



MACH (Management of Aquatic Ecosystems through Community Husbandry) is a Government of Bangladesh project supported by USAID. The project partners (Winrock International, Bangladesh Centre for Advanced Studies, Center for Natural Resources Studies, and Caritas Bangladesh) have worked closely with the Department of Fisheries since 1998. The aim was to establish community based co-management and restore and increase sustainable productivity at the ecosystem level in three large wetlands: Hail Haor in Sreemongal, Turag-Bangshi river and wetlands in Kaliakoir and the Kangsha-Malijhee basin in Sherpur. In the wet season these wetlands cover about 32,000 ha, and in the dry season they include over 100 distinct waterbodies. Over 110 villages inhabited by over 184,000 people are directly involved.

## Restoring Wetland Environments and Biodiversity: Lessons from MACH

The biodiversity within an ecosystem is dependent upon the quality of the habitat. Bangladesh's floodplains remain wetlands but much of the habitat is degraded. Dysfunction in the system is a major reason for declining diversity of fish and other fauna and flora. In turn this reduces the diversity and resilience of livelihoods of people, especially the poor, who depend on those wetlands. Restoration of habitat can take years to accomplish (e.g. 15-20 years in the US where natural processes are allowed to perform the restoration) and the resultant expected increases in biodiversity can take even longer. Full restoration to historical conditions is most often not possible because of human needs and requirements.

### BACKGROUND

More than 40% of Bangladesh's freshwater fish species are now threatened with national extinction (IUCN Bangladesh 2000) and may soon follow the path of other wetland fauna and flora. There have already been mass extinctions in the last 200 years in much of Bangladesh. In the mid-nineteenth century there were large areas of reed swamp, wet grassland and flooded forests, particularly in the haors of Greater Sylhet, where One-horned Rhinoceros, Tiger, Swamp Deer and Wild Buffalo all roamed (Sachse 1917). By 1967 large mammals had long since disappeared from the haors, but in Hail Haor "From horizon to horizon the sky was full of wheeling ducks and their clamorous voices could be clearly heard for half a mile." (Mountfort 1969). Yet monthly surveys of Hail Haor in 1992 revealed few ducks (FAP 6 1993); and in 2003 only a handful of wild ducks remained. The full indigenous biodiversity of the Ganges-Brahmaputra floodplains is now only to be found in a few national parks that retain the original habitats, such as Kaziranga in Assam and Royal Chitwan in Nepal.



The wetlands that cover half of Bangladesh are a source of food and income for perhaps 70 million rural households. However, flood embankments and water control structures have blocked fish migration routes; irrigation has expanded winter rice cultivation and reduced the water available for aquatic life to survive in the six-month dry season; industrial development causes locally severe pollution; overexploitation has reduced wild fauna and flora; and loss of tree cover and poor slope cultivation practices in watersheds cause high rates of siltation in wetlands. The most critical problem is the loss of dry season surface water which is vital for all aquatic life including fish.

Under MACH wetland habitats have been restored and conservation measures taken up by community organizations supported by local government. MACH's goal was to increase the sustainable productivity of all floodplain resources, including fish, plants, and wildlife over an entire floodplain ecosystem (*beels* - lakes and depressions, seasonal floodplains, rivers, and *charas/jharas* - streams).

## LESSONS LEARNT

**Attitudes and institutions**

Most people want prosperity for their family, like to eat a diversity of fish, and appreciate the natural beauty of wetlands. But most often these are seen as competing or conflicting ideals. MACH helped change opinions through:

- 1. Awareness building:** small group discussions, folk theatre, posters, and films opened the eyes of all strata in local society to the opportunities for reversing the decline in their wetlands and their productivity.
- 2. Building local institutions:** the conservation movement worldwide has recognized the importance of local support and tangible benefits linked with conservation. The primary institutions developed by MACH have been *Resource Management Organizations* (RMOs) representing all users of particular wetland areas. Linked with these are *Resource User Groups* of poor people who obtain training and credit to move into non-wetland dependent occupations. *Local Government Committees* provide a forum to coordinate between communities and administration for each larger wetland system.
- 3. Participatory planning:** wetland restoration should be technically feasible and address local needs. The RMOs have developed plans to address problems and needs in their areas, with advice from local officials and specialists.

**Habitat rehabilitation**

Effective actions have been: excavation to deepen silted up wetlands so that they hold more dry season water, excavation of small channels so that there are connections between rivers and beels when fish migrate in the early monsoon, and planting of trees along streams and to restore swamp or wetland border forests.

