources management in Bangladesh is based on a complex set of social, legal and customary rights. Over time, these have been modified by the penetration of market forces and interventions by the state. One of the consequences has been the attribution of various forms of common property and their displacement by private property.

Session 4. Better Options for Integrated Floodplain Management

Objectives:	After attending this session participants will be able to describe and explain the components and options of integrated floodplain management.
Time:	30 minutes.
Method:	Presentation, question and answer through brainstorming, discussion.
Resource Materials:	OHP/Multimedia slides, Handout: "Components and Options of Integrated Floodplain Management".
Equipments:	OHP/Multimedia projector, white board, flipchart board, flipchart paper, marker.
Process:	The facilitator will initiate the discussion by introducing the topic. He will present the components and options of IFM to the participants. In the process he will also ask questions to add-on from the participants experience and involve them more.
Notes for Facilitators:	This is the introductory session for the components and options for integrated floodplain management. Here each of the components, options and issues will be discussed in brief just to familiarize them to the participants so that they understand the interlinks and can conceptualize the whole process of IFM.

Better Options for Integrated Floodplain Management

The options for sustainable integrated floodplain management are:

1. Fishing Effort Control
2. Crop Diversification
3. Fish Friendly Sluice Gate Management
4. Land Retirement

Each of the options are discussed briefly here, detail session on each of them are part of this module.

Fishing Efforts Control

What is fishing effort control?

Reduction of destructive fishing gears and methods, reduction of fishing pressure to a sustainable rate along with conservation measures can be denoted as fishing effort control.

Why fishing effort control?

Fishing pressure, harmful fishing gears and destructive fishing methods are among the major reasons for reduction of fisheries resources from the open waters of the country.
All the mentioned factors are destroying the once rich open water fisheries resources. Imposing methods for fishing effort control is urgent. This will hopefully ensure that sufficient mother fish remain in the water bodies to spawn and propagate in the next breeding season, and thus sustain fish populations.

What are the methods of fishing effort control?

- Conserved area or Sanctuary: Whole or a part of a water body is demarcated, announced, and maintained as no fishing zone. Where fish and other aquatic animals are not harvested or disturbed through out the year.
- Closed season: Ban on fishing during critical part of its life cycle. As a result, fish can breed and propagate successfully, allowing produce to grow bigger.
- Restriction on harmful fishing gears: Restriction on *current jal, moshari jal* etc. restriction on mesh size of net is proved very useful for maintaining a healthy fishery.
- Ban on destructive fishing practice: Complete dewatering, cross dams along with fishing at a sluice gate opening is considered destructive for fish. Bans should be imposed on these methods.
- Ban on harvesting immature fish: Harvesting of immature fish should also be stopped to allow fish to breed at least once in their lifetime. Bans should also be imposed on the carrying and marketing of immature fish.

Crop Diversification

What is rabi crop diversification?

Diversification of rabi crops means here to reduce cultivation of water hungry boro rice in the floodplains and increase other rabi crop cultivation; those that need much less irrigation water. The main objective is to reduce the use of beel water, which is critically needed for fish and other aquatic life at that time. Experiments shows that there are a range of alternative crops that can be cultivated successfully in the floodplains instead of boro rice, and can benefit farmers even more using only one-quarter of the irrigation water. This will also benefit fishermen by improving fisheries.

Why is crop diversification for floodplains needed?

The dry season is the most critical period for floodplain fish; water in the beels or other depressions becomes scarce, and sometimes dries up completely, making the habitat uninhabitable for aquatic life. That is why it is important to keep sufficient water during dry season in the beel so that at least some mother fish can be sustained. However, boro rice cultivation in the floodplains is a big obstacle in this regard. To cultivate boro rice farmers tend to drain out beel water as soon as possible, and will use up the remaining beel water for irrigation. At the end, before harvesting, they will keep the gate closed, preventing early floodwater from entering the beels. As a result, beels are dry and aquatic life under threat.

An experiment in Pabna Irrigation Project shows that after irrigating 500 ha boro rice fish production reduced drastically and fisheries completely collapsed after irrigating 700 ha boro rice.

What are the benefits for fisheries from cultivation of alternative rabi crops?

If the floodplains are cultivated with maize, wheat, potato, garlic or other rabi crops, those requires much less irrigation water, it will help keep more water in the beel for fish. Pabna Irrigation Project experiments suggest that even after irrigation of 2,500 ha. for wheat, it is possible to obtain a fisheries production up to 50 kg/ha. If onions are cultivated, the same amount of fish can be obtained even after irrigating 4000 ha.

This clearly shows that the beel fishery can be protected if diversified cropping pattern can be introduced.

What are the benefits of rabi crop diversification?

- If floodplains are cultivated with diversified rabi crops, it will benefit the farmers more and this will also be benefited for the aquatic ecosystem.
- Other rabi crops can be harvested 3-4 weeks earlier than boro rice thus can avoid the risk of damage by heavy rain or early flooding.
- As the crop is harvested well in advance, the sluice gates can be kept open during early flooding to facilitate fish migration.
- Diversified cropping in rabi season and deep water Amon cultivation during monsoon will benefit the farmers as well as will provide an improved habitat for fish.
- If sufficient water can be retained in beels, it is possible to increase fisheries production to a satisfactory level.

What are the suitable alternative rabi crops?

Many alternative rabi crops such as wheat, maize, onion, garlic, potato and many other vegetable crops can be beneficially cultivated in the floodplains of Bangladesh. (Crop selection should be done based on soil quality) These crops need much less irrigation water (Table 1), thus keeping some more water for fisheries.

Sluice Gates Management

There is 653-flood control and irrigation (FCDI) schemes at present exist in Bangladesh and are impacting 5.5 million ha. wetlands. FCDI schemes are beneficial to the farmers, but at the cost of fisheries production and livelihood of millions of fishers and the natural wetland environment. This session first tries to create an understanding of the impact of these sluice gates in general, secondly, to suggest a fish friendly management of the sluice gates.

What is the significance of obstacles to fish migration?

One of the main reasons of the loss of floodplain fisheries production and biodiversity is the loss of migration facilities to complete fish's biological cycle. As a result spawning and growth of fish is hampered, production decreased, biodiversity threatened.

Why fish friendly operation sluice gate required?

To protect rice crop in the floodplains there are about 13,000 km embankment and 4,190 sluice gates constructed under 653 flood control and irrigation projects in Bangladesh. As a result 5.5 million ha. of floodplain are directly impacted. These sluices and embankments have severely impacted and reduced fisheries production and species diversity of the areas. This is why operating the sluice gates in a fish-friendly manner is very important. Research reveals that fish and crop friendly operation can benefit both, and increase fish production significantly and conserve species diversity.

What is fish friendly operation of sluice gates?

Sluice gates are operated mainly targeting crops, they are opened or closed to benefit crops alone. Natural fish movement never considered in this regard. But sluice gate management should be in such a manner that allows fish movement from one habitat to other in need and in time, which is urgent for fishes in the nature to propagate and survive, this way of sluice gate operation can be denoted as fish friendly sluice gate operation. It will enhance fisheries production and will conserve species diversity as well.

Land retirement

A natural outcome of the dry season sluice gate management strategy outlined above is the 'retirement' of some previously *boro*-cropped land from cultivation. As discussed above, this needs only be a small fraction of the total cultivable land, in the deeper areas of water-bodies, and adjacent to drainage channels. There may also be value in strategic retirement of occasional parcels of further land – for instance, plots vulnerable to early flooding[1], for the protection of which landowners petition sluice gate controllers to keep gates closed in the early flood season. Critically for the feasibility of this strategy, estimation is that these retirements need only constitute a small fraction of overall cultivable land in individual floodplain hydrological units.

[1] Although, these may be the same very low plots that are inundated by increased dry season water retention.

Which Lands are Suitable for Retirement and how can this be achieved?

As the water decreases farmers tend to plant rice on those lands in the beel beds, these lands are mostly khas. These lands are at high risk of flood damage in the early flooding season. Returns of rice from these lands are quite uncertain; these lands are suitable for retirement. But the success depends on how to motivate farmers to abstain from planting on these lands.

Experience suggest that motivate farmers to plant on these sorts of land is difficult. Strong motivational work with awareness

Session 5. Fishing Effort Control

Objectives:	After attending this session participants will be able to describe and explain: i. what is fishing effort control, why it is important: ii. the measures for fishing effort control, their importance, decision making and implementation process of these measures.
Time:	2 hours.
Methods:	Participatory discussion, presentation, small group work.
Resource Materials:	OHP/Multimedia slides, Handout: "Fishing effort control".
Equipments:	OHP/Multimedia projector, white board, flipchart board, flipchart paper, marker, adhesive tap.
Process:	The facilitator will initiate discussion through introducing the topic, he will than through brainstorming find out what is fishing effort control means and why it is important for fisheries management. After that he will invite participants to a small group work on what are the measures taken for fishing effort control and why (importance of each of the measures) and how to implement these measures in a given situation, what difficulties might arise in doing this. After presentation of each of the groups and discussion the facilitator will conclude the session.
Notes for Facilitators:	This session is the fisheries management part of the integrated floodplain management, so the relationship also be discussed. The facilitator will gain practical knowledge on the effort control measures, participatory decision-making process and on perceived difficulties before hand.

Fishing Effort Control

What is fishing effort control?

Reduction of destructive fishing gears and methods, reduction of fishing pressure to a sustainable rate along with conservation measures can be denoted as fishing effort control.

Why fishing effort control?

Fishing pressure, harmful fishing gears and destructive fishing methods are among the major reasons for reduction of fisheries resources from the open waters of the country.
All the mentioned factors are making the once rich open water fisheries resources empty. So imposing methods for fishing effort control is urgent at this moment. This will hopefully ensure that sufficient mother fish remain in the water bodies to spawn and propagate in the next breeding season, and thus sustainable fish population will be maintained.

What are the methods of fishing effort control?

- Conserved area or Sanctuary: Whole or a part of a water body is demarcated, announced and maintained as no fishing zone. Where fish and other aquatic animals are not harvested or disturbed through out the year.
- Closed season: Ban on fishing during critical part of its life cycle. As a result, fish can breed and propagate successfully, allowing produce to grow bigger.
- Restriction on harmful fishing gears: Restriction on *current jal, moshari jal* etc. restriction on mesh size of net is proved to be very useful tool for maintaining a healthy fishery.
- Ban on destructive fishing practice: Complete dewatering, cross dams along with fishing at a sluice gate opening is considered destructive for fish. Bans should be imposed on these methods.
- Ban on harvesting immature fish: Harvesting of immature fish should also be stopped to allow fish to breed at least once in their lifetime. Bans should also be imposed on the carrying and marketing of immature fish.

What is the result of effort control?

Experience in many projects working for fisheries management projects (MACH, CBFM 2, 4th Fisheries Projects) shows that fish friendly management and harvesting can result in remarkable increase in production. Again proper enforcement of all these management measures will have a positive impact on other aquatic resources that will bring benefit for the poor resource users too.

Charan Beel results with and without effort control measures

In Charan Beel, Kalihati, Tangail estimated fish catch was 72.5 MT during the first year (August 1999 to May 2000 - adjusted) of monitoring (Figure 3) and declined gradually until the fourth project year (June 2002 to May 2003) to 45.89 MT. Catch increased following CBFM-2 interventions in place from fifth year of monitoring (June 2003 to May 2004) and reached 111.12 MT in the sixth year. As usual, fish catch was highest in October/November and low during the dry season.

Figure 3: Catch per unit effort (CPUE)

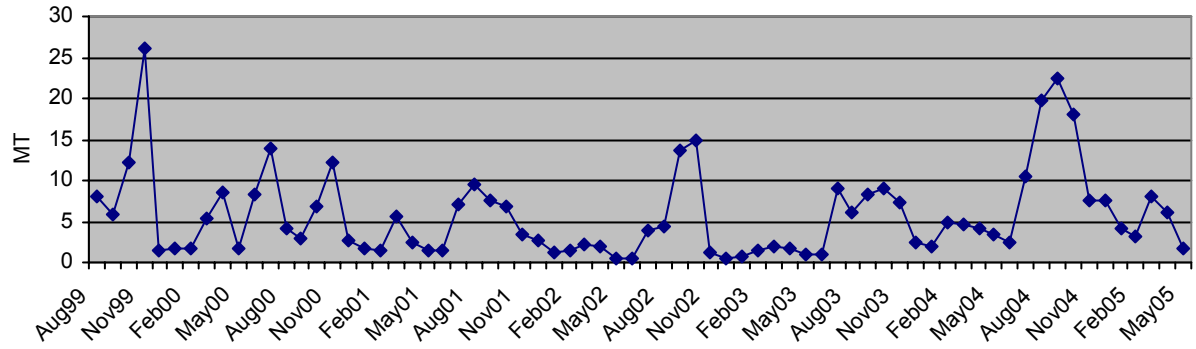


Figure 3: Fish catch trend in Charan beel.

Catch per unit effort (CPUE) of various gears varied depending on the size and nature of gear, such as active or passive, traps or nets, etc. Major fishing took place using ber jals in Charan beel. As expected, CPUE decreased in line with total catch uptil June 2002 – May 2003 and then increased until last year (Table 3).

Table 3: Catch per unit effort (CPUE) of major gears in Charan Beel.

Gear	CPUE (kg per unit effort)					
	Aug'99 - May'00	June'00 - May'01	June'01 - Apr'02	June'02 - May'03	June'03 - May'04	June'04 - May'05
Ber jal	23.977	47.145	30.653	21.327	23.500	50.923
Current jal	0.226	0.192	0.163	0.320	0.278	0.373
Daon borshi	0.021	0.006	0.004	0.007	0.022	0.029
Deul jal	4.854	4.523	5.437	2.514	11.859	8.823
Doar	0.082	0.048	0.055	0.063	0.100	0.066
Jhaki jal	1.533	1.223	2.233	1.778	3.359	2.962
Kathi borshi	0.004	0.005	0.007	0.010	0.015	0.011
Thela jal	1.284	1.492	1.197	1.458	1.527	1.328

Is it possible to enforce effort control?

At present in many localities under different development projects fishers or other resources users are successfully imposing effort control measures, monitoring by themselves and enjoying benefits.

Fish Sanctuary

What is fish sanctuary?

