MACH

Technical Paper 1

Restoring Wetlands through Improved Governance: Community Based Co-Management in Bangladesh The MACH Experience

Management of Aquatic Ecosystems through Community Husbandry

May 2006

A project of the Government of Bangladesh
Supported by USAID
Project Partners:
Winrock International
Bangladesh Centre for Advanced Studies (BCAS)
Center for Natural Resource Studies (CNRS)
CARITAS Bangladesh

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Sachindra Halder and Paul Thompson

May 2006

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Abstract

This paper provides an overview of the approach to establish co-management of wetland resources developed by the MACH project in three large wetland ecosystems in Bangladesh between 1998 and 2006. Wetlands and the livelihoods of those who depend on their products, especially fish, are in crisis in Bangladesh due to conversion of wetlands to agriculture and over exploitation. The project has demonstrated that habitat restoration and conservation measures can be established and bring benefits in terms of higher fish yields and consumption. These benefits depend for their sustainability on institutionalizing the improvements in environmental governance introduced through MACH.

The approach developed by MACH was participatory and involved working with local stakeholders to understand problems and identify possible solutions. The foundations of the approach are two types of community organizations developed for resource management and for livelihood development. The project has emphasized on making these institutions self reliant and self-sustaining, providing funds that they could manage, and establishing transparent procedures that make those taking decisions more widely accountable. Resource Management Organizations (RMOs) are voluntary bodies representing all stakeholders of the resource and focus on ensuring that norms and practices are followed that will sustain wetland productivity. Federations of Resource User Groups (FRUGs) are membership bodies, specifically for poor people who depend on the wetlands, to ensure they are able to access credit and training to increase their incomes while reducing fishing involvement, representatives of the Resource User Groups are included in the RMOs. However, new community based organizations can be fragile, and overlap with existing local government. Therefore MACH has achieved adoption and recognition of local co-management committees, known as Local Government Committees but which comprise of the leaders of the RMOs and FRUGs, the Union Parishad chairmen and the local government (Upazila) officials who meet together and cooperate to coordinate, resolve problems and oversee improved wetland management. For institutional sustainability the RMOs and FRUGs are independent social welfare organizations registered with the government. For financial sustainability revolving loan funds have been provided to the FRUGs, and endowment funds have been created to provide grants for further habitat restoration by the RMOs and to cover the costs of the LGCs.

The effectiveness of this arrangement as a framework for sustainable improved environmental management and fishery restoration based on community participation attracted the interest of the Department of Fisheries. Consequently this co-management structure has been adopted by the Ministry of Fisheries and Livestock as part of the Department of Fisheries' Inland Capture Fisheries Strategy. This offers a framework for scaling up lessons and approaches from MACH. It will be particularly appropriate where there are several water bodies or large wetlands within an Upazila, and where there are sizeable core areas that could be protected to serve the whole of a wetland system.

Acknowledgements

This paper summarizes the approach and achievements of the MACH project over a seven year period, so the contributions to this success of every past and present member of the project team from Bangladesh Centre for Advanced Studies, Caritas Bangladesh, Center for Natural Resource Studies and Winrock International must be appreciated along with the co-managers themselves – the officers of Department of Fisheries and other government agencies, Upazila administration, Union Parishad chairmen and members, and the local communities and their organizations – the Resource Management Organizations and Resource User Groups.

The following project team members have specifically contributed text, information and editing to this paper and are gratefully acknowledged for their valuable contributions: Ali Akbar Bhuiyan,

Daniel Bhuiyan, Darrell Deppert, Mokhlesur Rahman, Rony Rosario, M. Shahabuddin, and Anwara Begum Shelly. We thank S.N. Choudhury and Erin Hughes for their editorial assistance.

1. Wetlands in Bangladesh – a vital but threatened resource

In Bangladesh about 4 million hectares of land are inundated every year in the monsoon (rainy) season, and over half the country is under water in an exceptional flood year (Ali 1997). In the dry season, the wetlands reduce in size to form a system of rivers, *beels* (depressions and lakes that hold water permanently or seasonally), and *baors* (oxbow lakes).

The floodplains of Bangladesh are one of the world's most important wetlands and home to hundreds of species of plants, fish, birds and other wildlife. The wetlands provide the habitat for over 260 fish species (Rahman, 1989) and hundreds of thousands of migrating birds (BirdLife International 2004), and are an important source of income and nutrition for millions of households in rural Bangladesh, particularly the poor. As many as 80% of rural households catch fish for food or to sell (FAP 16, 1995) and about 60% of animal protein consumption comes from fish (BBS, 1999). In addition, poor and marginal households catch many small fish that are not included in official statistics or policies, and use aquatic plants and animals for food or as feed for livestock.

80% of rural people in Bangladesh depend on wetlands for fish and other aquatic resources, but fish consumption fell by 11% in recent years and about 40% of fish species are now threatened with national level extinction

Unfortunately, the wetland resources of Bangladesh are in decline due to over fishing and loss of habitat and connectivity. Wetlands in the past were thought to be "wastelands" in Bangladesh and government's goal was to drain out and "recover" for agriculture production (albeit for one crop a year during the dry season). Even in areas that have not been converted to agriculture, wetland ecosystems have been threatened by other pressures:

- Flood embankments and water control structures have blocked many fish migration routes.
- Irrigation has expanded winter rice cultivation but reduced the surface water that aquatic life needs to survive in the six-month dry season.
- The government leases out fishing rights in public water bodies, but short-term leases have encouraged maximum exploitation without giving incentives to protect resources for the next generation.
- Industrial development causes severe local pollution that kills breeding fish populations during the dry season.
- Deforestation and poor land management cause high rates of siltation, often filling in dry season wetlands that serve as fish holding habitat during a crucial time of the year.
- More and more people fish destructively using fine mesh nets.

Many water bodies now dry out rapidly soon after the start of the dry season and fish are caught in the shallow waters as the water recedes. The decline in wetlands has resulted in more than 40% of freshwater fish species being classed as threatened with national extinction (IUCN Bangladesh 2000). Since 1985, natural carp spawn catches have declined by 75% (Ali 1997) and major carp and large catfish have declined by 50% in national catches.

Fishing by dewatering – a common practice that removes all the next year's broodstock

The future prospects for freshwater wetlands and fisheries in Bangladesh look bleak if there is no change in the current trend. A recent review found that fish consumption fell by 11% between 1995 and 2000 (but by 38% for the poorest households), and estimated that inland capture fisheries catches

had fallen by 38% between 1995 and 2002 (Muir 2003). Having earlier grown at 5% per year presumably through high fishing pressure, these fisheries now appear to be in crisis with catches falling at 5% per year. Despite recent changes in national policies that call for an end on drainage of remaining wetlands (MWR 1999), wetlands continue to be encroached for agriculture, industry, brickfields and aquaculture with no sign of abatement.

Conservation of the quality and quantity of wetlands during the dry season is critical for survival of the fish stocks that provide brood fish for spawning in the following wet season.

The Management of Aquatic Ecosystems through Community Husbandry (MACH) project was formulated to develop new approaches to floodplain and wetland resource conservation and management with the aim of ensuring the sustainable productivity of all wetland resources – water, fish, plants and wildlife– over an *entire* wetland ecosystem (comprising beels, seasonal wetlands, rivers and streams), not just a single water body and thereby to help ensure food security and increase biodiversity.

2. The MACH approach

MACH emphasized the need to understand local conditions, to develop solutions that address local needs, and to facilitate changes that demonstrably benefit local people. The project was adaptively managed and evolved differently in the different sites.

MACH was a process based approach not a blueprint project

The MACH approach demonstrated co-management and participatory processes for planning, implementation and monitoring for sustainable wetland resource management. Realizing that a reduction in fishing is likely to be a critical part of reviving the wetland fisheries, the project has identified alternative income generating opportunities for existing and potential new fishers and others directly dependent on wetland resources. In addition to physical interventions to restore wetlands, much emphasis has also been placed on developing local institutions to sustain best practices. The project is supporting communities and local government in the planning and sustainable use of natural aquatic resources. The MACH project, funded by USAID, started in October 1998 and is due to complete its second phase in October 2006.