**Implementation** of excavation has been through three systems:

1. Enlisted contractors were engaged for larger schemes or where mechanical devices were required careful supervision is needed as contractors vary in their sincerity and quality;
2. Project staff directly executed some small works with the support of the concerned RMO, which provided direct benefits to RUG group members by employing them; and
3. Implementation directly by the RMO to maximize the community's direct involvement and to increase capacity of the RMOs. This has the advantage of enhancing ownership and developing RMO capacity, but the disadvantage of taking attention away from overall resource management and turning some RMO leaders into contractors.



Dredging in Hail Haor

**Planning and timing** are critical to excavation. Well ahead of each dry season the RMOs identified locations within their respective wetland management areas that were so silted up that they dried out and could not support fish in the dry season. After specialist review to ensure technical feasibility, positive biodiversity impacts and social acceptance, the selected schemes were endorsed by the concerned RMOs and Local Government Committee.

**Methods:** manual excavation methods that generate employment for the poor are preferable, but due to late or early rains often this is only possible when wetlands dry out completely during a short period in February-March. Consequently in most years only part of the planned excavation could be completed. Moreover some locations are never feasible for excavation by manual labor due to deep slushy soils. In these situations locally made dredgers have been used, for example in Baikka Beel sanctuary in Hail Haor. But mechanical problems can make progress slow, and careful attention is needed for managing the spoil and for verification of work. Very few contractors are presently capable of providing efficient customized small scale dredging services of this nature.



Many scarce species of fish have been reintroduced in MACH project sites.

**Fish release:** over a million fish of 15 native species that can naturally reproduce within the floodplain and do not rely on river connections were released by MACH into restored wetlands. The main contribution to increased fish biodiversity has been natural recovery of locally scarce species through protection and habitat restoration. Releases helped species such as Ayre and Chitol to reestablish in the restored habitat, but success depends on having a source for relatively abundant wild caught fry that is within 100 km and on skilled handling of the fry in transit.

**Tree planting:** 605,365 saplings of 56 species were planted by MACH up to the end of 2005, 21% were Hijal and Koroch planted to restore swamp and wetland border forests. These species need to be raised in nurseries until at least 5 feet (1.5 m) tall if they are to survive inundation when planted out, and with their slow growth should be seen as an ecological investment not a source of income. Trees planted along stream and river banks (riparian planting) achieve faster growth and is a source of income, bank stabilization, and biodiversity enhancement.

### Aquatic sanctuaries

The single most important resource management intervention of MACH has been establishing 56 wetland sanctuaries. These are areas from less than one hectare to over 100 ha that retain water throughout the year and where the community has banned all fishing. They enable fish to over-winter and then repopulate the wider floodplain during the monsoon. In most cases the sanctuaries include re-excavated areas. They also benefit aquatic life in general, including waterbirds and plants.

**Major sanctuaries:** a large permanent sanctuary of about 100 ha known as “Baikka Beel” in Hail Haor (covering Chapara, Magura and Jaduria jalmohals) has been set aside permanently by the Ministry of Land by taking these water bodies out of the leasing system. Selected by the community as the most feasible area out of over 3,500 ha of permanent water in the haor, and with a management plan prepared and implemented by the responsible RMO with support and endorsement of the LGC, it has demonstrated how communities can protect a sizeable wetland sanctuary and help restore fish catches within the wider haor and other biodiversity.

**Fish protection:** traditionally branches of trees are used to create brush piles as fish aggregating devices in Bangladesh in effect mimicking the lost swamp forests, making fishing difficult, sheltering fish, and providing a surface for plants and animals that are eaten by fish. However, this is not environmentally sustainable given the very low tree cover in Bangladesh. To attract and protect fish in permanent sanctuaries, MACH made permanent fish protection devices locally from reinforced concrete (hexapods and perforated pipes). Over 22,000 of these structures have been placed into sanctuaries making it very difficult for anyone to fish there. These also provide permanent fish sheltering habitat and an additional source of food.