The whole or part of a water body where fish and other aquatic life can take shelter and continue some of their biological activities with out interruption or disturbance can be denoted as a fish sanctuary. Harvesting of fish and other aquatic resources from a sanctuary is strictly prohibited. As a result, fish taking shelter in a sanctuary can breed and propagate in the following breeding season, playing an important role in increasing fisheries production and maintaining biodiversity.

Why sanctuary?

Many research results show that each year after indiscriminate fishing only 2% fish can survive in the floodplains of Bangladesh. This 2% of fish is not sufficient to replenish the vast floodplains. That is why, to maintain an optimum fish stock, for sustainable productivity and fish species diversity, fish sanctuaries have proved to be successful.

How big should a sanctuary be?

Research findings in the Pabna Irrigation Project suggest that maintaining 10 to 15% of dry season water area of a water body, as sanctuary will result in 50% increase in fisheries production. In case of a river or a Haor a part of it, in case of a *beel* complex a *beel* within the complex can be conserved as sanctuary.

Prediction from modeling results: A total dry season reserve area of less than 20 ha is predicted to bring only modest increases in yield (Table 4 and Figure 4). The model predicts that reserve area must exceed at least 25 ha before improvements in yield in excess of 10% are achieved. This reflects the fact that currently much of the total fishing effort is expended early in the season giving rise to growth over-fishing. Reserves are predicted to increase recruitment by reducing overall exploitation rates and thereby improving the survival of the spawning stock.

Table 4: Model predictions of average recruits, natural mortality, yield, % gain in yield, fishing mortality and yield-per-recruit (Y/R) for different reserve areas during the dry season (December – May).

Reserve area (ha)	% of min area	Recruits	M (y^{-1})	Predicted Yield (kg)	% Gain	F (y^{-1})	Y/R (g)
0	0	4873538	0.16	10186	0	3.27	2.09
1	1	4902654	0.16	10214	0.3	3.26	2.08
2	2	4932120	0.16	10241	1	3.26	2.08
3	4	4992129	0.16	10297	1	3.26	2.06
5	6	5053618	0.16	10353	2	3.26	2.05
6	8	5116642	0.16	10410	2	3.25	2.03
8	10	5181260	0.16	10469	3	3.25	2.02
15	20	5530515	0.17	10774	6	3.23	1.95
23	30	5930338	0.18	11106	9	3.21	1.87
30	40	6392582	0.18	11469	13	3.18	1.79
38	50	6933110	0.19	11868	17	3.16	1.71
45	60	7573621	0.20	12309	21	3.13	1.63
56	75	8792025	0.21	13069	28	3.08	1.49

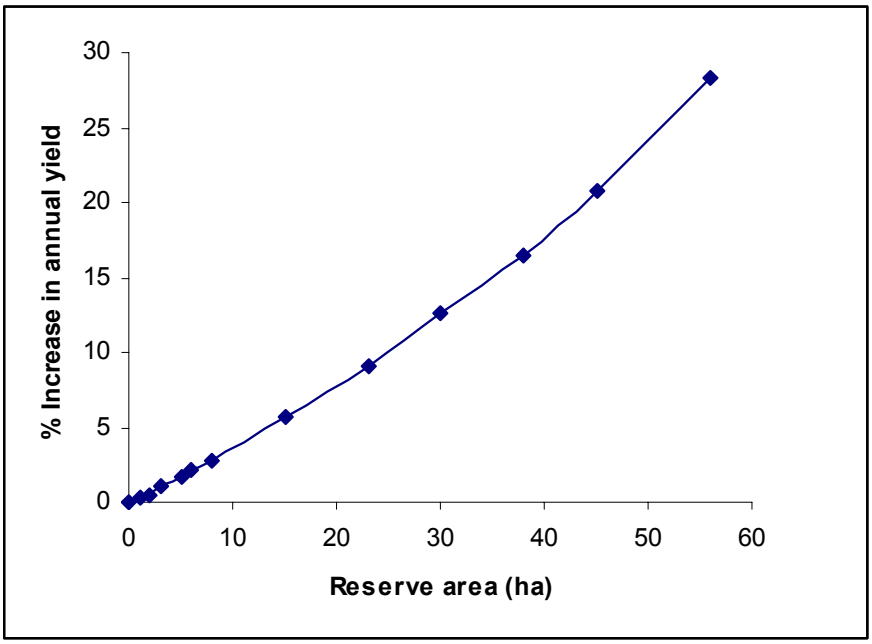


Figure 4: Predicted percentage increases in annual yield plotted as a function of reserve area in Charan Beel.

Where to establish a sanctuary?

Any place of a water body where sufficient water remains through out the year for fish is suitable to establish a sanctuary, like:

- ► Deep scour holes in rivers;
- ► Deeper areas or ditches in beels or floodplains;
- ► River or part of water body used by fish as breeding ground;
- ► Fish migration routes etc.

If the selected place for sanctuary is not deep enough to hold sufficient water in dry season, it can be excavated, for further protection of fish tree branches, bamboo, water hyacinth or other aquatic plants can be used.

What should be the duration of a sanctuary?

Sanctuaries can be long term or seasonal. Sanctuaries in deep beels or river scour holes can be maintained year round and longer period. On the other hand seasonal sanctuaries in floodplains, shallow beels or in canals are also important. These sanctuaries are mainly to allow safe migration of fish.

What should be the management of a sanctuary?

To ensure a proper and sustainable management of sanctuary it is suggested to involve local fishermen and other communities from the beginning through local CBO. They should also be given the responsibility of guarding and maintenance.

- Create awareness among the community;
- Stop fishing or any other harmful activities in the sanctuary;
- Establish 50-200 m buffer zone around the sanctuary;

- Responsibility to look after, repairing etc. should be given to local organization.

So far, established sanctuaries in different water bodies in different parts of Bangladesh have proved to be successful. A joint effort of establishing sanctuaries and maintenance would be an effective step towards enhancing open water fisheries.

Periodic Ban on Fishing or Closed Season

What is a periodic ban or closed season?

Generally, people fish round the year in the rivers, beels, and haors using different types of gears. The ever-increasing number of fishermen and gears creates a pressure on this self-sustaining resource that causes a decline in production. That is why periodic ban on fishing has proved to be successful method for fisheries management. People impose a ban on fishing during critical periods of a fish's life cycle.

Why is periodic ban important?

One of the major causes of declining floodplain fisheries production and biodiversity is over fishing. Over fishing reduces and finishes the stock, as a result production and diversity gradually reduces. To overcome this problem and maintain a sustainable stock, periodic bans on fishing are proved to be a successful method.

How long should be the ban period?

Length of periodic ban should be determined based on situation and need. Fishing bans can be 1 to 3 months period, maybe less or more. In this regard, the number of fishermen and their rate of dependence should be taken into consideration.

Which period is suitable for fishing ban?

As because ban is imposed for a short period, it should be determined which period will be more effective to maximize production. Experiences in Pabna Irrigation Project on 6,773 Ha floodplain shows:

- **One-month ban** in January resulted in 102% increase in production, which is higher than any other month. If a 1-month ban imposed in April will increase production by 95%.
- **Two months ban** in January-February will result in 125% increase in production. Based on local situation ban during April-May period will result in 20% increase in production.
- **Three months ban** during January-March can result in 139% increase in fish production, which is more effective than any other period of the year. Three months ban during July-September would increase production up to 124%, during October-December it is only 68%.

Local decision on this is more important depending on the water extent of the period and seasonality.

Model predictions: Closures during any month are predicted to improve yields reflecting excessive levels of fishing mortality (Table 5). The greatest gains are achieved by closing the fishery in July or August when fish are still growing rapidly. Currently this fishery is being *growth over-fished* as reflected in the large predicted gains in yield-per-recruit (Y/R) when the fishery is closed during this period of rapid fish growth. Significant gains are also

predicted by closing the fishery in April when fish densities are high and fish are vulnerable to capture. Improved fish survival increases recruitment to the fishery later in June.

Three-month closures from June to August are predicted to increase yields by as much as 60%, although earlier closures between May and July also predicted to result in significant increases in yield. A closure during this period may be more acceptable to fishers.

Table 5: Model predictions of average recruits, natural mortality, yield, % gain in yield, fishing mortality and yield-per-recruit (Y/R) for monthly closures.

Closed	Recruits	M (y^{-1})	Predicted Yield (kg)	% Gain	F (y^{-1})	Y/R (g)
None	4873538	0.16	10186	0	3.27	2.1
June	5071325	0.16	10436	2	3.24	2.1
July	4947936	0.17	12547	23	3.25	2.5
Aug	5035625	0.17	12577	23	3.25	2.5
Sep	5216786	0.18	11544	13	3.23	2.2
Oct	5403782	0.18	10800	6	3.23	2.0
Nov	5289288	0.18	10529	3	3.23	2.0
Dec	5175803	0.17	10463	3	3.24	2.0
Jan	5149475	0.17	10473	3	3.25	2.0
Feb	5243845	0.17	10559	4	3.25	2.0
March	5693328	0.17	10940	7	3.22	1.9
April	5988554	0.17	11172	10	3.22	1.9
May	5262929	0.16	10466	3	3.23	2.0
Feb-April	8167682	0.20	12809	26	3.13	1.6
April-June	6935067	0.18	11863	16	3.13	1.7
May-July	5588908	0.18	13495	32	3.18	2.4
June-Aug	5325425	0.20	16974	67	3.20	3.2

With respect to the situation in Bangladesh, how long should a ban period be?

Considering the population presser and dependence on fishing, especially by the poor fishers, a short period of ban, 1-2 months, would be feasible.

Some other management tools:

1. **Gear regulation:** Harmful or destructive fishing gears are not allowed, mesh size of fishing nets are controlled. CBOs within their management areas can stop using current jal, fixed engines, moshari jal, dewatering, etc. This will stop destructive fishing practices and allow fingerlings to grow bigger.
2. **Regulation of size limits of fish:** Minimum size limits for specific species can be imposed on fish that may be retained on board any fishing craft or landed, or exposed or offered for sale. This will allow big fish to grow up to its first spawning year at least.
3. **Quota system:** In principle the quota on catch (a fixed maximum catch per year per gear) is a direct regulation. It needs much data on the productivity and production. For Jalmohals in Bangladesh and in many other places it is very difficult to apply.
4. **Limited entry:** Allows only the limited number of fishermen required to cause the desired mortality, but allowing them to fish freely. For a Jalmohal this can be determined by the CBOs along with GoB and NGO officials.

5. **Licensing:** Keeping the capacity at the desired level compared to the potential of the resource needs some type of licensing system.
6. **Leasing of fishing rights of a water body:** Control goes to one person or to an organization.
7. **The improvement and increase of living resources:** Through physical interventions like stocking and habitat improvement.

Table 6: Comparison of different methods

Method	*Data requirement*	*Cost involvement*	*Objective*	*Efficiency*	*Fishers acceptance*
1. Closed season	Medium	Low	Increased spawning success	Efficient	Medium
2. Protected area	Low	Medium	Protect mother fish	Efficient	High
3. Gear regulation	High	Medium	Reduced & selective fishing	Medium	Low
4. Regulation of fish size	Medium	Medium	Fish attains maturity	Low	Low
5. Quota	High	High	Maintains optimum fishing pressure	Low	Low
6. Limited entry	High	Medium	DO	Low	Medium
7. Licensing	High	Medium	DO	Medium	Medium
8. Leasing system	Low	Low	Revenue/ one man/body controls	Medium	Medium
9. Physical Improvement of resource	Medium	High	Re-establish habitat	Efficient	High

Difficulties of open water fisheries management in Bangladesh

1. Number of dependent or user is very high.
2. National level policy and planning is not resource friendly.
3. Sufficient information for scientific management is lacking.
4. People (users mainly) are not aware of the sustainable use of the resource.
5. Many other factors beyond wetlands are also responsible for resource degradation.
6. Fish acts needs review and are not properly enforced.

Session 6. Crop Diversification in Floodplains

Objectives:	Attending this session participants will be able to describe and explain: i. the existing cropping pattern and need for diversification in floodplains; ii. the process of selecting suitable crops for floodplains; iii. brief cultivation method of some selected crops; iv. cost-benefits of the selected crops with boro rice.
Time:	3 hours.
Methods:	Presentation, brainstorming, participatory discussion.
Resource Materials:	OHP/Multimedia slides, Handout: "Crop Diversification in Floodplains".
Equipments:	OHP/Multimedia projector, white board, flipchart board, flipchart paper, marker, adhesive tap.
Process:	Step 1. The facilitator will initiate the discussion through introducing the topic, through brain storming he will figure out the existing cropping pattern of floodplains. He than will present the systems implications of boro rice cultivation in the floodplains. Step 2. The facilitator will invite participants in a group work. The participants in small groups will identify suitable crops for floodplain areas and the reason why they have selected them. Each groups will present their findings. Step 3. With assistance from the participants the facilitator will analyze cost and benefits of some of the selected crops and compare with the cost and benefits of boro rice. The facilitator will conclude the session.
Notes for Facilitators:	The facilitator will clarify that the floodplain is not only for growing rice, there are many other resources in the floodplains including fish. Diversified cropping pattern will be helpful for all the resources, as well as it will benefit farmer more.

Crop Diversification in Floodplains

In Bangladesh floodplains are predominantly converted into rice fields, more over Water Development Board (BWDB) every year constructing embankments and other structures so that farmers can bring perennial part of a beel under rice cultivation, destroying the habitat inhabitable for original aquatic life thus reducing resources production and other goods and services of wetlands.

Where and when is boro rice cultivated?

At present most of the floodplains and surrounding high lands are cultivated with boro rice in the dry winter season. Generally, boro rice is planted during December-January and harvested in April-May. Boro rice demands a very high quantity of water that is 3-4 times that of other rabi crops that are cultivated in the winter season. This uses the water from beels, canals and rivers and further reduces the already reduced aquatic habitat in critical dry season. That is why instead of single boro rice if diversified cropping is practiced in the floodplains, it will be beneficial for both farmers and the aquatic habitats.

What kind of problem created for fish by cultivating boro rice?

Analysis of situations suggests that boro cultivation in the floodplains has 3-fold effects on fish. All 3 effects are very harmful natural fisheries (Figure 5). It is to be noted here that 1 ha boro rice cultivation demands 10,000 cub.m. of irrigation water.