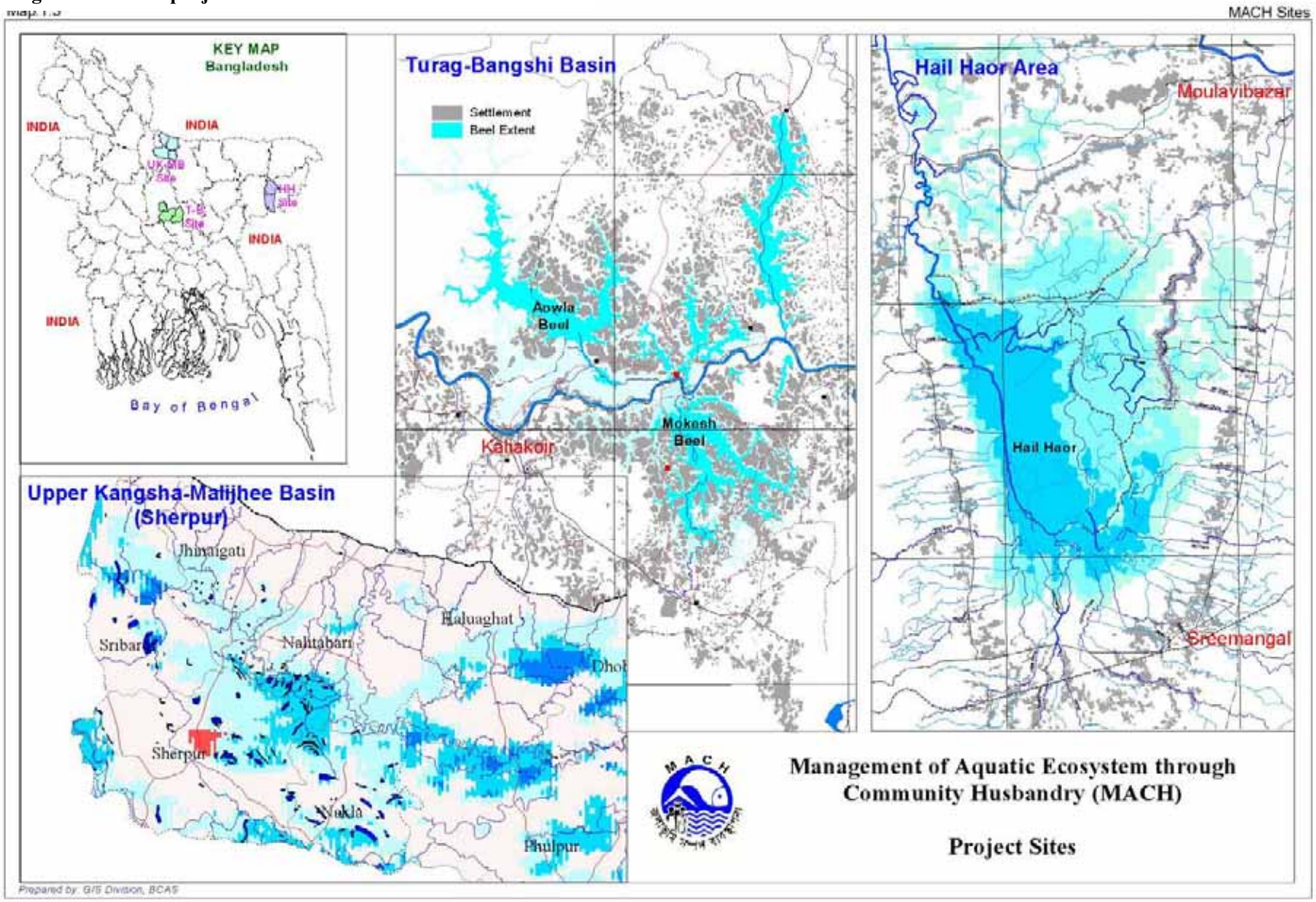
2.1 The sites

The MACH project has demonstrated its approach in three sites located in different ecosystems in Bangladesh Figure 1 shows their locations and key features of each site.

Fishing is often a team effort

Hail Haor is located in north-east Bangladesh and is typical of deeply flooded basins in that region known as *haors*. It is in the anticline between the Balishara and Barshijura Hills to the east and the Satgaon Hills to the west. Water originates from the surrounding hills and flows through 59 streams (once 350 were reportedly active) into the haor and on into the Lungla/Bilashi River. The haor is located in five unions of Sreemongal Upazila and in two unions of Sadar Upazila of Moulvi Bazaar District. The watershed of Hail Haor covers about 600 km^2 (237 square miles). The basin water originates from the surrounding hills, approximately 85% of the catchment lies in Bangladesh and 15% in India.

Figure 1. MACH project sites



Hail Haor was formerly connected with the Kushiyara and Manu Rivers. A series of flood control dikes along these rivers and a sluice gate on the Kamerkhali Khal restrict river flows and fish access to and from the haor. Another dike, intended to turn the haor into a large reservoir but now in disrepair, was built around the northeastern and eastern sides of the haor. The Shaka-Borak River and Kamarkhali Khal pass through Boro Haor (north of Hail Haor) and, if they were not blocked, would connect Gopla River (which flows through the Haor) with the Kushiyara River. The wet season area of Hail Haor is approximately 14,000 ha, whereas the dry season area is typically just over 3,000 ha on an average. Approximately 172,000 people live in 61 villages around the haor.

The **Turag-Bangshi** site is located just north of Dhaka and is typical of most low-lying floodplains of Bangladesh. The project site covers seven unions[1] of Kaliakor Upazila under Gazipur District and one union of Mirzapur Upazila of Tangail District. The Turag-Bangshi River runs through the site with numerous beels and canals on either side of the river. At the beginning of the rainy season, as floodwaters enter the upstream portions of the Bangshi, water spills over the riverbanks through khals (canals) that connect the river to those adjacent beels. Through these canals fish move from the river to the beel/floodplain areas for spawning or nursing, and then later as water recedes after the monsoon the fish move into the deeper perennial portions of the beels or back into the river. Dry season water levels in the local rivers and beels are much reduced from their former levels due to the vast expansion of ground and surface water extraction for boro (dry season) rice irrigation. In drought years, flows cease in the formerly perennial Turag River. Fish remain only in the deepest portions of the beels and the river. Annual fish production depends largely on the size of the breeding populations that survive the dry season.

Within the Turag-Bangshi site, there are a total of 26 beels with a water surface area of approximately 10,000 ha at full flood, which diminishes to less than 700 ha at the end of the dry season. The Turag River runs for approximately 30 km through the site and another 28 km of canals exist within the area. Seasons in the Turag-Bangshi floodplain, like all similar areas of Bangladesh, are determined by rainfall and water levels, which divide the monsoon (wet season) occurring during May-October from the dry period in November-April. Approximately 225,000 people live in 226 villages that make use of the river and floodplains.

The **Kangsha-Malijhi** site is located in the north-central part of Bangladesh in Sherpur Sadar and Jhenaigathi Upazila of Sherpur District. The area is geographically a part of Garo-Tura Hills watershed and includes the catchments of the upper Kangsha and Malijhi river system. The hills of this area were once covered with natural Sal (*Shorea robusta*) forest; now only remnants of natural forest remain. The wetlands and floodplain have a water area of approximately 8,000 ha during the wet season, which diminishes to about 900 ha in the dry season. The floodplain area contains 47 beels or low pockets, of which 18 are perennial. The population of the area is approximately 279,000 in 163 villages.

The Sherpur project site is prone to flash floods. The farmers of the site repeatedly suffer heavy damage of their crops by flooding from the Shomeswari, Malijhi, and Chellakhali Rivers. Each year, flash flooding from the neighboring hills occurs in these rivers more than once, flooding much of the lower land in this system, but then draining away. These flash floods discourage intensive pond aquaculture in the area because of the risk of loss of fish from ponds when they are overtopped. Continued flood damage to the monsoon crop forces farmers to shift to cultivating more dry season boro. The resulting increase in extraction of surface and ground water for irrigation poses a threat to wetlands and the environment in general during the dry season.

[1] A Union is the lowest administrative level in Bangladesh, typically there may be about 10 unions in a sub-district or Upazila. An elected council or Union Parishad governs each union comprising of representatives from the 10 or so villages within a union.

