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.

# Industrial Pollution and its Threat to Wetlands in Bangladesh: Example of Mokesh Beel Wetland in Kaliakoir

The textile and clothing industry is important for Bangladesh's economic growth, but has brought with it a range of problems one of which is water pollution. Mokosh Beel in Kaliakoir Upazilla is one example of a now very polluted wetland particularly during the dry season. During the participatory planning phase of the MACH project, local people emphasised the industrial pollution problem there. Several studies have been conducted to find ways to mitigate pollution and to reduce future pollution levels. This paper summarizes some important findings and issues raised by this experience, with the aim of informing better decisions and encouraging implementation and enforcement of existing regulations intended to protect people and wetlands from pollution.

## BACKGROUND

Since 1999 the project "Managing Pollution from Small and Medium Scale Industries" focused on improving ecosystem health and industrial practices in Kaliakoir Upazila of Gazipur district, which is approximately 25 km northeast of Dhaka. This is one of many similar industrial clusters that have developed as part of the rapid economic growth of Bangladesh and, as is the case with all, it is also an area of serious water pollution. Although poultry farms, pharmaceutical industries and a tannery have been established there, textile manufacturers, including dyeing and printing units, dominate the area (Chadwick and Clemett, 2002). By late 2005 there were around 166 textile related industries (all are export oriented) in the area, compared with about 12 that existed when MACH started working there in 1999. Many of these industries have Codes of Conduct that are strong on social responsibility but weak on environmental responsibility. Those that do have environmental criteria in their codes only refer to the need to meet national regulations.

**Much of Ratanpur khal contains biologically dead water, which threatens the recent gains from restoring fisheries through MACH project in Mokesh beel.**

These industries are providing employment, increasing local incomes, and earning foreign exchange for the country. However, these industries also discharge their waste into the ecosystem which local people depend on for their livelihoods, adversely affecting livelihoods and the day-to-day life of the community. It is a legal requirement in Bangladesh for all red category factories (textile dying and tanning) to establish Effluent Treatment Plants (ETPs). However, there are very few ETPs in the area, and some are "window dressing" as they are either not operated or not operated as they should be due to lack of technical expertise. Establishing an ETP can be expensive with Tk. 7-20 million (US$ 100,000-290,000), and up to 20-30,000 sq ft (1,840-2,760 $m^2$) of land being required. The operation of the treatment plant also involves recurring expenditure of about Tk 20-30 per 1,000 litres of waste water. Small-scale industries cannot afford to install and operate ETPs.

Because existing laws are poorly enforced, these industries can exploit the surrounding water bodies where they dispose of their untreated waste. In Kaliakoir, industries use Mokosh Beel, the Turag River and the Ratanpur Khal as disposal grounds for their untreated waste. It is estimated that these industries are discharging 30 billon litres of effluent water annually in these water bodies. This project was the first to attempt to understand and try to help the local community address the pollution problems in Kaliakoir area.

## LESSONS LEARNT

The research involved three key elements. These were: environmental monitoring and pollution assessment; alternative production techniques for pollution reduction in textile dyeing; and effluent treatment.

### Environmental monitoring and pollution assessment

Environmental monitoring included identifying the source of pollution that was affecting water resource users in the area and assessing the extent of pollution from these factories.

Regular monitoring results indicate that pollution far exceeds national water quality standards in various places, particularly in Mokesh beel (Table 1). High concentrations of heavy metals such as chromium were also found in sediments near the industries. These should be further monitored in the future as these are potentially serious for human health.

Water quality has deteriorated to a level which is detrimental to fish and other aquatic life requiring oxygen. This has reduced the availability of fish, fodder and other wetland products and services which local people have for generations depended on. There are reports of regular fish kills in the dry season and reduced rice production.