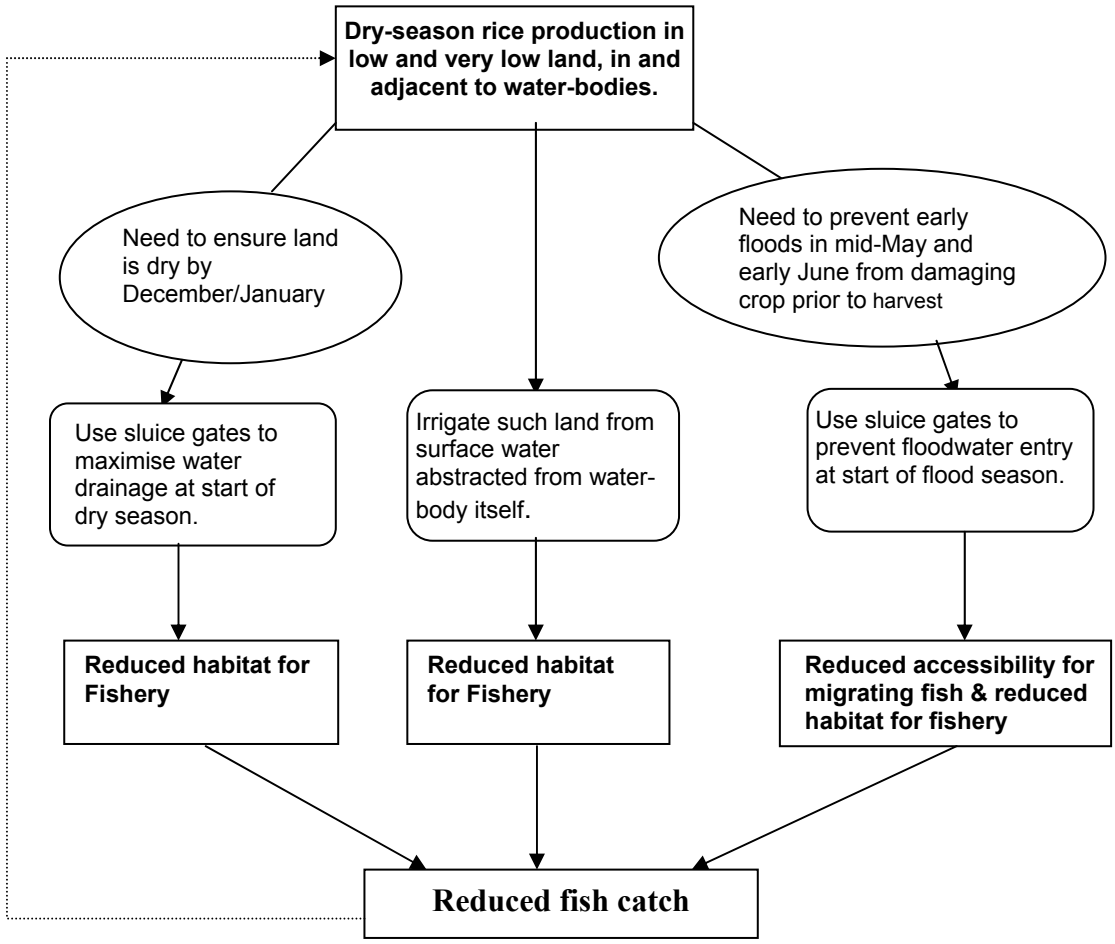
Firstly, farmers tend to drain out water to dry-up and prepare land for boro rice cultivation at the beginning of dry winter season during November-December.

Secondly, during intercultural operation farmers uses water from the beels, canals, rivers and other surface water sources to irrigate the *boro* rice. This further reduces the already reduced aquatic habitat.

Thirdly, during the early flooding time in April-May they stops entry of early rainwater into the floodplains till the rice is harvested. Brood fish, fry-fingerlings cannot migrate from one habitat to another which is a part of their life cycle.

All these activities reduces and destroys dry season fish habitats disrupts fish migration. The obvious result is reduced fisheries production and biodiversity.

Figure 5: The systems implications of lowland winter rice production



Dry season rice production in the beel/very low lands thus lies at the heart of the problems studied here. Firstly, sluices are opened to maximise drainage out of the floodplain at the end of the flood season, so that lowland will sufficiently dry out for rice cultivation. Secondly, proximity to the water-body encourages the subsequent irrigation of such plots from the residual water in the water-body. Thirdly, low-lying rice plots are most susceptible to damage from early flooding prior to harvest, which leads to pressure being put on sluice gate authorities to keep gates closed in the early flood season.

Through these process wetlands are loosing their natural productivity, resulting in loss production and biodiversity of fish and other aquatic animals and plants. The question here is, whether the water will be used for rice alone or for both rice and fish.

What is *rabi* crop diversification?

Diversification of *rabi* crops means here to reduce cultivation of water hungry *boro* rice in the floodplains and increase other *rabi* crop cultivation; those need much less irrigation water. The main objective is to reduce the use of *beel* water, which is critically needed for fish and other aquatic life at that time. Experiments shows that there are a range of alternative crops that can be cultivated successfully in the floodplains instead of *boro* rice, and can benefit farmers even more using only one-quarter of the irrigation water. This will also benefit fishermen by improving fisheries.

Why is crop diversification for floodplains are needed?

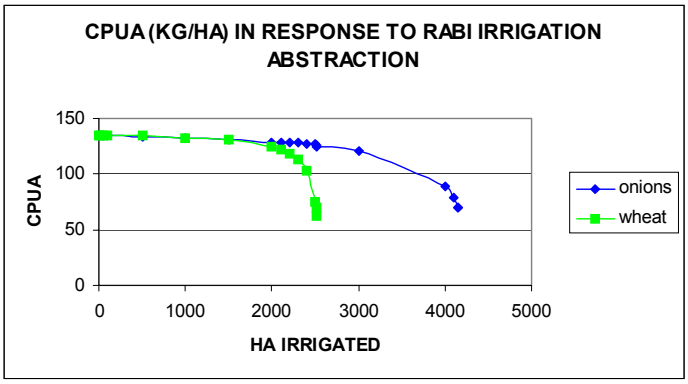
The dry season is the most critical period for floodplain fish, water in the beels or other depressions becomes scarce, and sometimes dries up completely, making the habitat uninhabitable for aquatic life. That is why it is important to keep sufficient water during dry season in the *beel* so that at least some mother fish can be sustained. However, *boro* rice cultivation in the floodplains is a big obstacle in this regard. To cultivate *boro* rice farmers tend to drain out *beel* water as soon as possible, and will use up the remaining *beel* water for irrigation. At the end, before harvesting, they will keep the gate closed, preventing early floodwater from entering the beels. As a result, beels are dry and aquatic life under threat.

An experiment in Pabna Irrigation Project shows that after irrigating 500 ha *boro* rice fish production reduced drastically and fisheries completely collapsed after irrigating 700 ha *boro* rice (Figure 1).

What benefit for fisheries from cultivation of alternative *rabi* crops?

If the floodplains are cultivated with maize, wheat, potato, garlic or other *rabi* crops, those requires much less irrigation water, it will help keep more water in the *beel* for fish. Pabna Irrigation Project experiments suggest that even after irrigation of 2,500 ha. for wheat, it is possible to obtain a fisheries production up to 50 kg/ha. If onions are cultivated, the same amount of fish can be obtained even after irrigating 4000 ha. (Figure 6). This clearly shows that the *beel* fishery can be protected if diversified cropping pattern can be introduced.

Figure 6: CPUA – Hectares irrigated relationship for alternate *rabi* crops



What are the benefits of *rabi* crop diversification?

- If floodplains are cultivated with diversified *rabi* crops, it will benefit the farmers more and this will also be benefited for the aquatic ecosystem through retaining more water in the dry season.
- Other rabi crops can be harvested 3-4 weeks earlier than boro rice thus can avoid the risk of damage by heavy rain or early flooding.

Table 7: Expected irrigation demands for *rabi* crops at Jhendiah (mm per ha for *rabi* season, not including land soaking and preparation demands)

Rabi	Irrigation
HYV Boro	835
Wheat	200
Maize	240
Brinial	320
Onion	175
Potato	190

- As the crop is harvested well in advance, the sluice gates can be kept open during early flooding to facilitate fish migration.
- Diversified cropping in rabi season and deep water Amon cultivation during monsoon will benefit the farmers as well as will provide an improved habitat for fish.
- If sufficient water can be retained in beels, it is possible to increase fisheries production to a satisfactory level.

What are the suitable alternative rabi crops?

Many alternative rabi crops such as wheat, maize, onion, garlic, potato and many other vegetable crops can be beneficially cultivated in the floodplains of Bangladesh. (Crop selection should be done based on soil quality) These crops need much less irrigation water (Table 8), thus keeping some more water for fisheries.

Table 8: Performance of alternative rabi crops demonstrated at Charan Beel site in year-1 (October'03-March'04)

Crops that performed best	Crops that performed fairly well	Crops that did not do well - not suitable (or further trials are required)
Tomato	Chilli	Onion
Maize	Wheat	Water melon
Sweet gourd	Potato	Bush bean
Egg plant	Datta	
Bitter gourd	Cucumber	
Radish	Lintel	
Long yard bean	Kalai	
Red Spinach	Motor shuti	

Some Piloting Results

Eighty-five farmers piloted alternative rabi crops in Charan Beel area during 2003-'04 rabi season with the assistance from CNRS and local DAE officials. The major crops were wheat, maize, potato and garlic. The results are presented here.

Comparing the cost and returns of all rabi crops demonstrated in Charan Beel, the results from potato was found encouraging (Figure 7 and 8). In absolute term, the gross returns of potato, of Tk.43,573/ha, was found to be the highest. However, the initial investment needed for potato was also the highest (Tk. 53,045/ha). Although the gross return from potato was highest, the amount of return was found low, at 82% of the investment. Thus, one has to invest relatively more money to cultivate potato.

Next to potato, garlic produced the second highest return, Tk. 33,678/ha. The cost of production of garlic was also higher (Tk. 26,600/ha) than that of wheat and maize. However, in case garlic the net return over investment was higher (126.61%).

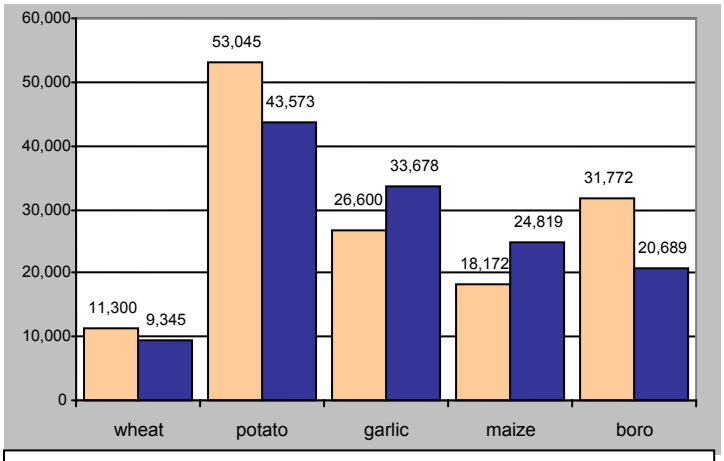


Figure 7: Comparative cost-benefit of boro rice and 4 alternative rabi crops cultivated in Charan Beel

Comparing all rabi crops, the highest return over investment of 137% was recorded for maize crop where Tk.24,819/ha was the net return against the production costs of Tk. 18,172/ha only.

Wheat produced the least return of Tk. 9,345/ha was achieved in absolute term. The investment in wheat was also very low, only Tk. 11,300/ha. However, return over investment was 83%, which is similar to that of potato (82%) and higher than that of boro rice (65%). Thus, wheat can be considered as the cheaper crop. With relatively low costs, this can be grown. Thus, wheat should be a good choice for the poor farmers in the rabi season.

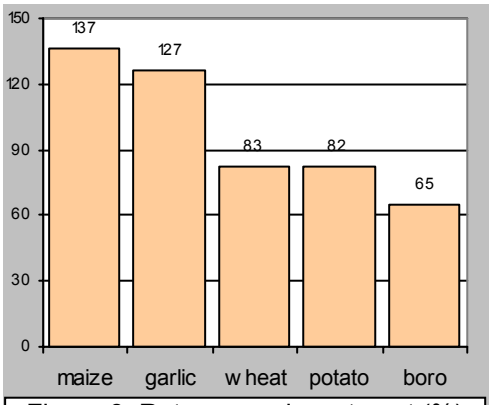


Figure 8: Return over investment (%) for different rabi crops

As observed, in terms of income, boro is not that bad. Although the investment in boro is higher than many rabi crops (except potato) the net return was found nearly double than that of wheat and near to maize. However, due to the cost-benefit ratio boro, it is not the right choice for farmers. Figure 13 shows that the net return over investment in boro was 65% only, was the lowest than all other rabi crops.

Based on the production performance and analysis of cost-benefits of different rabi crops, it can be concluded that all the four major alternative rabi field crops demonstrated are suitable for the Charan Beel site. Therefore, depending on land elevation and soil quality, farmers can continue cultivation of these rabi crops profitably along with boro rice.

Session 7. Sluice Gate Management

Objectives:	After attending this session participants will be able to describe and explain: i. present management practice of sluice gates and its impact to floodplain fisheries; ii. how to operate sluice gates in a fish friendly way.
Time:	45 minutes.
Methods:	Presentation, brainstorming through question and answer.
Resource Materials:	OHP/Multimedia slides, handout on: "Sluice Gate Management".
Equipments:	OHP/Multimedia projector, white board, marker.
Process:	The facilitator will initiate the discussion with introducing the topic; he will present sluice gate structure, its present practice of operation, its impact on floodplain fish migration and fisheries production. After that he will present the methods and ways of fish friendly operation of sluice gates.
Notes for Facilitators:	Present practice of sluice gate management is only targeting rice that is harmful for fish and other aquatic resources. But there are ways to manage sluice gates in a fish friendly manner, which will not harm rice but benefit aquatic resources within the floodplain. The ways and means of fish friendly operation of sluice gates also needs to describe and explain. Participants should be as much as possible included in the discussion process and share their local experiences.