2.2 The partners

MACH has been undertaken by a partnership comprising of: Winrock International (overall coordination and management), Bangladesh Center for Advanced Studies (geographic information systems, government linkages and policy advocacy), Caritas (livelihood support for the poor and associated community organizations), and Center for Natural Resource Studies (resource management and associated community organizations and fishery monitoring). This project team has worked with the Government of Bangladesh through agreements with the Ministry of Fisheries and Livestock and in particular with local government.

2.3 Community organizations and institutional development for wetland management

The project developed local organizations that helped engage, inform the resource users. These local organizations also served as a conduit to implement project activities and to develop rules of engagement for the wetland. Resource Management Organizations (RMOs) were eventually organized around wetland management areas that contained recognizable dry season water areas or systems (typically identifiable through a local name) but this followed a process of initial understanding, planning, and working in smaller parts of those areas with the communities. The RMO comprises of villagers, who serve as representatives of the community, chosen from those living in and around the wetland management area and using its resources. The RMO is responsible for the management of the wetland resource including identifying appropriate management interventions through participatory planning, and implementing them.

Local community organizations for resource management were formed over several years through steps involving community, project and local government

The project approach to form local organizations and institutions adopted the following general sequence of steps:

1. Conduct introductory meetings at the Upazila with Upazila Nirbahi Officer (chief administrative officer) and Union Parishad (local elected council) chairmen by senior project staff and staff from Ministry of Fisheries and Livestock.
2. Conduct meetings at the Union Parishad offices with council members and community leaders by senior program staff, government staff including the Deputy Commissioner, and the Assistant Deputy Commissioner (Revenue), and staff from USAID.
3. Introduce MACH and sensitize villagers about the importance of fisheries and other wetland wildlife and plants.
4. Identify the communities' wetland resource problems and possible solutions including management and physical interventions through the use of participatory approaches (Participatory Action Plan Development (PADP), a structured planning process discussed in the next section)
5. Identify potential management units – these comprise the wetland areas and water bodies and their associated villages and resource users – that are most interlinked and could form a unit to be covered by one local organization and implement outline plans prepared through the PAPD.
6. Build rapport and raise awareness in the communities within each management area including dissemination of messages regarding the process of forming local organizations, and their potential activities.
7. Post community organizers employed by the project to the sites – one per RMO.
8. Develop the institutions – this was done in a flexible way with important differences in approach between sites which are discussed in detail below. It included working with the

representatives from the area who form the general body of the RMO to select from among themselves their Executive Committee and discuss and agree on their constitution.

9. Register RMOs with the Social Welfare Department, thereby giving the RMOs a legal entity and status as a local non-government organization.
10. Develop the capacity of the RMOs and their members, for example how to run the organization, plan activities, supervise implementation, and introduce wetland resource management norms to their areas.
11. Over time work with the RMOs where gaps in coverage were identified, typically to enhance representation of the poor and of women by revising RMO membership to ensure a high representation of poorer people dependent on the wetland resources based on 60% of members being representatives of the Resource User Groups (RUGs) formed separately by the project (see later), and associated changes in constitutions to strengthen and protect the interests of poor people.
12. Implement an exit strategy to ensure that the RMOs are sustainable based on: adoption of guidelines on financial and natural resource management, adoption of a system of annual resource management plans developed by the RMO in consultation with the wider community and government, building offices for each RMO.
13. Conduct twice yearly reviews of RMO performance and status to guide capacity building and phasing out. Indicators are assessed through discussions with fishers, landless, women, RUG members, others in the community, RMO and its office bearers. Topics include: resource management, financial management, the functioning and governance of the organization, the role of the poor and women, and its linkages with other institutions.

It was key that the project took a flexible approach in the development of local institutions. The project staff considered the physical characteristics of the wetlands, the settlement of communities around the resource, pre-existing property rights (such as leases) to the wetlands and the social characteristics of the users. This took, however, a higher level of capacity in field based staff who facilitate the process, and places stresses on project management.

Flexibility was vital: the approach to developing community organizations was different in each site according to social, environmental, and administrative factors

The **Turag-Bangshi** (Kaliakoir) wetlands usually have a number of lower and consequently deeper pockets of water (locally known as *kur* or *kum* for rivers and *doha* for beels). These are the key hot spots for the fishery since they become isolated water bodies in the dry season and hold the remaining fish stock. Here the rest of the area is only seasonally flooded and comprises private crop land. Separate committees of local people from nearby villages were established to protect certain kums and dohas as sanctuaries, as agreed through participatory planning. Later RMOs were formed covering larger wetlands – the beel or river that is a common flooded area in the monsoon and contains several kums and dohas. All members of these kum and doha committees became general members of the RMO, resulting in relatively large organizations bringing together people each trying to protect their local part of a connected wetland resource system, and with the executive committee of the RMO coordinating and overseeing the activities of the constituent kum and doha committees.

The fishery of **Hail Haor** (Srimangal) has a different character and status. Instead of small dry season wetlands that were either open access or common property resources used by the neighboring communities as in Turag-Banshi, most of the main dry season water bodies of Hail Haor are larger and are *jalmohals* (state property where the government leases fishing rights to the highest bidder) and are distant from the many user villages that surround the large haor basin. Here, following village based PAPDs, the project directly organized stakeholder representatives including local community leaders from those few villages covered by the PAPD into eight RMOs spread around the Haor edges. The project then worked to have the leases for some of the jalmohals (one or more in each RMO area) reserved for that RMO without competitive tendering. The RMO then functioned as an enlightened leaseholder sub-contracting fishing to fishers and establishing best wetland management practices in these jalmohals and neighboring floodplain.

In **Kangsha-Malijhee** (Sherpur) area the wetlands comprise of distinct beels that are separate for most of the year. Organization development started by inviting all households in each of the main villages using a given beel system and dentified by the project team in its reconnaissance visits to a village meeting, there they formed village committees. These were short lived. Four PAPDs were held one each for two beel complexes and two for the largest wetland area, these formed the basis for the four RMOs that were formed with representatives from the user villages invited to the PAPD and later forming a core group for the respective RMOs

In total, 16 RMOs were formed (Table 1), each covering from 2 to 20 villages each with populations ranging from 555 to 1,580 households. Based on the selections made by villagers, the members of the general body of RMOs range from 40 to 182 people. The general members selected an Executive Committee ranging in size from 7 to 23. The general body members wanted relatively large Executive Committees to ensure participation of all villages. Because of the nature of the wetland, under the four RMOs in Turag-Banshi site, there are 20 constituent smaller area based committees (responsible for a deeper pocket within the wetland – a river section or daha), and in Kangsha-Malijhi site there are 18 village committees .At Hail Haor there are no such area based committees within the RMO.

Table 1 Community Based Organizations established for Resource Management

Site	RMO	Other ad hoc resource management committees
Hail Haor	8	5
Turag-Bangshi	4	5
Kangsha-Malijhee	4	16
Total	16	26

Others are mostly for tree plantations

In addition, a total of 26 more plantation management committees were formed to plant and guard trees (mainly in riparian areas), and are comprised of local landowners along with other (mainly poorer) stakeholders living nearby. These groups are not registered and simply function to maintain trees and to share benefits from the trees. The trees provide crucial habitat for birds and aquatic animals along streams and beels or lakes, and are also expected to reduce soil erosion and siltation in the streams and wetlands.

2.4 Resource management actions

2.4.1 Planning

Participatory planning was a vital first step.

Participatory planning in different forms took place in each site. Initially Participatory Community Planning (PCP) workshops were used to work with the communities to identify problems and develop potential solutions. This was used in Hail Haor and Turag-Bangshi sites. By 2001, in Sherpur the project made use of a systematic approach termed "Participatory Action Plan Development (PAPD)" (see Sultana and Thompson, 2004) that built on the methods used in the PCPs. In Sherpur, PAPDs were conducted with specific stakeholders of the communities. One-day workshops were held separately with each of four stakeholder types (fishers, farmers, landless and women) randomly selected to participate. These workshops included a problem census and ranking including a cause effect analysis by the participants in each stakeholder group. Through a plenary the main natural resource related problems were agreed upon. Then the separate stakeholder groups identified and analyzed the feasibility of potential solutions including their likely impacts on stakeholders. Thus the main outcomes of the PAPD workshops were lists of ranked problems and then analyses of possible management and physical interventions to address these. The main problems identified in all three sites were siltation and declining fish catches along with losses of other aquatic biodiversity (Table 2). Site specific problems included pollution in Kaliakoir,

flooding in Sherpur, and leasing of jalmohals in Sreemangal. However, overall, a wide range of problems were identified by the communities. The physical interventions identified through consensus typically included establishment of sanctuaries, habitat improvement, and connectivity restoration.