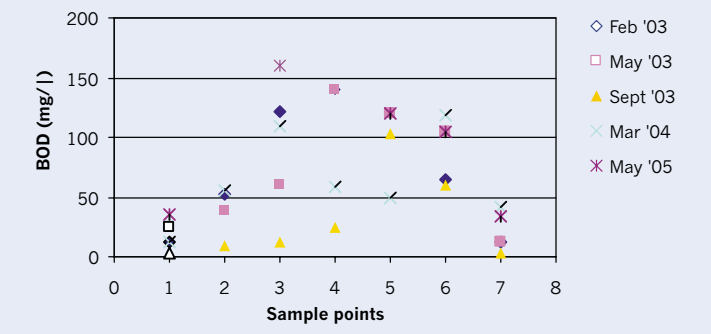
Focus group discussions and in-depth interviews with community members and health practitioners revealed that health problems, such as skin disease, are increasing in this area. This is widely believed to be a direct consequence of industrial pollution reaching the wetlands that the community traditionally uses as a source of water for multiple activities including irrigation, bathing and fishing. Pollution is very significant and is getting worse and will continue to do so unless industry responsibly cleans up their waste.

**Table 1: Water quality indicators in Mokesh Beel**

| Parameter | Bangladesh Standard for inland surface water (mg/l)[a] | Median value (mg/l)[b] | Range (mg/l)[b] |
|---|---|---|---|
| BOD (n = 7) | 6 or less | 407 | 380-500 |
| COD (n = 7) | *200.0 or less | 960 | 350 - 1600 |
| DO (n = 7) | 5 or more | 1 | 0.6 - 1.2 |
| Sulfide (n = 7) | *2.0 or less | 3.1 | 1.6 - 10.2 |

**Source:** [a] GOB (1997); [b] MACH (2001)

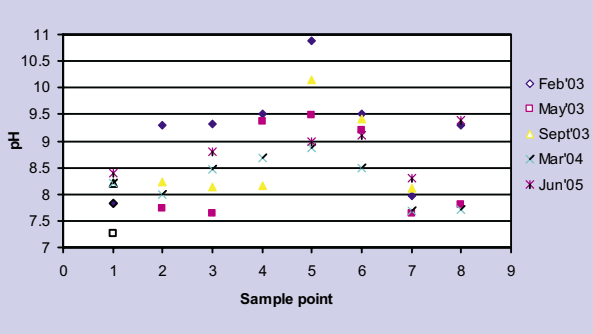
* = standard for waste water quality when discharged in inland water surface (Chowdhury and Clemett 2006).




Comparison of BOD level at different occasions and sites in the project area. The chart has been limited to 200mg/l therefore the maximum of 600mg/l (recorded at kahal at Ratanpur Railway Bridge in 2003) is not shown.

Local volunteer monitoring Dissolved Oxygen

Gangetic Dolphin (Platanista gangetica), a threatened species, regularly occurs in the fish sanctuaries in Turag River. This one died during a fish kill associated with poor water quality.




Comparison of pH level at different occasions and sites in the project area

## Alternative Production Techniques for Textile Dyeing:

The focus here was on assessing the main sources of pollution within the industry and suggesting mitigation measures. To assess the pollution within the industries, a cleaner production audit process was carried out with the cooperation of the industrialists. This focused on the raw materials coming on to the premises, the processes undertaken and the materials (products, by-products and waste) that leave each factory site. In addition water quality analysis was undertaken in the effluent and in the different stages of production, to support the cleaner production audit process data.

Textile dyeing process

In order to reduce waste, many alternative production trials were carried out to optimize the production processes. Industries were informed that a number of interventions could improve their efficiency, reduce waste and save them money. These interventions include improved housekeeping, training of factory staff, and optimization of dyeing conditions (changing dyeing parameters and introducing alternative inputs or processes).

More efficient production can both reduce industrialists' costs and reduce the costs to the nation, local community and environment in terms of pollution.

Research in the industries themselves identified potential alternative production options which can raise dye fixation to 70% from around 40-65% which is found at present, and thereby reduce the dye that is discharged to the water bodies. Not only would this reduce pollution and environmental costs, this would increase efficiency and could **save** the average factory each year the equivalent of tens of thousands of dollars in dye costs alone and significantly reduce the necessity for re-dying and re-shading.

## Effluent Treatment:

The few industries in the project area that had Effluent Treatment Plants (ETPs) were also assessed on the performance and management of their ETPs. The project provided guidance on ETP management and worked with the industries to reduce the cost of chemical treatment. Those industries that did not have ETPs were provided with advice on treatment plant design.