Sluice Gates Management

There is 653-flood control and irrigation (FCDI) schemes at present exist in Bangladesh and are impacting 5.5 million ha. wetlands. FCDI schemes are beneficial to the farmers, but at the cost of fisheries production and livelihood of millions of fishers and the natural wetland environment. This session first tries to create an understanding of the impact of these sluice gates in general, secondly, to suggest a fish friendly management of the sluice gates.

What is the significance of obstacles to fish migration?

One of the main reasons of the loss of floodplain fisheries production and biodiversity is the loss of migration facilities to complete fish's biological cycle. As a result spawning and growth of fish is hampered, production decreased, biodiversity threatened.

What are the major obstacles?
Studies identified followings as the major obstacles to fish migration:

1. **Flood control and irrigation projects:** At present there are 653 such projects in the country that are negatively impacting 5.5 million ha. wetland. Fish migration to and from these wetlands is either completely or largely stopped. Generally three types of structures are built in these sorts of projects:
    a. **Earthen embankments along the river** to protect spill over from the river to adjacent crop fields, floodplains and beels.
    b. **Mouth of Canal blocked** to stop river water entering the beels or floodplains through canals.
    c. **Regulators at the mouth of canal/distributaries** to regulate entry of water to adjacent beel or floodplains.

    All these three types of flood control structures hamper fish migration. Among them, regulators are less harmful if operated in a fish friendly manner, allowing limited fish movement, which is possible without hampering rice production.

2. **Catching migratory fish:** With the onset of monsoon, when fish start to migrate, many people begin catching fish in, and at the mouth of, canals / small links that are used as their migratory routs. Studies revealed that 50% of the migratory fish are caught before reaching the regulators.

3. **Silted up of the canals:** Due to afforestration and unplanned land use land slide and erosion has increased in the hills and uplands and as a result canals and small rivers are being silted up. As a result, water flow through them either completely stopped or reduced significantly, which is hampering fish migration. Silted up of the canal between Juginee Beel and Laohajang River at Tangail District is a good example, where the fish production in the beel reduced suddenly as the connection was disrupted and no fish could enter into the beel from the river.

4. **Fishing at the regulator or sluice gate points:** There are 4,190 regulators or sluice gates in 653 FCDIs. When fish tries to enter into the floodplains through them people sets net and other gears there and catches up the fish those were able to escape from catching in the canals.

How to remove these obstacles to fish migration?

- Re-excavation of silted canals, so that early season flooding water carrying fish spawn and hatchlings can enter into the floodplains through them.

- Stop catching migratory fishes, while they are going one habitat to another for breeding or growing.
- Stop fishing at the regulator points by using nets, spears or other means especially during spawning migration.
- Keep the gate open during fish migration period, especially during spawning period to allow brood fish and spawn/hatchling movement. The sluice gate committee can do this with out hampering rice.
- Declare as seasonal sanctuary can also protect fish from catching in canals or at the mouth of the sluice gate or regulator.

Why fish friendly operation sluice gate required?

To protect rice crop in the floodplains there are about 13,000 km embankment and 4,190 sluice gates constructed under 653 flood control and irrigation projects in Bangladesh. As a result 5.5 million ha. of floodplain are directly impacted. These sluices and embankments have severely impacted and reduced fisheries production and species diversity of the areas. This is why operating the sluice gates in a fish-friendly manner is very important. Research reveals that fish and crop friendly operation can benefit both, and increase fish production significantly and conserve species diversity.

What is fish friendly operation of sluice gates?

Sluice gates are operated mainly targeting crops, they are opened or closed to benefit crops alone. Natural fish movement never considered in this regard. But sluice gate management should be in such a manner that allows fish movement from one habitat to other in need and in time, which is urgent for fishes in the nature to propagate and survive without damaging rice, this way of sluice gate operation can be denoted as fish friendly sluice gate operation. It will enhance fisheries production and will conserve species diversity as well.

This sort of operation of the sluice gate needs the willingness of the committee, close observation on day-to-day water extant and decision-making. It will be possible to achieve if the committee is well motivated and have fisher representatives.

How important is fish friendly operation of sluice gates?

In different parts of Bangladesh there are four very expansive fish passes are constructed to allow fish movement to and from river and enclosed floodplains. However, all the four fish pass are ineffective at present due to technical and management faults. Considering the situation local people and the scientists suggests that instead of constructing more costly fish passes it would be prudent to establish a fish friendly operation of the existing sluice gates, where the gate will be closed or opened coordinately to allow fish movement through them whilst at the same time protecting crops. Fishermen and farmers representative will jointly discuss and decide. Piloting results proves that it is possible to increase fish production considerably with out hampering crops in this way.

How to operate a sluice gate in a fish friendly manner?

Sluice gate should be kept open with the onset of monsoon when fish starts moving from floodplains to river and river to floodplains so that fish and fish spawn and hatchlings can move one habitat to another as per their need. At the same time it should be regularly monitored whether floodwater is damaging the crops or not. Again, at the end of the monsoon gate should be kept closed as long as possible to maintain sufficient water inside the embankment to allow fish to grow for a longer period too, this will also increase fisheries production.

What are the principles of fish friendly sluice operation?

To enhance fisheries production within flood control projects 6 principles should be followed:

- Gate should be open frequently at the onset of monsoon to allow fish to enter into the floodplains, but water scours should be avoided at the mouth.
- At the end of monsoon when water starts to recede, the water should be released slowly.
- At the end of monsoon some more water should be preserved inside the embankment as long as possible, this will allow fishes a longer growing time.
- The connectivity's from river to gate and from gate to beel should be well protected; fishing is controlled to allow fish, spawn and hatchlings to enter.
- Framers should be motivated so that they will grow early harvestable low water demanding crops instead of boro rice so that it will be possible to keep the gate open for longer period and well in advance.

  All this activities should be done with the participation of local community and all stakeholders including farmers and fishers.

Session 8. Land Retirement

Objectives:	After attending this session participants will be able to describe and explain i. in relation to present agricultural practice why land retirement is important; ii. which lands are suitable for sacrifice for fisheries and how to achieve.
Time:	45 minutes.
Methods:	Presentations, brainstorming, small group work, open discussion.
Resource Materials:	OHP/Multimedia slides, handout: "Land Retirement".
Equipments:	OHP/Multimedia projector, white board, Marker.
Process:	The facilitator will initiate discussion by introducing the topic. He will present the present farmers practice of gradually extending rice cultivation and acquiring wetlands and justify why land retirement is important for floodplain management. He will also highlight which lands are suitable for retirement and the social and institutional approach for achieving this.
Notes for Facilitators	Land retirement is a newer and less attractive option for farmers but important for fisheries. So it is important to emphasis on the process of community management.

Land retirement

A natural outcome of the dry season sluice gate management strategy outlined above is the 'retirement' of some previously *boro*-cropped land from cultivation. As discussed above, this needs only be a small fraction of the total cultivable land, in the deeper areas of water-bodies, and adjacent to drainage channels. There may also be value in strategic retirement of occasional parcels of further land – for instance, plots vulnerable to early flooding[2], for the protection of which landowners petition sluice gate controllers to keep gates closed in the early flood season. Critically for the feasibility of this strategy, estimation is that these retirements need only constitute a small fraction of overall cultivable land in individual floodplain hydrological units.

Which Lands are Suitable for Retirement and how can this be achieved?

As the water decreases farmers tend to plant rice on those lands in the beel beds, these lands are mostly khas. These lands are at high risk of flood damage in the early flooding season. Returns of rice from these lands are quite uncertain; these lands are suitable for retirement. But the success depends on how to motivate farmers to abstain from planting on these lands.

Experience suggest that motivate farmers not to plant rice on these sorts of land is difficult. Strong motivational work with awareness is required under long term programmes. Incentives for doing this might attract farmers to abstain from cultivating such lands.

[2] Although, these may be the same very low plots that are inundated by increased dry season water retention.

Session 9. Habitat Degradation: Problems, Issues, and Participatory Habitat Restoration

Objectives:	After attending this session participants will be able to describe and explain i. present status of floodplain habitats of Bangladesh; how they are degrading, what are the related problems and issues; ii. how to restore habitats in a participatory way.
Time:	1 hour 30 minutes.
Methods:	Presentation, brainstorming, discussion, small group work.
Resource Materials:	OHP/Multimedia slides, handout on: "Habitat Degradation: Problems and Issues and Participatory Habitat Restoration".
Equipments:	OHP/Multimedia Projector, flipchart paper, flipchart board, white board, Marker.
Process:	Step 1. The facilitator will initiate the discussion through introducing the topic. He will make a presentation on present status of floodplain habitats. Step 2. He will than invite participants for a small group work on how these floodplains are degrading, what are the problems and issues arising from this degradation. Each group will present their findings and discuss. Step 3. The facilitator will identify activities for floodplain habitat restoration with the help of participants and note them on the flipchart paper. He will than with the help of participants determine the ways and means for accomplishing them. The Facilitator will conclude the session.
Notes for Facilitators:	Present status of specific habitat and activities for restoration to be identified before hand through PAPD. During implementation detailed action plan preparation and accomplishment is better to do with a local existing or formed organization.

Habitat Degradation: Problems, Issues, and Participatory Habitat Restoration

A habitat is the home or the area where an organism lives. Habitats include all the features of the environment.

Due to various anthropogenic and natural causes, the wetland habitats in Bangladesh are under threat. Most of habitats in the floodplains have been degraded, many habitats have been degraded partially and degradation initiated in the remaining habitats. In fact, there is no habitat left in Bangladesh, which is free from any disturbance or in other words, there is no habitat in its natural condition. However, there are a few in near natural condition where the anthropogenic interventions are less due to difficulty in access or under stringent control of an organization or agency.

Sustainable management of inland open water fisheries therefore requires understanding of floodplain environments, biology of fish species or guilds and interrelationship of fish and physical habitats in dynamic floodplain ecosystems through which the robust fishery of multiple species composition attain a self-sustaining status in nature.

The major causes of degradation of wetland habitats

- Siltation of the wetland beds
- Conversion of wetland into crop lands
- Fragmentation of wetland due to road and other infrastructure
- Water control dykes and regulators
- Clearing of forests from wetlands
- Clearing of trees and vegetation in the watershed
- Unsustainable cultivation practices in the watershed

How have these degradations taken place?

All these are man-made and by the people at various hierarchies of use, who manage and control the wetland habitats. For example, local people encroach in the wetland, grab khas lands, and convert them into croplands. They carry out unsustainable cultivation practices in the watershed, and cut trees in the swamp areas, as well as in the watershed and riparian areas. Government agencies construct flood control dykes, regulators and rural roads at seldom consider wetland ecology and related issues, sustenance of inland capture fisheries production and livelihood aspects of floodplain communities. Due to lack of trans-boundary management arrangements with the upper riparian countries, Bangladesh receives huge quantity of silt, which rapidly fills up the wetland habitats thus degrading the habitats, resulting reduced fish yield, and declining species diversity.

The overall scenario is alarming. Lack of a proper and effective policy to protect the wetlands in Bangladesh generates frustration therefore; ways and means of protecting the valuable fishery in the open waters are at risk. Scientific knowledge and information base on the underlying facts and issues of wetland functions, values, and contribution to the income and livelihood of the millions of rural people in Bangladesh is not in an articulated form. Although there are many studies and projects generating important information and outputs including suitable approaches in floodplain resource management, concrete guideline to move forward is still lacking largely due to patchy information and division of interests and responsibilities

Restoration of wetland habitat

What is restoration of wetland habitat?

Restoration of habitats can be defined as the activities undertaken to bring back the degraded or semi-degraded wetland habitats in to their functional stages**.** The restored habitats should be brought to a stage so that the said habitats after restoration can support a species or group of species or a community or communities to perform its or their relevant required natural functions at different life stages viz. migration, reproduction, feeding, growth and refuge. For example, if a canal is restored, fish and other aquatic biota can perform their migration, similarly if a degraded beel is restored to a perennial stage, then fish and other aquatic biota can have year round habitat for feeding, growth and refuge (in the dry season).

Wetland restoration can be defined as reestablishment of a disturbed or altered wetland as one with greater function or acreage. This may involve re-establishing original vegetation, hydrology, or other parameters to re-establish original or closer-to-original wetland functions (Fields, 1993). Degraded wetlands present restoration opportunities for improvements to water quality, habitat, water storage and other functions, and these opportunities can be particularly useful for watershed-scale environmental planning. The goal of restoration is typically to re-establish wetland ecosystems to levels that existed before human influence.

How to assess restoration activities?

Ideally, restoration of a wetland habitat should be assessed through comparing the changes of value and functions of a wetland by capturing pre and post restoration information. Such effort is usually considered very much scientific research. However, to assess the changes of fisheries resources due to the restoration of habitat, following methods/process could be considered as worthwhile and easy to adopt at the project level, since the approach is new and is being tested in Bangladesh.

How to do social monitoring?

Household monitoring program is an indirect tool of assessment of habitat restoration that focuses on overall value. The objective of this program is to compare the changes associated with capture fisheries due to restoration/intervention. Household monitoring program can be designed to generate pre and post project database on:

- Fish and aquatic resource consumption
- Species diversity
- Involvement of people in fishing and aquatic resource harvesting
- Fishing income

Following two methods can be adopted in collecting data from the sample households:

a) <u>Traditional Method:</u> Traditional method refers to the conventional method of data collection through deploying trained enumerators to selected households using structured questionnaires. Resident Monitors (RMs) from the respective local villages can be deployed to collect data from the sample households.

b) <u>Participatory Method:</u> Participatory method refers to the process of data collection involving rural women or students who have basic literacy and numerical skills for using very simple data cards. They can record information from their own household and from adjacent households for

selected days in every month by direct observation. They can also use traditional balance for weighing fish and others.

How to do biological monitoring?

A direct way to measure the changes in fish production and species diversity in the wetlands within a restored area is to follow a catch-monitoring program to generate pre and post intervention data; however the survey methods can be complex and may not cover the overall values. The points are:

- **Fish harvest**
- **Species diversity**
- **Fishermen types and fishing intensity**
- **Fishing methods and arrangements**
- **Fish migration**

What should be the approach?