Table 2 Priority problems identified by stakeholders in participatory planning

Problem	Hail Haor overall top problems?	Kaliakoir (no. villages out of 8 putting in top 10 problems)	Kaliakoir (average score) *	Sherpur					Addressed by MACH
				fisher	farmer	women	landless	average score	
Siltation	**YES**	8	**9.2**	5.8	7.8	2.5	2.0	**4.5**	YES
General decline in fish	**YES**	6	**5.0**	7.8	4.8	8.3	8.0	**7.2**	YES
Loss/catching of fish spawn and brood fish		4	**3.9**	5.5	6.5	3.8	2.3	**4.5**	YES
Pollution	**YES**	4	**3.9**						P(?)
Leasing system	**YES**								YES
Use of destructive gear		6	**3.5**	6.0	5.8	1.0	7.5	**5.1**	YES
Lack of employment		4	**2.5**	1.0		3.3	4.5	2.2	YES
Rice seed (HYV) quality		3	**2.5**						NO
Fish disease		4	2.4	6.3	4.3		4.3	**3.7**	NO
Decline in aquatic resources plants/ animals	**YES**	4	2.1	3.0	1.3	3.3	4.8	3.1	YES
Water logging/ high monsoon water levels		2	2.0						NO
Inedible fish		2	1.5						NO
Some fish species lost		2	1.5	2.8	4.5	2.0	4.0	**3.3**	YES
Low water in dry season/ irrigation problem	**YES**	2	1.4	1.3			1.8	0.8	YES
No sluice gate		2	1.4						NO
River bank erosion		2	1.1						NO
Flood damage					6.8	4.3	2.8	**3.5**	NO
Lack of capital				6.8		4.8		2.9	YES
Loss of trees				1.0	1.0	2.5	1.0	1.4	YES
Lack cattle						3.0	2.5	1.4	NO
Loss of water birds	**YES**				1.5	2.3	1.5	1.3	YES
Lack of gear				2.5		2.3		1.2	NO
No cultivable land							3.0	0.8	NO
Crop pests					2.2			0.6	NO
Poultry problem						2.3		0.6	YES
Beel enclosure/ loss of access				1.8				0.5	YES
Lack tube well						1.5		0.4	YES
No credit							1.0	0.3	YES
Declining crop yields							1.0	0.3	NO
No homestead land				1.3				0.3	NO
Over fishing				1.0				0.3	YES

* Average of village based scores where: 1st priority problem = 10, 2nd = 9, etc.
Bold = top seven problems by site, bold problem name = top problems common to all three sites

2.4.2 Resource management plans and limits on fishing effort

Based on the outcomes of participatory planning, each RMO developed and agreed upon a set of rules or norms regarding fishing within those areas where it directly controls access or has direct influence[2]. These have been formalized into resource management plans with associated maps and endorsed by

[2] By 2005 the Ministry of Land 30 jalmohals had been reserved for management by the 16 RMOs for 10 years on condition that they pay the government a lease fee each year, and were in the possession of the RMOs. A further 8 jalmohals had been set aside permanently by the government to be sanctuaries protected by the communities. In addition the RMOs influence resource use in private lands that are seasonally flooded which surround these jalmohals, and also in Hail Haor they aim to influence the practices of the leaseholders of other jalmohals.

the Upazila Fisheries Officer (UFO). The main access limits introduced by RMOs to ensure sustainable fisheries are:

- aquatic sanctuaries;
- closed seasons of various lengths for all fishing in the early monsoon to protect fish when they are breeding;
- bans on fishing gears and activities that have been identified with the local communities to be most harmful to the fishery and wetland – such as dewatering and pumping out of deeper parts of the lakes (beels) and ditches, and use of fine mesh nets that target juvenile fish; and
- On order to cover costs of water body leases, maintenance of conservation measures and RMO operations, they collect payments for fishing from fishers that just cover these costs. I would add something about who is included who is excluded and how the rules are enforced.

2.4.3 Aquatic Sanctuaries

As the dry season progresses, water in even the deeper parts of wetlands becomes shallow and fish have few places to shelter. To make matters worse for fish, the water that remains is sometimes pumped out so that all the remaining fish can be caught. Other aquatic animals and plants are also destroyed when all the water is removed. When this happens, parent fish stock is not available to breed in the next monsoon with the result that fish stocks decline. Similarly, the populations of other aquatic flora and fauna including water fowl are declining due to habitat degradation.

The role of community based organizations such as the RMOs is to address the problems facing resources and their users. One of the main management tools that they have adopted are aquatic sanctuaries to conserve and enhance aquatic resources. By agreeing to stop fishing year round in areas that retain water in the dry season, the community ensures that adult fish can survive the dry season to breed (and the RMO establishes a general closed season at that time to improve the chances of spawning and juvenile fish). The benefits are expected to be higher catches in the rest of the wetland system, and restoration of biodiversity including fish, plants, invertebrates and birds, notably wintering water birds (the RMOs have stopped hunting in their areas).

By the end of 2005 MACH had helped RMOs establish 56 functioning wetland sanctuaries at the three sites covering 427 acres (173 ha), as shown in Table 3. The sanctuaries are of two types:

1. Most have been established by the RMOs within water bodies (jalmohals) where they hold the fishing rights for 5-10 years. These sanctuaries are part of local management plans and are designed to restore fish catches for the local communities represented by the RMO. Typically they are a small but vital part of the water body that retains water through the dry season and overall cover about 1.9% of the dry season water area of the MACH sites.

A typical small sanctuary in Hail Haor.

2. A few sanctuaries have been declared directly by the Ministry of Land, after proposals made by the project. These are larger areas of national importance to protect wetland habitat, fish and other aquatic fauna and flora. They have been taken out of the leasing system permanently, and on payment of a nominal rent the respective RMO is entrusted by the government to protect the sanctuary. In the Turag River three deeper spots were declared as

sanctuaries in this way and function in a similar way to those established just by the RMO. However, in Hail Haor a much larger sanctuary that in effect covers a contiguous area of about 100 ha has been established to serve as a wilderness refuge for the whole haor to protect fish, wildlife (water birds) and restore haor habitat.

The sanctuaries have been demarcated by flags placed on bamboo poles and permanent signboards. In many cases, based on RMO's plans, the project funded deepening the sanctuaries through excavation. The project has adapted traditional fish aggregating practices to increase fish populations in sanctuaries. Traditionally local landowners use tree branches to make brush piles in deeper parts of a water body to provide shelter for fish. Algae, plankton and other organisms grow on the surface of these tree branches and become a source of food for fish, and the branches prevent unwanted fishing, then the owner contracts specialist fishing teams to encircle the shelter, remove the branches and catch all the fish. In the river sanctuaries MACH has supported the RMOs using the same local technology but with no harvesting of fish in the sanctuaries. However, tree branches rot and have to be replaced regularly which contributes to loss of tree cover, so in beel sanctuaries the project has developed and promotes the use of "hexapods" and pipes made of concrete which will last for many years and serve the purpose of providing shelter and preventing fishing without repeated investments by the RMOs or reducing local tree cover.

Table 3 Wetland sanctuaries existing in MACH sites in late 2005 by year of creation.

Year and water body type	Hail Haor			Turag-Bangshi**			Kangsha-Malijhee		
	# of sanctuaries	Improved habitat* (acre)	No-fishing area (acre)	# sanct.	Improved habitat* (acre)	No-fishing area (acre)	# of sanct	Improved habitat* (acre)	No-fishing area (acre)
Beel									
2001	6	9.49	11.44	9	5.24	26.20	12	5.92	11.63
2002	1	0.15	0.15	5	10.94	54.70	0	0.00	0.00
2003	1	21.88	21.88	0	0.00	0.00	0	0.00	0.00
2004	0***	100.50	211.72	6	5.00	25.00	1	1.50	4.30
2005	0	0.00	0.00	0	0.00	0.00	1	3.00	7.07
River/khal									
2001	0	0.00	0.00	3	5.80	29.00	2	1.66	2.22
2002	1	1.19	10.32	0	0.00	0.00	3	2.20	2.88
2003	1	0.46	0.96	0	0.00	0.00	3	2.12	6.89
2004	0	0.00	0.00	0	0.00	0.00	1	0.50	0.78
2005	0	0.00	0.00	0	0.00	0.00			
Total	10	133.67	256.47	23	26.98	134.90	23	16.90	35.77

* Re-excavated area and/or area with fish protection devices such as hexapods within sanctuary (the area reported in MACH annual reports).