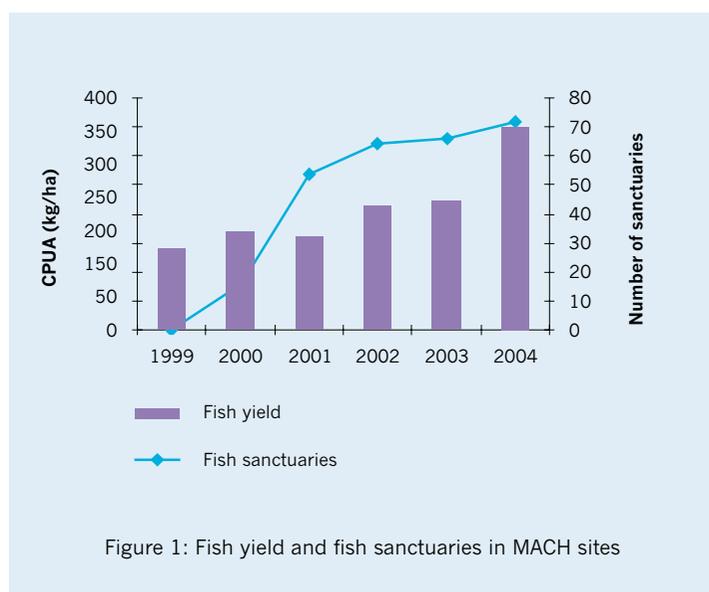


Figure 1: Fish yield and fish sanctuaries in MACH sites

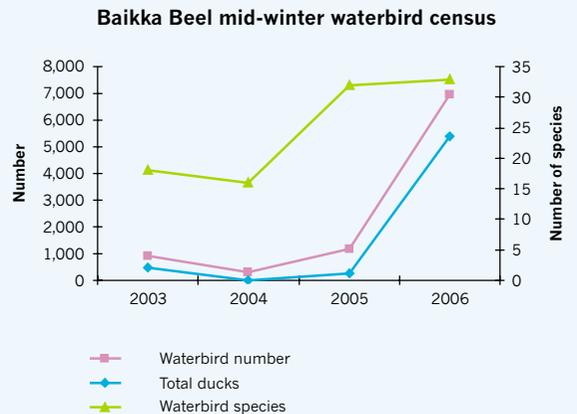
## IMPACTS

Restoration of wetland habitats and conservation measures such as sanctuaries and closed seasons have not only increased fish catch per hectare by about 140% between 1999 (baseline) and 2004, but have helped to restore populations of several locally rare fish species. Impacts depend on the location, but examples of species that have shown relatively large increases in catches include Foli and Gozar in Hail Haor, Chapil and Guzi Air in Turag-Bangshi and Bata in Kangsha-Malijee sites. Now over 80 species of fish are caught each year in each of these wetlands. As all species are consumed this diversity and quantity have improved the diets of local people, including the poor. Regular monitoring of a panel of households revealed that by 2004 fish consumption was on average 52% higher than before MACH started, at 17.5 kg/person/year in 2004.

Community management has also maintained a range of other aquatic resources. Around two thirds of households living around Hail Haor collect non-fish aquatic resources each year, such as grasses and straw for fodder and Dhol kolmi (*Ipomea*) for fuel; while around 10% of households collect snails for poultry and fish feed, and several plant species for human consumption. Swamp forest will be preserved as a long-term investment in ecological restoration. However, the

return for the communities from the first felling cycle of the other trees should be US\$ 3.2 million by 2020 (net of replanting costs).

In Hail Haor the wintering waterbird population in the permanent sanctuary of Baikka Beel has increased dramatically since it was protected. Where only a few hundred birds of 16-18 species were found in 2003 and 2004, there were almost 7,000 waterbirds of 33 species in February 2006, mostly migratory ducks but these also attracted scarcer species such as eagles and ibises. This wildlife is attracting human visitors also, offering the RMO and community an opportunity to earn something from eco-tourism.



Fish and migratory bird populations can quickly recover when sufficient areas of wetland habitat are protected and restored.

## RECOMMENDATIONS

1. In smaller wetlands part of the permanent water, even if a hectare or less, should be protected to restore fisheries. A good target sanctuary area is about 5% of the dry season water area.
2. In large wetland systems proportionately larger areas of permanent water should be protected and permanently set aside from use to regenerate wetland productivity and biodiversity (fish, birds, plants).
3. Excavation to deepen sanctuaries and enhance dry season water retention is vital, but must be part of a package that ensures these areas will **not** in future be leased out for fishing, that sees communities and local government agree on and enforce a strict no use policy, that makes fish shelters there, and where short closed seasons are followed in the wider wetland to allow fish to spawn and repopulate.
4. Inland capture fisheries management depends on sound wetland habitat management, including water and vegetation. Restoring wetland trees is an important part of this process.
5. To secure these benefits for the long term, local management plans and measures need to be formally recognized nationally and internationally. This will require institutional changes, since conservation is presently dominated by forest protection interests. Department of Fisheries should be mandated to take the lead in protecting the major wetlands of Bangladesh.

## REFERENCES

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