To achieve the objectives of restoration of a wetland, implementing agencies should critically assess the associated activities and to be systematic in approach of each of such activity. Emphasis should be given to involving the local people in the site identification, planning, and implementation processes. To this end, measures should be taken to incorporate the people's knowledge and perceptions in the implementation framework as well as to preserve/ensure interests of various occupational and stakeholders groups likely to be affected by the restoration. Some points are listed below which are important to consider during planning:

1. The activity is planned with the CBO from the beginning and wider community is fully aware.
2. Physical and biological benefit of the plan must be determined.
3. Period for earth cutting or any other physical activities will be very short in open water bodies.
4. The soil type and condition must be checked and plan made accordingly.
5. In some cases dewatering will be helpful to start early.
6. Plan for place and proper dumping of earth.
7. Vested interested group of people will show up.

How to select a site?

In selecting the site, different activities have to be carried out at various stages. The stages and activities are briefly presented below:
At the first stage, several visits are to be paid to working areas. Various types of maps and satellite imagery should be collected and used to locate suitable wetlands for restoration viz. *beels, khals* in the working area. During such reconnaissance visits, preliminary discussion should be undertaken with the local community and officials regarding restoration concepts and components, and other related aspects of possible sites.

However, some basic criteria should be set to select the restoration sites

- The site should be as such that fish migration is obstructed or delayed due to choking of *khals* due to siltation due to rural infrastructures which act as a hindrance;
- The proposed intervention would not adversely affect socio-economic and ecological functions of the wetland;
- There exist community interests and consensus of the proposed rehabilitation of *khals* and *beels*.

Habitat restoration should be part of an overall management plan developed through participatory planning by the local community with local government. Steps involved in such a process include:

- Reconnaissance survey, area demarcation and resource mapping.
- Stakeholders' identification and categoraization.
- Orientation of local government (UP, Upazilla etc.).
- Participatory planning, for example PAPD with direct stakeholders' to identify problems and agreement on possible solutions and priority actions.
- Formation of implementation committee from the resource users communities.
- Develop detailed proposal.
- Commission necessary approvals from respective government department and local government body.
- Generate/collect resources for implementation of project activities.

How to calculate the cost of restoration?

The major cost required for physical intervention in a restoration program is for earthwork. Head wise percentage of cost analysis in earthwork activities has been made on the basis of CNRS experience in 2001 (Table 9).

Table 9: Cost analysis of earthwork activities, % Distribution of costs by types of activities.

Direct labor for earth cutting	Labor for casual maintenance work	De-watering	De-weeding	Honorarium	Meeting	Transportation	Photocopy & stationers	Miscellaneous
88.01	2.27	3.29	0.33	3.05	0.15	1.21	1.65	1.65

It is experienced that average earthwork cost for wetland restoration (in a beel) is Tk. 1,240 per 1000 cft and therefore a total of Tk. 420,000.00 is required to excavate 3 feet depth in one-hectare beel area. In addition, a few labourers are required for accomplishing some casual works (not directly involved in earthwork). Very short time period is available for earthwork in wetlands. To undertake the earthwork, in some cases, de-watering may be required. Local committee designates a few community people/ committee members for supervising the earthwork activities and therefore they are paid honorarium for their job. Committee sits in a series of meetings for earthwork. Local people are hired to serve the notice and there are other costs to hold meetings viz. refreshment, conveyance etc. Transportation cost is required for project staff, engineer, shifting of equipment during earthwork. A large amount of photocopying is needed for reproducing master roll, proposals, minutes, and other necessary papers. Stationary like measurement tape, file, scale, pen, stapler, etc are also required. Miscellaneous cost covers various types of compensation for community viz. damages of standing crops, and to meet unpredicted expanses.

Session 10. Watershed Management

Objectives:	After attending this session participants will be able to describe and explain i. present status of watersheds in Bangladesh, how they are degrading and what are the related problems and issues; ii. how to do watershed management and what are the activities.
Time:	45 minutes.
Methods:	Presentation, brainstorming, participatory discussion.
Resource Materials:	OHP/Multimedia slides, handout on: "Participatory Watershed Management".
Equipments:	OHP/Multimedia projector, flipchart paper, flipchart board, white board, marker.
Process:	Step 1. Through introducing the topic the facilitator will initiate the discussion, and will create an understanding on watershed and its importance for concerning floodplains. He will than make a presentation on present status of the watersheds, causes of degradation and its consequences on the floodplains. Step 2. Through brainstorming he will list down activities for watershed management and ways and means for achieving them. The facilitator will conclude the session.
Notes for Facilitators:	Watershed and its issues may be a new area for most of the participants so a elaborate explanations might be required. Again, for many floodplains watershed may be beyond their reach or a cross boundary issue.

Session 11. Consensus Building Among Stakeholders

Objectives:	After attending this session participants will be able to describe and explain i. the importance of consensus building among stakeholders in IFM; ii. method and process of consensus building among primary and secondary stakeholders.
Time:	2 hours.
Methods:	Presentation, brainstorming, participatory discussion, small group work.
Resource Materials:	OHP/Multimedia slides, Handout: "Consensus Building Among Stakeholders".
Equipments:	OHP/Multimedia projector, white board, flipchart board, flipchart paper, marker, adhesive tap.
Process:	Step 1. The facilitator will initiate the discussion through introducing the topic. He than will invite all the participants to a group work by dividing them into small groups. In small group they will work out: i. Who are the primary and secondary stakeholders of floodplain resources? ii. Why it is important to build consensus among the stakeholders? Step 2. The facilitator will present the process of PAPD method in building consensus among the stakeholders. During the process of presentation he will involve participants to share there experiences elsewhere. The facilitator will conclude the session.
Notes for Facilitators:	Floodplains are multi resource system used by multiple stakeholders. So for an participatory integrated management of these resources consensus among the stakeholders is a must. At present PAPD is being used by many organizations for participatory programms for sustainable management of common property resources in particular. This session is planned for creating an understanding among the participants on the need and process of consensus building. Doing PAPD in reality will require more training.

Consensus Building Among Stakeholders

Consensus building among the stockholders in integrated floodplain management is very important, mainly because this will deal with multiple stakeholders and with multiple resources. Intervention in any of the resources systems might influence others, more importantly management of all the resources system would ensure a sustainable production of the natural system.

CNRS evolved and using PAPD for consensus building among multiple stakeholders successfully for several years in natural resources use and other cases.

What is PAPD?

PAPD (Participatory Action Plan Development) is a participatory method for building consensus among multiple stakeholder groups on the sustainable management of natural resources. PAPD uses different participatory tools to reach consensus amongst the community on actions that area needed to improve the management of natural resources. The method recognizes the many stakeholders involved in the management and use of natural resources and ensures that all stakeholders' views are represented. PAPD encourages community participants to respect others' concerns and appreciate their dependency on the resource base as well as the function and values of the resource systems. A flowchart below shows the PAPD process sequentially.

In PAPD processes, the participating stakeholders will identify problems related to the natural resources within their locality and prepare a consensual plan on solutions through analyzing each of the prioritized problems. An action plan is then developed with the participation of all stakeholders' (both primary and secondary). The method requires active participation of stakeholders from different occupational groups and classes as it gives an opportunity for their opinions and concerns to be discussed and recognized. The method can potentially reduce conflict during project implementation and if the situation arises it assists the local people with resolving it. Thorough the process the local users of certain resources understand the importance of their participation in all the steps (starting from identification of problems, deciding upon solutions, preparing a work plan and in implementation). This enables them to feel a sense of ownership and play a more effective role during implementation of solutions.

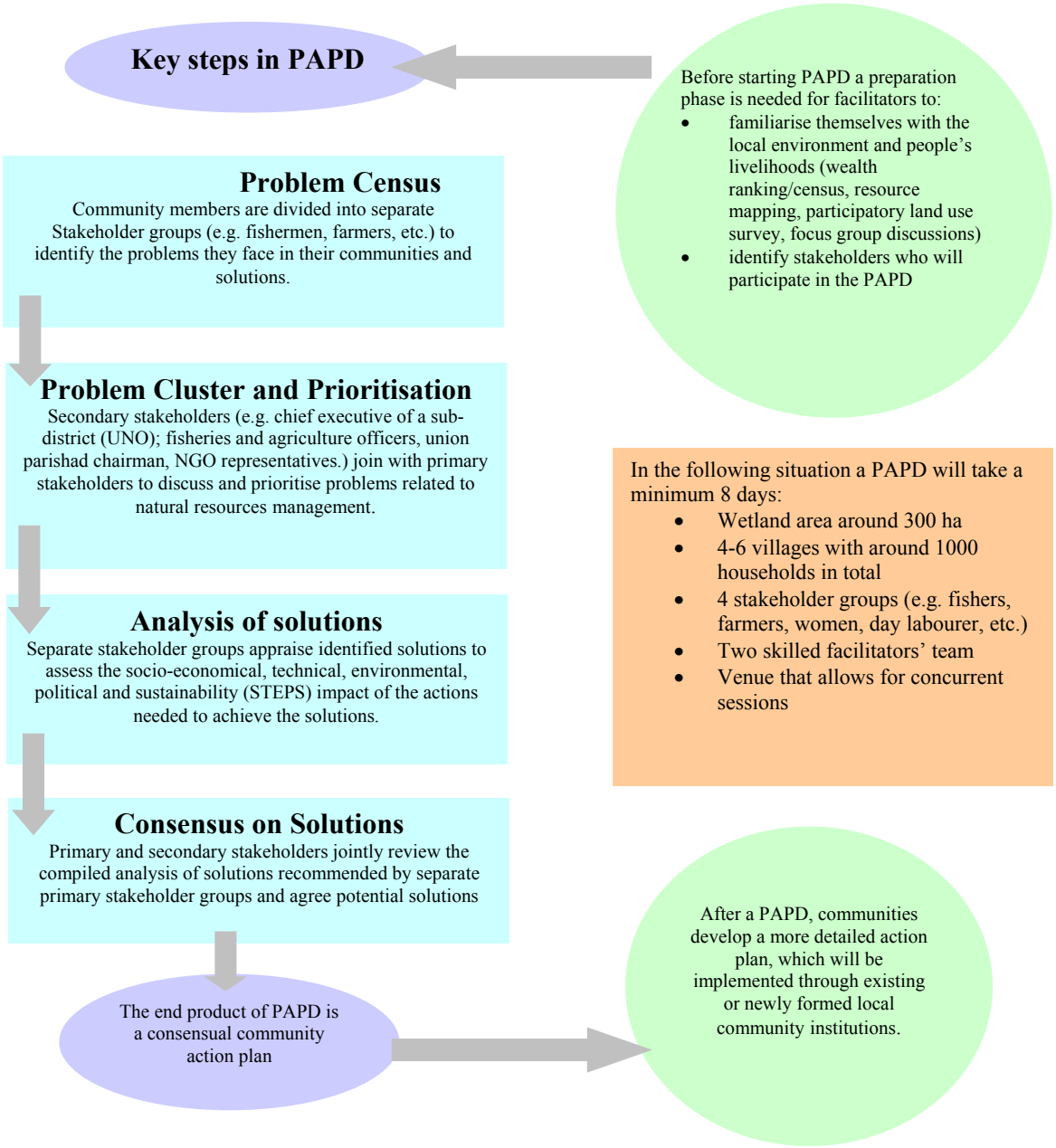


Figure 9: Flow chart showing major steps of PAPD

When is PAPD used?

Rural people, especially the poor, are directly dependent on common pool resources within their locality. The increasing pressure on these resources, along with unplanned use causes rapid degradation of the resources. Considering all these factors, the need to practice sustainable resource management is inevitable, where all the stakeholders and their representatives participate in planning and implementation processes through consensus.

At present both non-government and government sector projects involved in natural resources management emphasise the participation of local stakeholders for their improved livelihood and sustainability of resource base. Government agencies in Bangladesh are central to any common pool resources management in the country (for example, the Department of Environment, Department of Forests and Department of Fisheries). There are also many national, international and UN organizations involved in participatory resource management initiatives, which aim to benefit the poor. PAPD is an appropriate method for all these organisations. PAPD can ensure effective participation of user communities to achieve

their development goals. Some of these organisations in Bangladesh have already started using PAPD in developing management plans for natural resource management.

PAPD can be used at different levels to involve stakeholders from different professional groups, agencies and departments and specialists from different disciplines, to prepare a sustainable resource management plan. PAPD can help to build multi-level stakeholder platforms for decision-making. The potential levels for practicing PAPD are at local, regional and national.

So far many projects involved in the management of natural resources (e.g. wetlands, fisheries, forests, land, coastal resources, etc.) have received encouraging results through using PAPD, though primarily at a local level. Initiatives are currently underway in testing the use of PAPD at a regional level.

Who are the participants of PAPD?

Participation of both primary and secondary stakeholders of any resource system is considered important and essential in PAPD. Primary stakeholders are those who get direct benefits (e.g. through harvesting, using and selling their products) from the resources for their livelihoods. Secondary stakeholders may not be directly involved in resource management, but they may have some influence (e.g. administrative, legal) or be affected (either positively or negatively) by decisions made by primary stakeholders. Participation of secondary stakeholders in PAPD is therefore very important. Types of participants might vary depending on the type of resources and the objectives of conducting PAPD.

Table 10: Shows examples of primary and secondary stakeholders of two different resource systems in the context of Bangladesh.

Stakeholder type	Floodplain Resource Base	Coastal Resource Base
Primary Stakeholders	• Fulltime fishers • Subsistence fishers • Farmers (land owner and share croppers) • Landless • Women • Other resource users • Pump owner, boatman etc.	• Fishers; • Shrimp fry collectors (male, female, children); • Workers in fish handling; • Net/boat owners; • Firewood collectors; • Crab other resource collectors • Small money lenders/fishers
Secondary Stakeholders	• UP Chair, members; • Upazila Nirbahi Officer; • Upazila Fisheries Officer; • Upazila Agriculture Officer; • Upazila Social Welfare Officer; • Upazila Cooperative Officer; • Lessee, local elites; • Involved NGO staff etc.	• UP Chair, members; • Upazila Nirbahi Officer; • Upazila Fisheries Officer; • Local Forest Officer; • Upazila Social Welfare Officer; • Upazila Cooperative Officer; • Money lenders, local elites; • Involved NGO staff etc.

Besides, participating stakeholders' types and numbers for PAPD will depend on its goal and objectives and the social boundary of the locality, extent of resource base and other related factors.

How to do PAPD?

PAPD is done in three phases: i. pre-PAPD activities, ii. PAPD sessions and iii. Post PAPD activities. Each of the phases are again divided into several steps, activities and tasks are listed below.