** In 2005 six sanctuaries with 9.2 acres of improved habitat and total no-fishing area of 46 acres were created in nearby areas of Kaliakoir but outside of the RMO management/influence areas.

*** Part of the same national sanctuary as the beel area reported in 2003 in this site, note that 111.22 acres is khas land which is part of the no-fishing zone but not formally declared as sanctuary by the government.

Abandoned sanctuaries:

Hail Haor - in several cases more than one spot with improved habitat is in a contiguous sanctuary (no fishing zone) so the number of sanctuaries reported here is reduced from previous documents. Four sanctuaries (total area 6.48 acres) were only observed for one year 2001-02. Another of 0.52 acres was planned and included in project reports for 2001 but was never actually established.

Turag-Bangshi - two of unknown characteristics, one replaced in 2001 the other in 2004.

Kangsha-Malijhee - one 0.21 acre fish protection device of 2001 was converted shortly after to a katha for fishing by the RMO with LGC approval.

2.4.4 Re-excavation of beels and khals

Siltation of canals and beels is a major problem that results in a reduction in the volume of water stored in beels. In 1999 it was found that the largest *chora* (hill stream) feeding the haor carried over 200,000 m^3 of sediment just in July. In 2001 silt loads of 22 choras were monitored – they carried 50,000 tons, suggesting that the total of 59 active choras carry over 100,000 tons of silt into Hail Haor each year. Moreover sediment traps showed deposition of 8-15 cm of silt in one year near the outfalls of the choras, which results in an average estimated raising of the haor bed by about 5 cm per year or

1 m in 20 years (MACH 2004). With only 2-3 m of water in most of the Haor in the monsoon, Hail Haor is changing rapidly, the fringes of the haor are rapidly filling in, and it could disappear as we know it today. This pattern is repeated in the other project sites and throughout the country. The connecting channels or *khals* between beels and rivers are silting up, and this has a disproportionate impact on the fish populations. Some species of fish breed in the river environment and then juveniles migrate from rivers to beels at the onset of the rains when water levels are rising, later adults return to the river at the end of the monsoon when water levels fall. Blockage of connecting canals by siltation and sluice gates delays or prevents migration of both adult fish and offspring.

About 1.8 million person days of work was created through manual excavation of silted up wetlands

To address this adverse trend, wetland habitat has been restored by re-excavating canals to improve flows, and re-excavating beels (mostly within areas declared by the RMOs as sanctuaries) to increase the depth to maintain water year round. The improved habitat provides better shelter for fish, and facilitates breeding and regeneration of aquatic plants and animals.

RMOs and local government formed Project Implementation Committees to oversee contractors and in some cases employ the laborers required for earthworks. Though the total area excavated is modest compared with the total dry season water area (see Table 4), these deeper fish refuges and canal connections directly serve and link with the majority of the dry season water area in the three sites.

Table 4 Re-excavation in MACH Project sites between 1999 and 2005

Site	Canal length (km)	Canal area (ha)	Beel area (ha)	Total area (ha)	Area of directly connected water bodies (ha)
Hail Haor	11,202	56.43	13.94	70.37	210.98
Turag Bangshi	9,500	221.50	20.84	242.34	144.55
Kangsha Malijhee	9,240	33.62	11.12	44.74	147.27
Total	29,942	311.55	45.90	357.45	502.80

2.4.5 Reforestation and soil conservation

Contour cultivation of pineapples can increase profits by over 100% and reduces soil erosion which severely affects wetlands such as Hail Haor

Re-excavation of wetlands addresses the outcome of the siltation process but not the root causes. MACH introduced a watershed approach to address water catchment management on a pilot and demonstration basis, this has worked in upland areas that are outside of the wetland and RMO managed areas to address problems identified by the communities. Land use mapping for two chora catchments flowing into Hail Haor revealed that 46% is under tea estates (which are already reasonably well managed to limit soil erosion), 28% is forest land under the responsibility of the Forest Department (some of which has poor tree cover), and 13% is privately managed pineapple and lemon gardens. The pineapple disproportionately contributed to siltation because the growers habitually grew pineapple in rows running up-down slope accelerating soil erosion in this high rainfall area (2,200 mm pa; MACH 2004). The lemons are more typically grown at the base of the hills and not on the steep slopes. By bringing in expertise on pineapple growing and working with a few farmers to test and demonstrate it

was found that contour cultivation was not only feasible but resulted in denser planting per ha, reduced fertilizer costs, and generated higher profits (an extra Tk 130,000 (US$ 2,000) per ha), and of course reduced soil erosion.

Communities felt it was important to plant native trees to mitigate the past trend for loss of tree cover including swamp forest in the wetlands and riparian areas, this is also expected to help reduce the present sediment loads in small rivers and channels flowing into the wetlands through bank stabilization. Notably the project has helped to pioneer and demonstrate nursery raising and planting out of native wetland trees - Hijal *Barringtonia aquatangula* and Koroch *Pongamia glabra* – that are adapted to being inundated by a meter or more of water for up to half of the year. This swamp forest is important for providing habitat for growing fish during the monsoon as well as habitat for other wildlife, and helps to shelter villages and provide branches for brush piles.

Swamp forest trees, Hail Haor

Table 5 summarizes the extent of reforestation through the project. Other locations dominate, notably local roadsides which also helps limit runoff and soil erosion, and sapling distribution to individual members of the RUGs for their livelihoods.

Table 5 Wetland and other reforestation undertaken by MACH up to November 2005.

Site	Swamp forest (no. trees)	Riparian plantation (no. trees)	Other plantation (no. trees)	Total (no. trees)
Hail Haor	72,105	52,053	59,028	183,186
Turag Bangshi	18,057	59,692	46,304	124,053
Kangsha Malijhee	34,803	121,543	141,780	298,126
Total	124,965	233,288	247,112	605,365

2.5 Community organization for livelihood development for the poor

The project recognized from the outset that to restore wetlands and then ensure that they are only used at sustainable levels involves limits on access and use, for example closed seasons and sanctuaries prevent people from fishing as they had done. Moreover the remaining wetlands, even with some excavation, are a finite resource that cannot provide a decent living for increasing numbers of fishers and a growing population.

The project developed alternative livelihood sources for poorer resource users and provided access to micro-credit. Small groups were formed, called "Resource User Groups" (RUGs), of 15 -30 men or women from poor households, generally those owning under 0.2 ha of land or less, laboring for part of the year, having a low education level, who did not belong to any other NGO's groups, and that made use of the wetlands covered by resource management activities. These households were mostly from villages close to the wetlands and generally were involved in fishing or collecting other aquatic resources for income or food, by 2005 about 57% of RUG members fished for an income (some having left the profession as a result of RUG membership). Following normal NGO practice for credit and savings programs in Bangladesh, only one person per household could join a RUG, membership is based on making regular personal savings in weekly group meetings. On the basis of savings the members could propose income generating activities for receiving loans from the project. The recipient members also discussed wetland management in their meetings and were trained in

Poultry rearing has been one of the most profitable enterprises for RUG members

business and enterprise skills that they then used their loans to establish. Typical enterprises include raising livestock, small shops, and individual skilled work such as tailoring or operating a tree nursery. By April 2005 5,334 households had members belonging to the RUGs. Of the RUG members about 68% are men, about 75% own under 0.2 ha of land.