Textile industries increased 8-fold in 3 years in the Turag-Bangshi catchment. Few have functioning ETPs that they are required to have by law.

The project has highlighted the need for more effluent treatment facilities and better management of those that already exist. It is estimated that factories processing 5 tons of fabric produce 750,000 to 1,800,000 liters per day (i.e. 750-1,800 ton/day) of effluent water. The average treatment cost is currently Tk. 20-30 per 1,000 litres. By flow segregation and optimization of chemical dosing, this operating cost can be reduced by up to 30%.

Flow segregation and optimization of chemical dosing can reduce the operating cost of ETP.

In Kaliakoir, the number of textile related factories has increased from 20 in 2003 to 166 in late 2005, so overall the pollution problem is getting worse. This means that there has to be a massive increase in implementation of pollution mitigation measures if there is to be any meaningful reduction in pollution in the future. Current laws and regulations are evidently not being followed otherwise Bangladesh would not have to suffer from dead or anaerobic river stretches and wetlands that are rapidly dieing.

Effluent Treatment Plant (ETP)

## KEY MESSAGES

- Public water bodies are failing to meet national water quality standards, threatening the livelihoods of those dependent on wetland products and biodiversity, and this is a direct consequence of the failure of factories to meet the same national standards in their waste water.
- Alternative production options and effluent treatment should be promoted and adopted by industry to improve production efficiency thereby saving cost while reducing the water pollution.
- Industries that fail to take up these options to remedy their problems that cause harm to the public interest should face the consequences as stipulated in the law.
- The number of industries is increasing rapidly without consideration of the local impact on livelihoods from natural resources. There is no zoning policy or local development planning at the Upazila level. Even if good practices were adopted by some industries, pollution levels in the Kaliakoir study area could remain high because the number of factories in the area continues to increase rapidly. If these new industries do not adopt clean production technologies and clean up their waste then the gains from the few that do will not be enough.
- Water resource degradation is a poverty and governance issue that needs to be addressed now and on a national scale. Government departments especially the Department of Environment (DOE), industrial associations and chambers, research institutions, international buyers, non-governmental organizations and legal experts need to work together to develop a framework and modalities of implementation for improved environmental governance. Existing national standards need to be enforced and adhered to.

## POLICY RECOMMENDATIONS

Existing water quality standards need to be enforced through the following steps:

- Increased awareness among industrialists about the pollution problem and their legal and social responsibility to prevent it.
- It should be mandatory for all textile and dyeing industries to adopt more efficient production options.
- It should be mandatory that industries construct and then regularly and efficiently operate their ETPs and monitor their effluents to keep them within the standards set by law.
- Voluntary or public provision of common ETPs may be a solution to serve adjacent small scale industries, operating on a cost sharing basis.
- National and community level bodies should be established and validated to monitor water quality of khals, beels and rivers, and the results used to determine anti-pollution measures, operating permits and actions (including legal actions) against offending industries.
- Given the scale of the problem, its resource limitations, and the need to demonstrate transparency and objectivity, DoE should accredit and appoint competent third party organizations to work on its behalf to monitor industries regularly in addition to its own monitoring.
- DoE should seek to actively work with and inform local government at Union and Upazila levels of the issues and how local government can use its powers to minimize pollution. DoE should make formal links with Upazila Fisheries Committees to assist them in ensuring acceptable water quality in wetlands and capture fisheries.
- International buyers have a key role in influencing industry, they need to be influenced to adopt environmental codes of conduct and then to enforce them on their supplying industries.
- Bangladesh trade bodies should change their role and set environmental conditions on membership, for example they could cancel membership of companies that fail to install and operate properly ETPs.

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**Author:** Nishat Shahid Chowdhury | **Edited by:** Dr. Paul Thompson, Darrell Deppert and Masood Siddique | **Coordination:** Esha Husain

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**For more information contact**
MACH Headquarters, House No. 2, Road No. 23/A, Gulshan 1, Dhaka 1212, Bangladesh,
Phone: 8814598, 8816602, 9887943, Fax: (880-2) 8826556, URL: www.machban.org

DESIGN: www.intentdesign.net