Phase 1. Pre-PAPD Activities

1. Acquire knowledge of the local area
2. Acquire knowledge on natural resources system
3. Acquire knowledge on social and institutional systems
4. Identify stakeholder groups
5. Acquire knowledge on household socioeconomic features
6. Select participants for PAPD
7. Preparation for conducting PAPD sessions

Phase 2. PAPD Sessions

Planning for PAPD

PAPD Step 1: Problem Census

Activity 1. Problem identification
Activity 2. Problem selection
Activity 3. Problem prioritization

PAPD Step 2: Problem Cluster and Prioritization

Activity 4. Problem analysis and solutions
Activity 5. Problem cluster and consensus on solutions

PAPD Step 3: Impact Analysis of Solutions

Activity 6. Stakeholder analysis
Activity 7. Impact analysis of solutions
Activity 8. Analysis of indicators for consensus building

PAPD Step 4: Consensus on Proposed Activities

Activity 9. Consensus among primary and secondary stakeholders for proposed activities
Activity 10. Opinion of local government and local administration on proposed solutions
Activity 11. Community action plan for implementation of activities

Phase: 3. Post PAPD Activities

Activity 1. Informing resource users about the plan
Activity 2. Formation of plan implementation committee or institution
Activity 3. Detailed planning, budgeting, approval and resource collection
Activity 4. Implementation of activities
Activity 5. Monitoring and evaluation

How PAPD Benefits a Community?

Participation in a shared learning process, which is not controlled by the most vocal or socio-politically powerful. It is a pro-poor method that actively encourages participation by the poorer members of a community.

Facilitating a community to have greater control over the change process and improvement in their community's management and use of natural resources.

Ensuring the agenda for discussion is internally driven and evolves with time rather than being fixed and imposed by external actors.

What can be achieved with PAPD?

1. Understanding in a community on how to reach consensus amongst different stakeholders.
2. Community action plans that identify interventions, which are agreed on and acceptable to all stakeholders.
3. An opportunity for communities to improve the management of natural resources, especially common property resources.

What is needed for a PAPD?

PAPD needs skill facilitation and a good understanding of the resource systems and local social functions.

PAPD takes a minimum of 8 days with 2 to 4 skilled facilitators in a situation dealing with 4 to 6 different primary stakeholder groups (e.g. Fishers, farmers, landless, women, sharecropper, leaseholders etc.). The length of PAPD depends on the number of stakeholder groups and facilitators.

For details on PAPD please see:

CNRS/ITAD 2004. The PAPD Facilitators' Guide. Version 1 November 2004. Dhaka, Bangladesh: Centre for Natural Resources Studies (CNRS).

Session 12. Institutional Approach in IFM

Objectives:	After attending this session participants will be able to describe and explain i. the importance of institutionalization in IFM; ii. process of institutionalization in IFM; iii. what are the barriers and challenges for institutional sustainability.
Time:	2 hours.
Methods:	Presentations, brainstorming, small group work, open discussion.
Resource Materials:	OHP/Multimedia slides, handout: "Institutional Approach in IFM".
Equipments:	OHP/Multimedia projector, white board, flipchart board, flipchart paper, marker.
Process:	The facilitator will initiate discussion by introducing the topic. He will through discussion create an understanding of community institutions among the participants. He will invite participants in small groups to work on: i. importance of community institutions in IFM; ii. who should participate and why; iii. structure of a community institution for IFM iv. what should be done for institutional sustainability.
Notes for Facilitators:	This session is designed to widen participants understanding on the importance of community institutions in IFM, its structure, who should participate, how it will sustain.

Institutional Approach in IFM

Effective local participation is considered at present central to sustainable management of common property natural resources. This appears in the form of Community Based Management (CBM) with the participation of user communities. Many recent projects have established community based organizations and committees for resource management, termed as "Resource Management organizations (RMIs)". Certainly these are increasing participation of all levels of stakeholders, secondary stakeholders also realizing the importance, programmes are more inclusive. But evidence suggests that most of them could not make much progress or have failed largely on two counts: i. **pro-poor outcomes** and ii. **sustainability**. This session will discuss mainly approaches, models and structures and certainly the barriers and challenges ahead in institutionalization process involved in IFM projects for ensuring programme performance through community participation.

The process and institutions need to be more inclusive and focus on achieving equitable benefits through collective actions. Here some CBM approaches, structure, barriers and challenges for establishing CBM is presented.

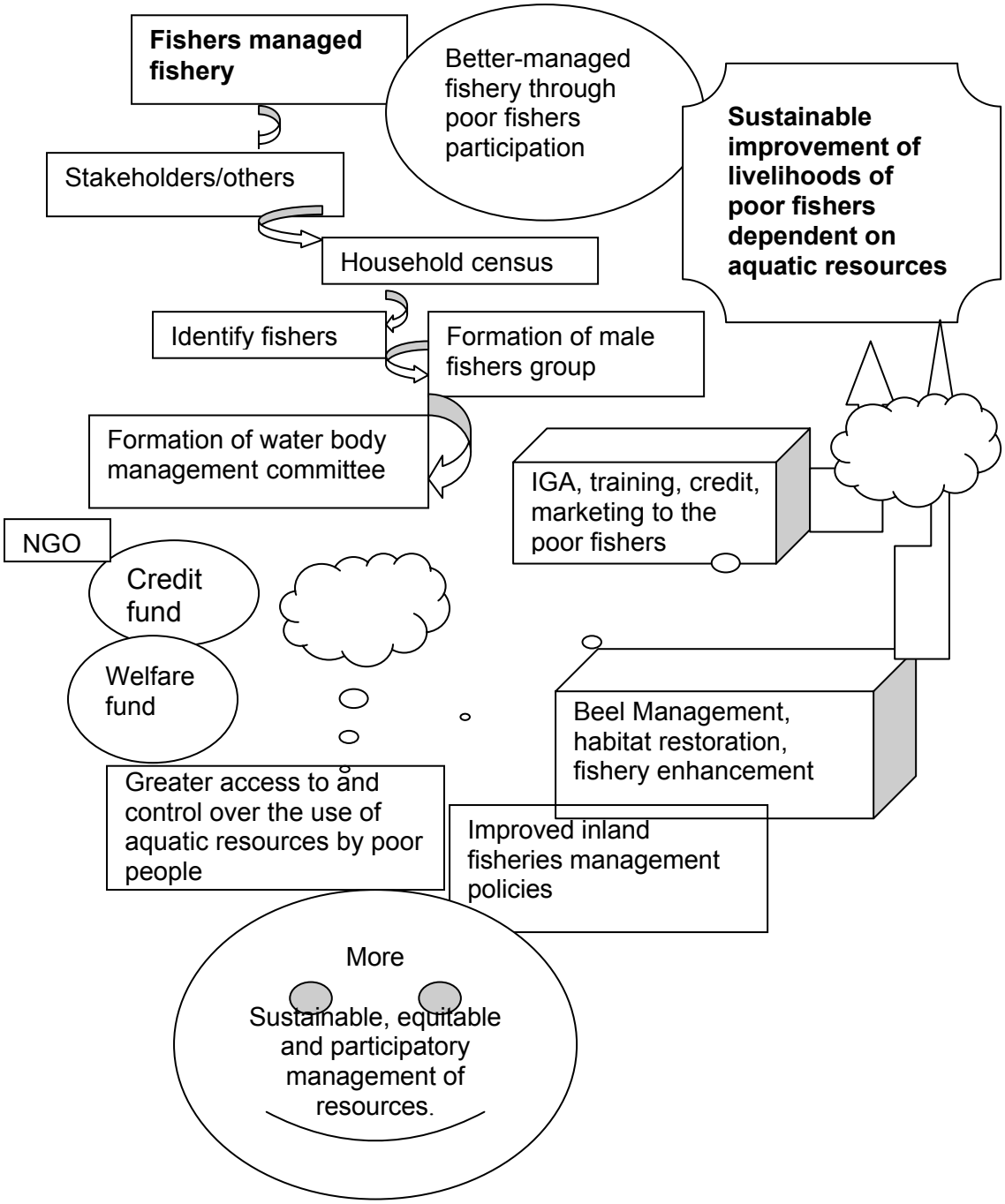
Possible management approaches and models for CBM

In 1950, under the State Acquisition and Tenancy Act, wetlands fisheries were acquired and recorded as land. Ministry of Land started managing them through district and other local administrations. The management often referred as 'revenue-oriented' management; biological management and entitlements are ignored for revenue and considered as a major barrier for sustainable management and equitable distribution.

Realizing the practical situations government has taken some steps, but those was not that much helpful to rectify the situation. For instance "Abolition of leasing of Open Jalmohals: 1995", aiming to protect the interest of poor fishermen and make the earning of their livelihoods easier the government has decided to abolish the procedure of leasing rivers, canals and jalmohals. In practice the influential peoples, those who have mussel power, are harvesting the benefit. Community based management of common property renewable natural resource is considered as a potential alternative and is gaining popularity in Bangladesh. This coincides with a change in emphasis towards participatory sustainable resource management and use and involves the local institutions for this. Again, entitlement and equitable access to resources is still a big question. Related questions are: who are fully dependent on the resources for their livelihood and for their family nutrition supply? who should participate? what sort/structure of community organization will be able to manage the resources properly and will ensure the poor users entitlement? Based on these questions some approach, models and structures are proposed below.

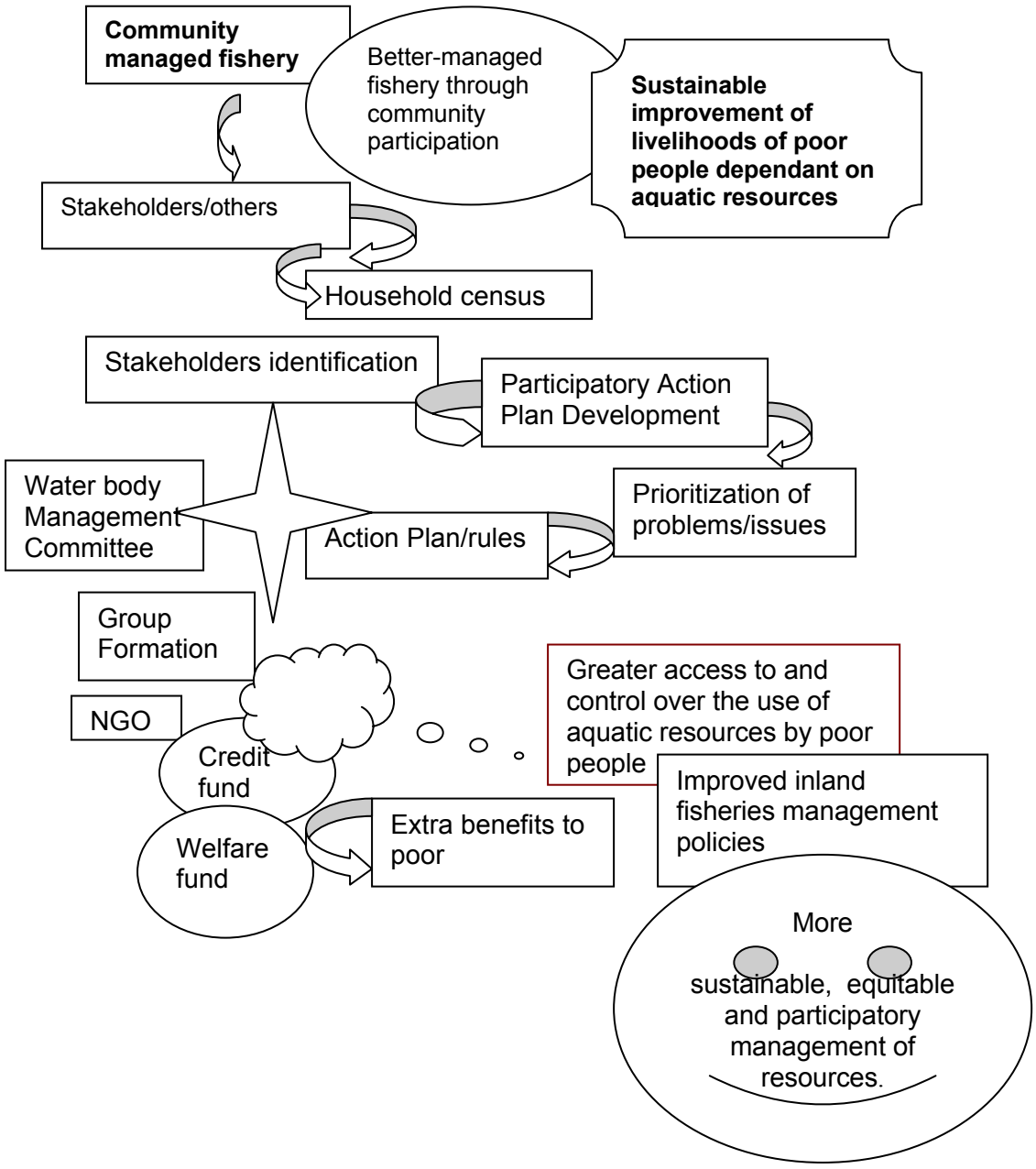
a) Approach 1: fishers managed fishery

The first approach includes stakeholder identification through household census, identification of fishers, and forming groups by NGOs with male fishers only. Group representatives will then identify the community activities (through consensus among the group members and among the groups), and these group representatives will be the members of the Beel or River Management Committee. The NGO role is to facilitate the community participation, and to give direct support (training, credit, etc.) to the group members in technical aspects of management.



b) Approach 2: Community managed fishery

The second approach starts with stakeholder analysis, informal grouping according to livelihood characteristics, building consensus among the livelihood category and then among all stakeholders on the natural resource problems and constraints, and possible solutions, analysis of social, economic and ecological/environmental impacts of the possible solutions and finalization of an action plan. Waterbody Management Committee will be formed according to the suggestions of all stakeholders to then implement these plans. Direct NGO support to groups of poor people is not the basis of the approach but is a component where it would help to compensate for their adoption of fishing limits.