The MACH approach to the livelihood support linked with fishery and wetland management was unique because:

- The RUGs are overlapping but separate from the RMOs. About 60% of the volunteers who belong to the RMOs come from the RUGs and represent the interests of their respective RUGs when they attend the RMO. Similarly wherever there is a RUG in the villages using one of these wetlands it has a representative in the respective RMO.
- For the RUG members, the project focused on developing skills and enterprises that would enable participants to reduce their fishing effort or even leave fishing altogether. This included providing vocational training (for example as electricians or drivers) and in some cases providing larger loans of up to Tk 35,000 (US$ 500). As a result, 153 participants started new skilled jobs or invested in enterprises that provide full time work (for example a power tiller or medium scale broiler chicken farming raising batches of 500 or more chicks).
- Activities to benefit the poor were linked to technical interventions such establishing tree nurseries or trials of alternative crops with lower dry season water demand in an attempt to reduce abstraction from dry season water bodies. However, this initiatives have been scattered and achieving changes in agriculture on a larger scale that would be linked up with resource management planning by RMOs for the wetland including water and land use still has a long way to go.
- Federations of RUGs (FRUGs) have been formed roughly coinciding with Union Parishad boundaries (13 in all). These have been registered with the Social Welfare Department, and the revolving loan funds provided under the project are being transferred to these FRUGs. The FRUGs then have responsibility for managing the savings of their members and credit funds from which they lend to their members. As such they are entirely membership based organizations with elected office bearers from among the members, but will employ staff (using portions of the interest charged on the loans) to operate their funds.

As of April 2005 the RUG members had accumulated on average about Tk 1,300 (US$ 20) each in savings making a total of over US$ 95,000, and had revolving loan funds of about US$ 250,000. According to a survey undertaken in 2002 the average household income of the RUG participants at that time was about Tk 35,000 (US$ 540) during the previous year (below the national poverty line of Tk 45,000 (US$ 690) per household per year). The net profit for borrowers after repaying their loans was Tk 2,150 (US$ 33) per loan, and up to one loan can be taken in a year.

2.6 Impacts of improved wetland management on fishing and economic value

2.6.1 Methods

It is well known that fish contribute the majority (85% in 1982; Ahmad and Hassan 1983) of animal protein to the Bangladeshi diet, but national fish consumption declined between 1995-96 and 2000 by 14% to 11.1 kg/person/year (Bangladesh Bureau of Statistics household expenditure survey data quoted in Muir 2003). To assess direct impacts of improved wetland management on livelihoods, especially those of poorer people, fish consumption was monitored for a panel of households (490 in Hail Haor, 280 in Turag-Bangshi and 280 in Kangsha-Malijhee). To assess changes in fish consumption, local women were trained as monitors and visited each sample household once every three days (10 days per month) to weigh by species the fish being prepared for cooking and home consumption.

Each wetland complex comprises different types of wetland habitat: river, canal, beel and floodplain. Fish catches were monitored by fisheries biologists in specific locations selected to include representative areas of different wetland habitats (floodplain, beel, river) in each site: seven areas totaling 1,174 ha in Hail Haor (9% of the maximum inundated area), eight locations totaling 383 ha in Turag-Bangshi site (4% of the maximum inundated area), and eight locations totaling 268 ha in the Kangsha-Malijhee site (3% of the maximum inundated area)[3]. Each sample location was surveyed for three days every month. Within that defined area separately operating fishing units (which may be one or several people) were recorded according to the equipment (gear) they used for fishing. For three fishing units of each gear type or 10% of units of that type (whichever was the higher figure) the gear type and characteristics, expected duration of fishing, and catch by number and weight of fish were recorded. The sample area catches are taken to be representative of the whole wetland system and the total catch estimate for the sample areas multiplied up by the fraction of the total area gives an estimate of total catch.

A typical catch of small fishes

2.6.2 Fishing effort and catches

Compared with the baseline years (the first year of records for each site, when there were no management interventions) there have been substantial increases in total fish catch and in catch per hectare in all three sites (Table 5). The greatest percentage gains have been at the Turag-Bangshi site where the fishery was in a very poor condition before restoration. Although effort appears to have increased to a very high level there, catch per person day has also increased. The low levels of catch per person day in both Turag-Bangshi and Kangsha-Malijhee sites reflect the greater importance of subsistence fishing in floodplains in these sites – as this is a supplement to income more people fish for just part of a day or spend days fishing when they have no other work, whereas most of those fishing in Hail Haor do it for their daily income. A complication to interpretation of the trends is that 2004 was a high flood year with greater availability of fish and hence effort increased to take advantage of this bounty. The fact that catch per person day was higher that year in all three sites than in the baseline year suggests that fishing was still more sustainable than before the project.

Achieving compliance with the fishing norms introduced through the resource management plans has not been easy, and the RMOs have tended to concentrate on water bodies where they hold fishing rights and have had less influence on other areas. Although there is generally relatively little fishing in the months when a closed season was introduced, there is no sign of any overall reduction in effort in that time. However, they do appear to have changed opinions to some extent regarding use of fishing gears and practices identified as particularly harmful. The percentage of effort using such gears has fallen, although total effort with these gears remains substantial.

[3] The sample areas comprise a higher percentage of the dry season water area since the choice was made to include some of the key dry season fishing grounds.

Table 6 Changes in fish catches in relation to wetland management activities in MACH sites.

Year and site	Maximum area inundated (ha)	Cumulated area of sanctuaries (ha)	Cumulated area excavated (ha)	Total estimated catch (t)	Effort (person days per ha)	CPUE ** (kg/ person day)	CPUA *** (kg/ha)	Effort in closed season		Effort with banned gears	
								person days	% of effort	person days	% of effort
Hail Haor											
1999-2000*	NA	0	6.65	2,137	120.8	1.13	171.1	8,896	5	62,853	36
2000-2001	12,214	5.65	10.28	2,561	93.3	1.76	205.0	12,682	9	42,447	31
2001-2002	12,215	8.87	20.30	2,382	89.6	1.71	190.8	15,601	12	40,640	31
2002-2003	14,926	18.11	31.94	3,588	78.1	2.95	287.3	7,979	7	32,592	28
2003-2004	13,490	103.79	70.35	2,021	72.0	1.80	161.8	11,093	11	31,572	30
2004-2005	15,835	103.79	70.37	4,854	138.3	2.25	388.6	21,706	11	57,128	28
Turag Banshi											
1999-2000*	NA	0	0	253	217.3	0.27	57.8	4,290	5	24,917	30
2000-2001	NA	22.34	2.37	546	397.5	0.31	124.7	16,896	11	62,960	41
2001-2002	NA	44.48	4.91	458	491.7	0.21	104.8	37,856	20	31,473	17
2002-2003	NA	44.48	6.12	613	500.4	0.28	140.1	11,855	6	36,797	19
2003-2004	4,297	54.59	34.72	1,379	509.3	0.62	315.2	19,665	10	41,237	21
2004-2005	NA	54.59	39.92	1,403	717.2	0.45	320.7	24,102	9	68,378	25
Kangsha-Malijhee											
2000-2001*	NA	5.69	1.69	1,233	568.6	0.23	150.2	12,838	7	20,416	12
2001-2002	14,926	6.77	9.69	1,225	651.0	0.20	149.2	21,578	11	45,074	23
2002-2003	NA	9.56	21.27	2,244	996.9	0.24	273.4	49,141	16	54,063	18
2003-2004	NA	11.61	46.04	2,591	754.9	0.37	315.6	27,874	12	27,631	12

* Baseline (no interventions to improve wetland or its management.
** Catch per unit effort
*** Catch per unit area
Assumes core closed season is Baishak – Ashar i.e. 17% of the year.
Only banned gear considered here is current jal
Maximum area inundated is calculated using GIS and a digital elevation model for Hail Haor each year, but has only been estimated once for each of the other two sites.
The actual excavated areas are shown and do not include the total area of water bodies within which perennial water areas were created.

Fish species diversity was assessed as a simple count of species recorded from the sampling program, which was a constant effort between years in each site. There was at best a modest increase in the number of species recorded between the baseline years and subsequent years (Table 6). The dominant species by weight caught in all three sites included Jat puti *Puntius sophore* which is typical of open waters in Bangladesh. Small shrimps were the highest percentage of catch (10-19%) in baseline and subsequent years in Turag-Bangshi and Kangsha-Malijhee sites. This is a concern, as de Graff et al. (2001) have argued that a high proportion of shrimps in floodplain catches indicates a fishery that has been severely damaged as it lacks appropriate conditions for breeding and recruitment of larger and beel resident fishes.

Table 7 Fish species diversity (number of species recorded)

Year	Hail Haor	Turag-Bangshi	Kangsha-Malijhee
1999	71	82	Na
2000	71	81	Na
2001	69	86	64
2002	79	91	67
2003	67	85	71
2004	81	85	73

Years defined as follows: Hail Haor - April to March of next year; Turag-Bangshi - May to April of next year; Kansha-Malijhee - August to July of next year.

2.6.3 Fish consumption trends

In both Hail Haor and Turag-Bangshi fish consumption has gradually increased since the baseline year, and in 2004-05 was respectively 33% and 66% higher than the baseline period (Table 7). These benefits have been shared widely across poor and better off households. Most of the households monitored were landless (about 60%) or marginal farmers (about 20%), and in Hail Haor these were the types of household that have enjoyed significantly higher fish consumption since 2002-03, the other landholding households have not significantly increased fish consumption and since the larger landowners had higher consumption at the baseline this means that the poor have caught up in their consumption. However, this was a more productive fishery even before MACH started its work

compared with the other two sites and so fish consumption was much higher than the other sites and the national average. In Turag-Bangshi all landholding categories had similar levels of fish consumption before the project and all have gained significantly. The timing of increases in fish consumption in the three sites is indicative of a project impact since sanctuaries and excavation only started to be implemented in 2001 so impacts in the next year might be expected.

Table 8 Fish consumption (g/person/ day)

Year	Hail Haor	Turag-Bangshi	Kangsha-Malijhee
1999	49	29	Na
2000	52	28	Na
2001	54*	30	24
2002	60**	37**	28*
2003	58**	47**	29*
2004	65**	48**	34**

Hail Haor and Turag-Bangshi "1999" data are from September-October to April of following year, subsequent years are May to April of next year; Kangsha-Malijhee data covers full calendar years.
Figures are averages of each household's average consumption in the period.
* = significantly higher than baseline consumption, ** significantly higher than both baseline and 1st impact year, t-test, $p<0.05$

2.6.4 Value of wetlands

It is increasingly being recognized that the economic value of wetland ecosystems worldwide has been under-recognized by decision makers (Barbier et al. 1997), and Bangladesh is no exception to this trend. Wetland areas produce a wide variety of economic benefits. Some benefits can be more readily identified and quantified than other benefits. Direct benefits such as fisheries production, production of aquatic vegetation and products can be estimated from sample surveys and monitoring of beneficiaries. Other benefits such as recreational value, flood control value, water quality improvement, pasture value, biodiversity, and water table impacts, have real and very significant economic value but are much more challenging to estimate. Failure to include the economic value of all wetland outputs has clearly biased development efforts in Bangladesh towards conversion of wetlands to agricultural and other uses.

The ecosystem approach of MACH and detailed monitoring program gave an opportunity to make a detailed assessment of the economic value of Hail Haor by developing a simple bio-economic model using data from 1999-2000. Table 8 indicates that the annual value of non-fish aquatic products including aquatic grasses, plants for human consumption, snails, mussels and other products is as high as that of fish. The estimates are conservative since a number of important benefits and uses from the haor that are difficult to value were not included. Although boro rice is grown in a significant part of the wetland, it is clear that if the rest of the haor to be converted to rice production there would be an economic loss to the nation as well as to the local community, since at that time the net return from Boro rice was only Tk 18,254 per ha (BBS 1999). With the management improvements put in place by the co-management systems significant increases in the value (from that shown above) of the wetlands as wetlands have occurred.

Table 9 Estimated value of Hail Haor economic outputs in 1999-2000.

Type of good or service	Total returns (Tk)	Value per area (Tk /ha)*	Percent
Commercial fisheries	56,272,200	4,580	12
Subsistence fisheries	83,651,100	6,800	18
Non fish aquatic products**	127,973,300	10,410	28
Boro rice value	63,857,500	5,190	14
Project / biodiversity funds	43,650,600	3,550	10
Pasture value	40,292,800	3,280	9
Flood control	23,443,200	1,910	5
Recreation	7,025,600	570	2
Transportation	8,758,300	710	2
Total (Tk)	**454,924,600**	**36,990**	**100.0**
Total (US$)	**$7,981,100**	**$650**	

Water quality, aquifer recharge benefits and existence value were not valued.
* Total output value divided by maximum water area (12,300 ha in 1999).
** Includes aquatic plants used by local residents and by tea estates

2.6.5 Achievements in addressing priority problems

It is important to review how the RMOs and resource management interventions have performed in addressing the problems that the communities identified as most important in planning activities at the local level. As Table 2 showed, the local communities identified a wide range of problems relating to their wetlands and livelihoods. Many have been addressed through MACH activities, but the extent of this varies between sites.

The most obvious impacts are that fishery management has improved in all three sites. Many trees have also been planted in all three sites, but there were no other specific activities undertaken in Kaliakoir to address siltation from neighboring raised lands (many of which have been deforested in recent decades). This aspect of watershed management could be addressed in future by the co-management committee at upazila level since land use in much of this area is beyond the influence of the RMOs.

Reflection on progress also highlights some issues that were addressed in one site and where lessons and approaches might have been shared more between sites. For example, pollution was subject to special studies and efforts in Turag-Bangshi where undoubtedly it is a major issue that has grown since the baseline period, but in Hail Haor it was also identified as one of the top problems. Hail Haor in particular has had success in protecting water birds and reversing the decline in aquatic life, in Turag-Bangshi site these were not recognized as high priority problems by the community, and there is evidence of increasing hunting and losses. Other issues remain to be addressed in sustaining these wetlands and improving the livelihoods of poor people dependent on them. For example, early flash flooding was identified as a key problem in Sherpur and there is scope to work with farmers to try crops with earlier harvests and with the RUGs to identify enterprises that are more resilient.

3. Community-based co-management

Co-management has been a focus of attention in fisheries (and natural resources) management in the last two decades. Although IUCN defines co-management as "a situation in which two or more social actors negotiate, define and guarantee amongst themselves a fair sharing of the management functions, entitlements and responsibilities for a given territory, area or set of natural resources." (Borrini-Feyerabend et al. 2000), in the case of fisheries it has most often been taken to mean a sharing of responsibility between government and fishing communities. Co-management stretches from government dominated decisions at one end of the range with government instructing users, through consultations, to at the other extreme users advising or informing of their decisions for government endorsement (Berkes 1989; Pomeroy and Williams 1994; Sen and Nielson 1996).

Co-management has been promoted in the belief that a shift from top-down management to sharing decisions and responsibility between resource users and government would improve the quality of decisions and local compliance with management plans. Therefore the intention of co-management is to empower fishers both as an end in itself and in the expectation of better management (Viswanathan et al. 2003). This requires major changes in institutions, organizations and attitudes.

The MACH approach could be termed community-based co-management. It has focused on helping communities organize for improved management of their resources (RMOs) and helped the poor organize to improve their individual livelihoods (FRUGs). But establishing community based management of wetland resources is unlikely to sustain without recognition from and linkages with other formal institutions, and strong community organizations are needed if wetland users are to share decision making with government. The MACH project has developed and demonstrated a combination which is new for Bangladesh and has proved very effective. Although the project has been undertaken by NGOs, and has focused on establishing recognized local community organizations to sustain resource management (RMOs) and credit for income generating activities (FRUGs), they have been formally linked with local government.

Co-management involves sharing decision making and responsibilities between resource users and government. MACH achieved this through two tiers: (a) community based organizations to manage specific wetland areas, and (b) local government committees that include officials, elected representatives and community based organization leaders to coordinate and guide the process.

This approach creates a co-management body that recognizes and empowers the community based organizations and enhances local government involvement in an advisory and trouble shooting role. Fisheries and wetland administration in Bangladesh does not operate in a fully top down mode: water bodies are state property but they are either open access fisheries (in which case there is limited scope for government to enforce any fishing rules) or are leased out (in which case the leaseholder takes all subsequent practical decisions on fishing access). By reserving use rights for 10 years for community based organizations – RMOs – the government recognizes the right of those RMOs to make and implement management plans and sets of rules just as leaseholders have done in the past. The difference is that with long term rights and considering their community interest, the RMO adopts better practices that sustain and restore fish stocks and wetland biodiversity.