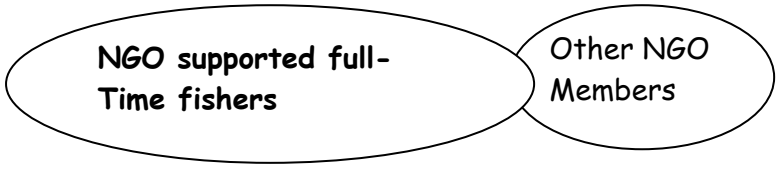

Community managed fishery
Better-managed fishery through community participation
Sustainable improvement of livelihoods of poor people dependant on aquatic resources
Stakeholders/others
Household census
Stakeholders identification
Participatory Action Plan Development
Water body Management Committee
Action Plan/rules
Prioritization of problems/issues
Group Formation
NGO
Credit fund
Welfare fund
Extra benefits to poor
Greater access to and control over the use of aquatic resources by poor people
Improved inland fisheries management policies
More sustainable, equitable and participatory management of resources.

Possible models of community based organizations at the water body level

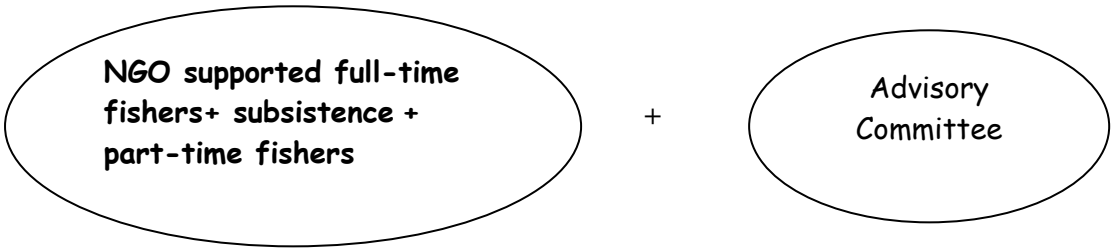
For better management of fisheries through any of the CBM approaches, local organizations need to be developed which in the long run will be established a recognized institution for local resources management. There are many different possible organizational arrangements. Possible community based organizations as envisaged by the NGOs can be categorized into "models". Which of these will be followed depends on the local situation, local needs and types of constraint. The selection of the model will be completely participatory. The involved staff will assist villagers to form the organization or committee. The size and composition of the committee would be decided through general meetings or during the Participatory Action Plan Development (PAPD) process.

The following are some of the possible categories of model identified so far but they are not intended to be a complete list of possible organizational arrangements.

a) In the first model the NGO forms groups with only fishers who fish for an income but are poor. The management committee includes NGO supported full time fishers only, but other NGO members may join the committee if the fishers want to involve them.

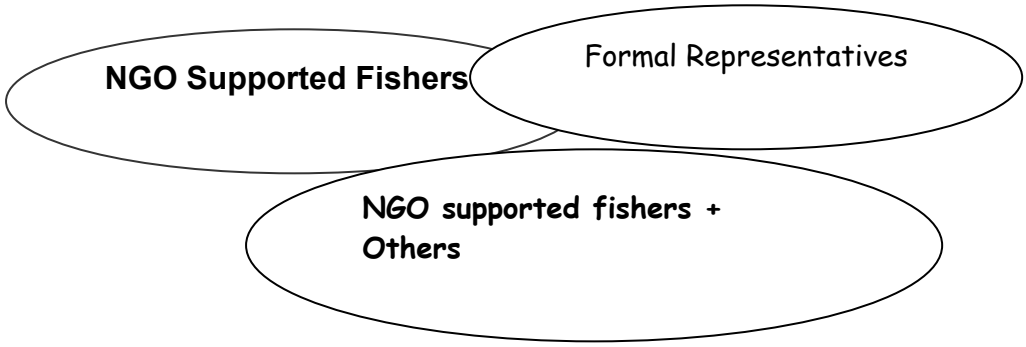


b) In the second model all types of fishers can participate in the management committee. Other stakeholders may form an advisory committee to support the management committee. Such an advisory committee would probably include local influential and elites, local government and NGO coordinator.

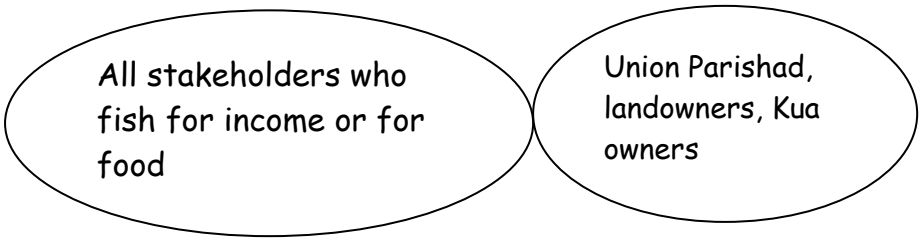


c) The third model includes NGO supported fishers in the organization but formal representation of concerned GOB office, Local government official, and NGO will be included to support the fisher representatives.

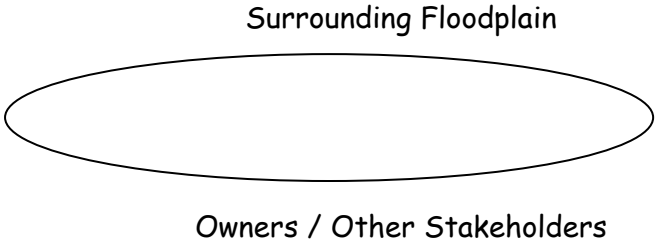
d) The fourth model includes NGO supported fishers and other fishers. These are the groups who fish for income.



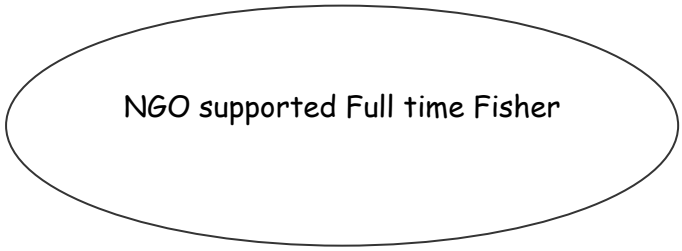
e) The fifth model includes representatives from all types of stakeholders. A shadow advisory committee including Union *Parishad* Chairman, representatives of landowners and *Kua* owners might be formed somewhat distinct from those who fish. This model could be applicable for floodplain.



f) The sixth model includes a Resource Management Committee (RMC) formed by the leaders/representatives of NGO group members who pay revenue for the waterbody. The *bee*l area shrinks during the dry season and expands greatly in the monsoon season and the people who own the surrounding land may also fish and often have both common interests and conflicts with the fishers. The RMC could be a sub-committee of a larger organization or could be linked with a second floodplain level body that would liaise with and support the RMC. This model could be applicable for open beels and some closed beels.



g) The last model includes only NGO supported full-time fishers. This model will be applicable for the closed jalmohols where fishers pay government revenue and stock fish and have exclusive rights; it might also be relevant in some rivers where poor fishers access rights under NFMP.

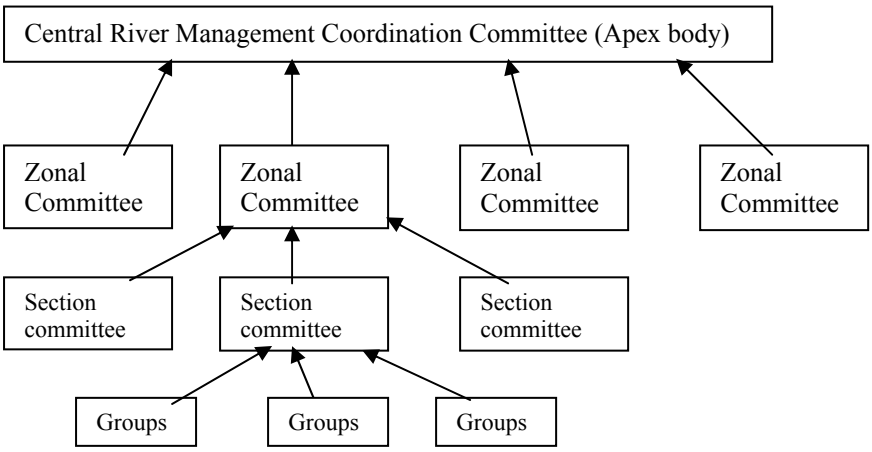


Possible linkages for cluster of water bodies

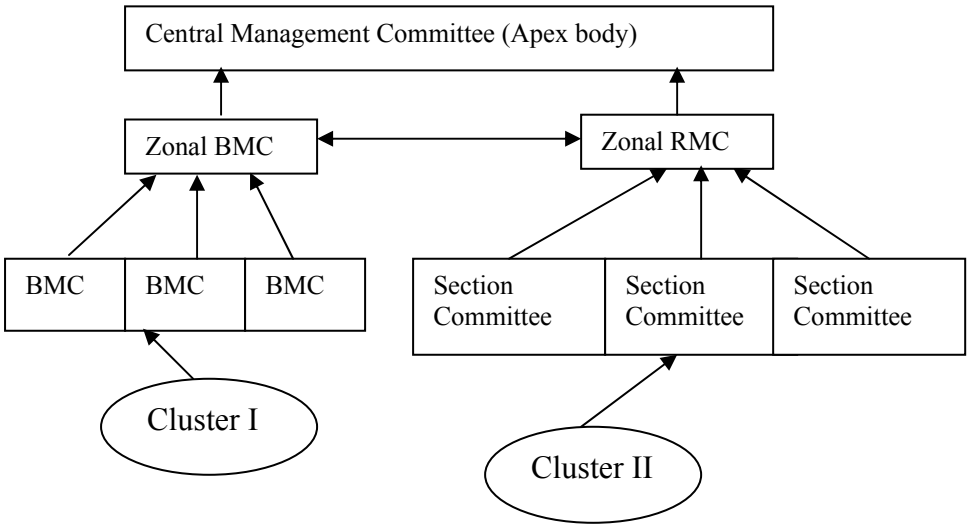
Projects target to identify and test mechanisms for linking local community management of water bodies in larger clusters. Preliminary arrangements for this have been identified through discussions with some of the partners, although these are likely to develop and

evolve over time. In each cluster of waterbodies, each *beel* or each section of river is expected to have its own management committee.

In riverine cluster sites different river sections (reaches) would each have a committee formed with multi-stakeholders (50% beneficiary + 50% others). There will be a formal advisory committee formed with representatives from all levels - Union *Parishad*, local government, NGO, other professionals etc. Representatives from about three adjacent section committees will form an informal zonal committee. Representatives from each zonal committee will form an apex central coordinating committee. The section committees and central committee would be formally registered as cooperatives and a coordinating committee of cooperative societies will be formed, an example is given below:

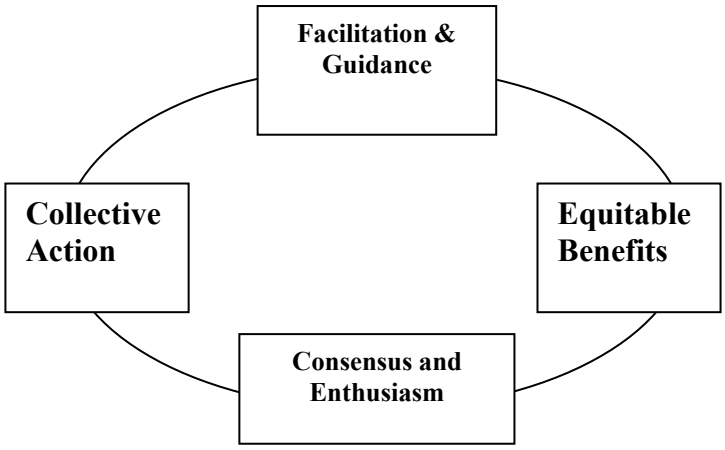


Another alternative linkage arrangement the management organizations (committees) for each water body in a cluster will be linked through a ”zonal” (cluster) committee. Representatives from the zonal committee of each cluster along with representatives of any separate water bodies with community organizations would then form a central committee at the district or upazila level. This would be appropriate where there are several clusters possibly with different NGOs supporting CBM in each cluster. (see following figure)



Finally, the institutional approach, model and structure and the linkages would be decided by the local community based on the resources that will be facilitated by the involved NGO in consultation with other stakeholders.

Barriers in Institutional Approach



Many recent Natural Resources Management (NRM) projects have emphasized **increased local participation**, mainly through Community Based Management (CBM). They have established community based organizations and committees for resource management, here termed "Resource Management Institutions (RMI)'. Evidence suggests that most of them could not make much progress (have failed) largely on two counts: **pro-poor outcomes** and **sustainability**. The process and institutions need to be more inclusive and focus on achieving equitable benefits through collective actions.

What are the Barriers?

Collective Action: Inadequate participation

1. *Pre-initiative indifference* can be due to lack of clear understanding of project objectives among community members, and through real exclusion of the poor (as in some fisheries projects).
2. *Post initiative decline in support* for institutions can arise if certain stakeholders are disenfranchised or alienated and if the opportunity cost for participation is too high.

Facilitation: weak facilitation

1. *Declining dialogue and interaction:* participation tends to be an early focus (for example as an early stage of the project cycle) but later interaction between primary stakeholders and facilitating/supporting agencies becomes less frequent.
2. *Gaps between objectives and understanding*: the level of support for new initiatives aimed at benefiting the wider communities for the long term depends on residents clear understanding of project objectives, institutions and activities, but process documentation revealed gaps.
3. *Poor linkages* and ineffective coordination between government agencies and partner NGOs at national and local levels give rise to conflicts (or confusion) and result in poor participation. Government agencies tend to focus on technical aspects and production, while NGOs are seen as responsible for livelihoods and equity. For example, Local Government has not been formally involved in most project activities, and this is a missed opportunity. MACH experience suggests establishing a strong link with a suitable (or appropriate) local government committee for community-based management of wetland resources produces positive results.
4. *Lack of NGO Capacity*: poor skills of NGOs and their staff in facilitating local RMIs have failed to maximize participation and develop effective organizations. FFP evidence suggests that smaller NGOs were less effective.

Equitable Outcome: inequitable poverty outcomes

1. *Resource capture by non-targets*: 'resource capture' by elites and the workings of local power structures can result in benefits being channelled (or siphoned) away from the poor. New opportunities that arise from IFM interventions are most readily accessed by

the wealthier who can afford investment in time and money. The problem is more acute where interventions, such as fisheries management in several projects, are based on subsidy (provision of access rights and inputs) without due concern for mechanisms to assure preferential access to (or by?) the poor.