In this approach wetland resource management decisions are taken by the RMOs, but these are endorsed, coordinated and overseen by a co-management body. Two tiers of local government are relevant. The Union Parishad is a local elected council typically covering around ten villages, and is the only long standing form of representational local government in Bangladesh. Among its responsibilities is local planning. The Upazila or sub-district is staffed by technical officers of various line agencies as well as administrative officers, and has responsibility for delivering government services.

MACH was able to establish Local Government Committees (LGCs) in the four main Upazilas where it is working. These comprise of the relevant Upazila officers (chaired by the chief administrative officer – Upazila Nirbahi Officer – and the member-secretary is the Upazila Fisheries Officer), the chairmen of those Union Parishads where wetland management is being improved, and the chairpersons of the community organizations established through MACH – the RMOs and FRUGs. Through this forum the problems and potential solutions to wetland degradation have been discussed, plans for habitat restoration by RMOs are debated and approved, and problems and issues encountered by the community organizations and project have been discussed and solutions found. In addition to this formal co-management body, the RMOs have developed informal links with the Union Parishads in whose areas they work, and are invited to attend the Union Parishad meetings.

Thus both formally and informally the networking and social capital of the community based organizations have been enhanced through co-management committees playing this supportive role, and local government has a well defined and more substantial role than under the previous system. Figure 2 shows the linkages involved. The LGC has a scope limited to MACH related activities, but it can refer issues that are outside of its scope to resolve either to the appropriate line agency, such as the District Fisheries Officer, or to the Upazila Development Coordination Committee which is charged with coordinating all activities within an Upazila.

To sustain these institutional arrangements beyond the MACH project, MACH has raised awareness within the Government of Bangladesh of the merits of the LGCs as co-management committees. The Department of Fisheries has now proposed that this arrangement be made permanent and extended (eventually to all Upazilas) by establishing Upazila Fisheries Committees with the same composition as the LGC and with both the responsibilities of the MACH LGCs and those of the former Upazila Jalmohal Management Committees (which were concerned only with leasing of some jalmohals). The great merit of this framework is that although it is a uniform prescription, it is for coordination and oversight, within this community based organizations of any and all forms that are effective in improving wetland management and community participation can be supported, just as already the nature of the RMOs under MACH differs between the three sites.

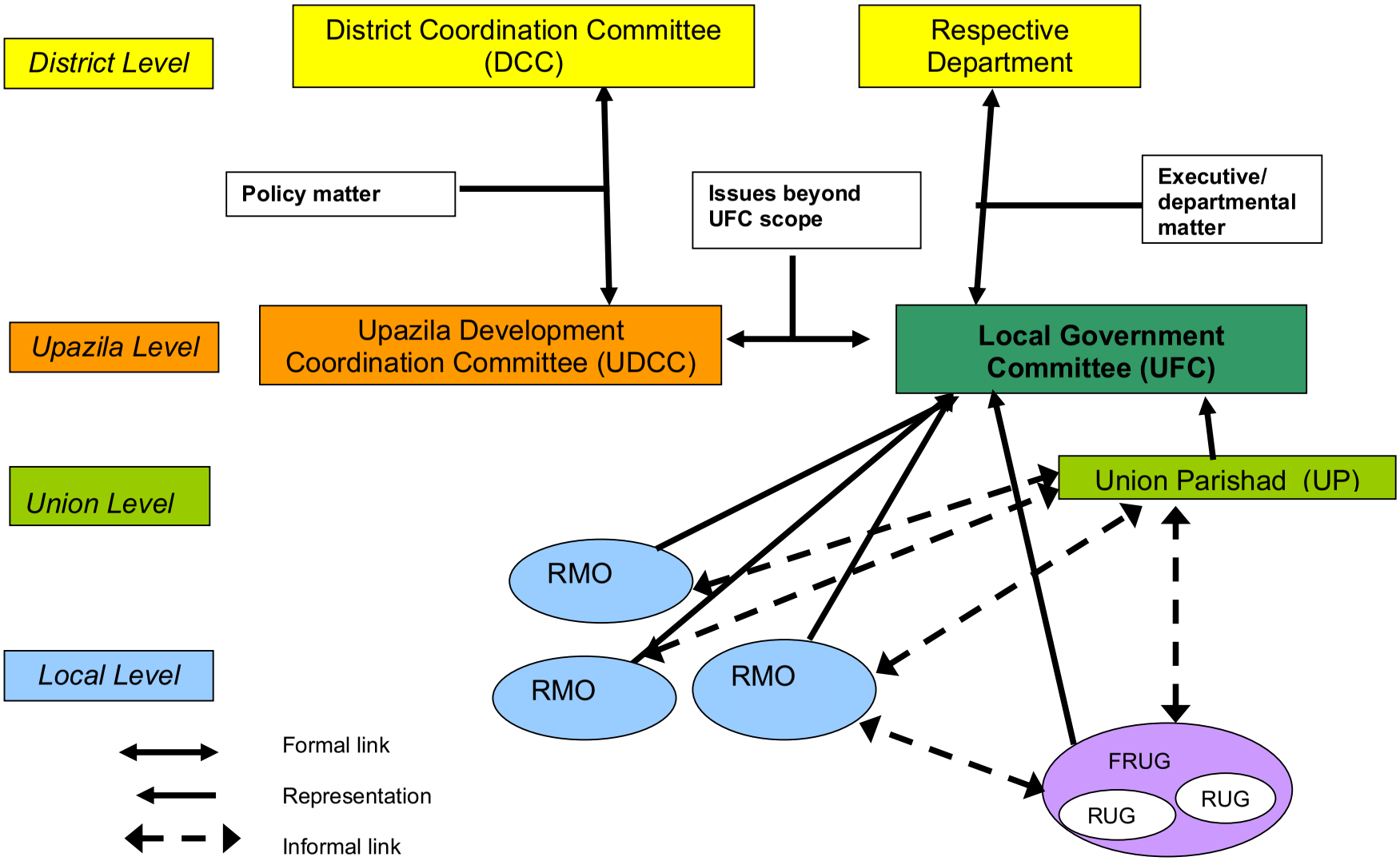


Figure 2 Institutional Arrangement for Wetland Co-management under MACH

4. Conclusions

MACH has followed a process approach based on participatory planning with the local communities. It has successfully implemented a range of interventions to restore the productivity of three large wetland ecosystems. Since fisheries contribute the main use value of these wetlands much of the focus has been on their management, but an ecosystem or catchment approach was adopted that has also seen measures to restore tree cover and reduce erosion and sedimentation. Resource management has been linked with support to diversify and enhance the incomes of poor people in ways that would reduce their fishing effort.

The project set out to adopt a co-management approach at each of the sites so as to achieve its environmental improvement goals and to ensure a workable institutional framework that allowed for the interventions to be taken and established. Consequently not only did the project develop community based organizations which have gradually taken over direct resource management responsibilities, but it also linked these with existing institutions - Union Parishads and local administration and agencies through the Local Government Committee. The effectiveness of this arrangement as a framework for sustainable improved management based on community participation, made institutional development a major focus of the second phase of MACH and attracted the interest of the Department of Fisheries. Consequently this co-management structure has been approved by the Ministry of Fisheries and Livestock as part of DOF's Inland Capture Fisheries Strategy.

The differences in RMOs between MACH sites confirm that this structure can operate as a framework that could support different types of community organizations for fishery and wetland management. It will be particularly appropriate where there are several water bodies or large wetlands within an Upazila. In this regard the relatively intensive MACH approach is likely to be most appropriate for larger wetland systems in need of restoration, and preferably where there is the scope to protect sufficiently large areas to act as core areas with restored wetland ecology that will enhance fish catches in the remaining areas. In addition there is scope within the DOF Inland Capture Fisheries Strategy framework for support programs through links with NGOs and others to help develop resource management organizations or similar community organizations and to enhance access for poor people to livelihood development. In this regard the most significant issue emerging from MACH is the need to clearly link any micro-credit and traditional NGO support with the participants adopting activities that help them to limiting fishing effort and resource use, and thus explicitly ensuring that initiatives for livelihood and resource management improvement complement one another.

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A project of the Government of Bangladesh

Supported by USAID

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WEB: www.machban.org

MACH Headquarters:
House No: 2, Road 23A
Gulshan 1, Dhaka 1212
Bangladesh