2. *Unrestricted access to RMIs*: community organizations open to all create an opportunity for the powerful to join committees, influence decision-making and take control of resources. Approaches that limit elite capture, while including some elites who can help influence opinion positively need to be found.
3. *Limited understanding of constitutional arrangements*: constitutional arrangements (voting rights, eligibility for different posts, etc.) governing the operation of the RMIs need to be established early or there is space for elite dominance as in several fisheries where there is a past history of cooperatives that lacked transparency.
4. *Influence of pre-existing power structures*: often the distribution of benefits is influenced by pre-existing power structures (e.g. UP Chairman, mosque committee members, samaj), for example OLP and Jalmohal project identified mastaans or previous leaseholders and their associates as a major problem. However, MACH has invested in building linkages to local, formal institutions. UP Chairmen may act as arbitrators when conflicts or discrepancies occur.
5. *Unwillingness to challenge local elites*: NGOs have generally been unwilling to challenge local elites in fear of post project adverse reaction. NGO skills and commitment to helping the rights of poor people, challenge local elites and overcome conflicts cannot be assumed. In general, most projects lack focus (lack of provision) on grass roots advocacy aspect and thus the RMIs are week in systematically raising their voices to challenges local elites and other anomalies.
6. *Fuzzy property rights regimes*: this problem arises when the local reality does not correspond with pre-defined IFM objectives. In some cases this can be incorporated for the benefit of sustainable and equitable IFM, for example local access arrangements are sometimes found to operate on behalf of a broad range of stakeholders which may be equitable by giving seasonal open access to local poor in beels and encourage agreement on and compliance with conservation measures.
7. *A sectoral focus to IFM* can introduce conflict and polarize the positions of different user groups, for example in some CBFM sites only fishers have been supported when there are multiple stakeholders. **Participatory Action Plan Development (PAPD)** has been successfully used to develop mutual awareness and consensus between farmers, fishers and other interest groups.
8. *A structured orientation to NRM*: should move away from a focus on technical service provisions. So far IFM has not empowered the beneficiaries on awareness of rights and entitlements, which would enable them to counteract ‘exploitation’ or ‘exclusion’ by powerful interests. Several projects use production increases as their success indicator but the poor may be excluded in the process of raising production.

Consensus: Lack of Widespread Support

1. *Intervention induced conflict*: Unfortunately, IFM interventions have tended in several cases to alienate some groups, widen differences in interests and create conflicts. This probably relates to the difficulty in achieving collective benefits available to a wide range of stakeholders. Conflict has been less in some sites where PAPD was used.
2. *Lack of strategic communication and policy influencing*: lesson learning and policy influence have been ad-hoc and unstructured. There was no uptake of research findings and lessons learnt from projects to create widespread support or scale up IFM neither in the policy arena nor for transferring this for new programmes. Donors and projects are

increasingly aware of this and projects such as CBFM2 and MACH include communications for policy influence but that still lacking of effective strategy and actions.

Integrated Floodplain Management: Challenges Ahead

Collective Action

1. The purpose of IFM institutions must be clearly explained before interventions, and project messages must be easy to understand.
2. Activities and objectives should impact a range of groups in a range of ways so that all stakeholder groups can realize benefits.
3. Cost-effectiveness for participants must be ensured, and the wider community and members of RMIs should expect transparency and accountability from their representatives.

Facilitation

4. Project staff should maintain dialogue and disseminate the project's messages throughout its life span.
5. Cooperation among government agencies and NGOs is crucial. Forging links between RMIs, local government and the local administration is critical for sustainability of new RMIs.
6. The experience of NGOs recruited to develop and support RMIs should be assessed carefully. Training needs of NGOs and their staff should be assessed at the time of recruitment.
7. Local NGOs should be backed up by close support and mentoring from experienced field based technical assistance staff, or a more experienced NGO team.

Equitable Outcome

8. Ensure early inclusive planning and increase staff awareness of power issues.
9. Avoid strongly subsidized inputs for production and access rights; instead start with low cost smaller actions.
10. Formalizing (registration with social services or cooperative) RMIs can help improve the prospects of sustainability but is not sufficient to ensure appropriate institutions.
11. The needs and proper representation of fishers/resource users should be incorporated in all IFM projects.
12. A full understanding of the role of the key informal institutions should be achieved prior to any intervention.
13. Inclusive and participatory decision-making (PAPD) can provide a role for the elite in supporting IFM initiatives.
14. Facilitators need to adapt to existing local access arrangements and fully understand them in relation to the livelihoods of the poor, particularly the opportunities they provide at certain times of the year.
15. Some form of social reconnaissance should attempt to map informal NRM mechanisms.
16. By adopting a more integrated approach including different livelihoods groups, new IFM can build relationships and linkage among those groups.

17. Project design should incorporate elements of empowerment and awareness of rights and entitlements.

Consensus

18. A process approach can build capacity through flexibility and adaptability of project activities.
19. Implementing agencies should be aware of the bottlenecks that tend to appear and of strategies to avoid them.
20. Dispute or conflict resolution should be seen as an integral part of RMIs.
21. The capacity of each project to consider these issues is limited. National policies are starting to stress cross-sectoral links, with calls for integration at ministerial level.
22. A structured approach to communication for policy influence should be incorporated in new IFM initiatives.
23. Because floodplain management performance (outcomes and impacts) relate very closely to approach and objective, IFM agencies should carefully consider their future role and approach in the light of lessons learnt from past experience.

Pre and Post Test Questioner
Integrated Floodplain Management
Time: 30 minutes

Answer all the questions

(Each of the questions carries 2 marks)

1. What is floodplain?

(Put tick on the correct answer)

2. Which of the following is not a floodplain product?

   a. Rice b. Grass c. Stone d. Crab

3. Who is not a primary stakeholder of floodplain resources?

   a. Fish trader b. Farmer c. Fuel wood collector d. Rickshaw puller

4. Which one is not a natural floodplain habitat?

   a. *Beel* b. Canal c. *Haor* d. Pond

5. Which one is not a benefit (services) from existence of a wetland?

   a. Ground water recharge
   b. Flood extent control
   c. Balancing local climate
   d. Cultivate rice.

6. Which one is the main crop cultivated in the Bangladesh floodplains at present?

   a. Wheat b. *Boro* rice c. *Amon* rice d. Potato

7. Which one is a problem for sustaining floodplain fisheries associated with *boro* rice cultivation in the floodplains?

   a. Use of *beel* water for irrigation during critical dry season;
   b. *Boro* rice is costly;
   c. *Boro* rice is a less profitable crop;
   d. *Boro* rice grows everywhere.

8. Which one of the followings is a component of integrated floodplain management?

   a. Cultivation of rice in the floodplains
   b. Fishing in the floodplains
   c. Crop diversification in the floodplains
   d. Harvesting grass from floodplains.

9. Which one is a suitable alternative crop to *boro* rice in *rabi* season for floodplains?

   a. Wheat b. Jute c. Tea d. Papaya

10. Which set of the followings are the components of IFM?

    a. Crop diversification, grass harvesting and wetland management;
    b. Rice cultivation, travelling by boat and fish harvesting;
    c. Crop diversification, fishing effort control, sluice gate management and land retirement;
    d. Effort control, fishing, and water management;

11. Which statement best fits with IFM objectives?

    a. Save *beel* water;
    b. Save paddy;
    c. Improve communication;
    d. Sustainable use and secured livelihood for all users.

12. Which one of the following IFM components will be most difficult to implement?

    a. Crop diversification b. Fishing effort control c. Land retirement d. Sluice gate management.

13. Why land retirement (for land at the *beel* bottom) is a difficult choice in Bangladesh?

    a. This land is suitable for growing rice;
    b. Farmers tend to plant rice any fallow land around and gradually occupy;
    c. This land is costly;
    d. This land is more fertile.

14. Why it is important to keep open the sluice gate during early monsoon?

    a. So that river water can enter and facilitate fish migration
    b. So that flood water can inundate rice
    c. So that rice can get more water and grow bigger
    d. So that farmers can harvest rice easily.

15. Who is the most potential barrier to IFM implementation?

    a. Local seed dealer;
    b. Irrigation machine owner;
    c. Farmers;
    d. Fishers.

<u>Put tick on the true statement.</u>

16. In IFM:
    a. All resource users' participation is equally important;
    b. Only fishers' participation is enough;
    c. Only farmer's participation is enough;
    d. Participation is not much important.

17. To ensure participation:

    a. Local institution is important;
    b. Local elite and vocal people are important;
    c. Different stakeholders need to be separated;
    d. Local government is enough.

18. In IFM:

    a. A fishers separate plan is more important;
    b. Consensual action plan of all the stakeholders is a key;
    c. Consensual action plan is not much important;
    d. A farmer's plan is more important.

19. For the poor resource users:

    a. Rice field is more important;
    b. Wetlands are more important;
    c. Conversion of wetland is beneficial;
    d. Aquatic resources are not important.

20. To strengthening of an IFM Institution:

    a. Registration with a relevant government organization is the only requirement;
    b. Registration with a relevant government organization is important;
    c. Registration is not at all required;
    d. Registration creates problem.

21. In community based management conflicts:

    a. Should be avoided;
    b. Are not expected;
    c. Should be seen as an integral part;
    d. Need not to resolve.

22. In IFM related community level conflict resolution:

    a. The CBO should take lead;
    b. The NGO should take lead;
    c. The concerned government agency should take the lead;
    d. No reaction should be shown.

23. In IFM role of local formal and informal institutions:

    a. Should be ignored;
    b. Should be considered and used for future development;
    c. Should be illuminated;
    d. Should be eliminated.

24. IFM activities with CBOs:

    a. Should be started with high cost activities subsidised from project;
    b. Should be started with low cast activities;
    c. No subsidy should be given;
    d. CBO will bear all costs.

25. In a CBO managed IFM in the present situation:

    a. Always only poor gets the benefit;
    b. Benefits can be channelled to wealthier people;
    c. All participants gets equal benefits;
    d. No body gets any benefit.

Reference and Further reading

1. BBS. 1995. *Fish Consumption*.

2. CNRS. 2005. Fact Sheets: “Integrated Floodplain Management” is an effective initiative for poverty reduction through sustainable management of wetland resources. Better Options for IFM: Uptake Promotion. NRSP (R8306).

3. CNRS.2005. Policy Brief 1: Integrated Floodplain Management: Better options for sustainable livelihoods. Better Options for IFM: Uptake Promotion. NRSP (R8306).

4. CNRS.2005. Policy Brief 2. Integrated Floodplain Management: How can we better utilize scarce dry season water for balanced production of fish and crops in Bangladesh floodplains? Better Options for IFM: Uptake Promotion. NRSP (R8306).

5. CNRS.2005. Policy Brief 3: Integrated Floodplain Management: How can we save fish from being over fished in Bangladesh floodplain. Better Options for IFM: Uptake Promotion. NRSP (R8306).

6. CNRS.2005. Policy Brief 4. Integrated Floodplain Management: Can sluice gates be operated to enhance the fisheries inside modified floodplains? Better Options for IFM: Uptake Promotion. NRSP (R8306).

7. de Graaf, G. J., Born, B., Uddin, K.A., Marttin, F. 2001. *Floods, fish and fishermen.* Dhaka: The University Press

8. FAP 17. 1995. *Fisheries Studies and Pilot Project*.

9. FRSS. 1995-2004. *Fish Catch Statistics*. Fisheries Resource Survey Systems. Department of Fisheries, Bangladesh.

10. Halls, A. S., Kirkwood, G. and Payne, A.I. 2001. *A dynamic pool model for floodplain-River fisheries*, unpublished manuscript.

11. Halls, A. S. 1998. Impact of flood control schemes on river fish migrations and assemblages in Bangladesh. *Journal of Fish Biology* 53:358-380

12. Halls, A.S. 2005. Integrated Floodplain Management Modeling Report. Better Options for Integrated Floodplain Management (R8306).

13. Halls, A.S. 2005. Floodplain Fisheries: A Managers Guide. London, MRAG Ltd. 6p.

14. Halls, A.S., D.D. Hoggarth, S. Huq, M. Rahman and H. Reid. 2005. Promotion of FMSP Guidelines for Floodplain Fisheries Management and Sluice Gate Control. FMSP Project (R8486). 53pp.

15. Hoggarth, D. D., Halls, A.S. 1997. Fisheries dynamics of modified floodplains in southern Asia: Project Final Technical Report to ODA.

16. ITAD-CNRS. 2005. Institutional Integration for Sustainable Integrated Floodplain Management. Training Module. Institutions Promotion Project (R8495).

17. IUCN. 1993. Fresh water wetlands in Bangladesh: Issues and approaches for management. Dhaka:IUCN

18. Lewins, R. 2004. *Integrated Floodplain Management – Instructional Environments and Participatory Methods.* Final Technical Report. ITAD Limited. (R8195)

19. Lewins, R., A. Suman, A. Islam, P. Sultana, M. Rahman and H. Ahmed. 2005. *Social and Institutional Uptake of IFM Options – Observations Derived from Project Documentation*. Final Technical Report. Better Options for Integrated Floodplain Management in Bangladesh: Uptake Promotion (R8306).

20. Mulhall, A., M. Rahman, and A. Islam. 2005. Communications Plan. Annex D. Final Technical Report. Better Options for IFM: Uptake Promotion. NRSP (R8306).

21. Rahman, M., M.A. Islam. 2005. Final Technical Report. Annex A. Better Options for IFM: Uptake Promotion. NRSP (R8306).

22. Rahman, M., *et. al*. 2005. Piloting of IFM Options: Charan, Kalihati, Tangail Site. Final Technical Report. Annex B-1. Better Options for IFM: Uptake Promotion. NRSP (R8306).

23. Shankar, B. 2002. *Maximization of Joint Benefits from Multiple Resource Use in Bangladesh Floodplain*. Final Report. NRSP, DFID.

24. Sultana, P., P. Thompson, H. Ahmed and A. Hossain. 2005. *Piloting IFM Options: Narail Site.* Final Technical Report. Annex B-2. Better Options for Integrated Floodplain Management in Bangladesh: Uptake Promotion (R8306).

25. Tsai, C.F., and Youssouf Ali, M. 1997. *Open water fisheries of Bangladesh* Dhaka: University Press Ltd.