



IMPACT EVALUATION OF  
AQUACULTURE INTERVENTIONS  
IN BANGLADESH

evaluation

2009.01



**MINISTRY OF FOREIGN AFFAIRS OF DENMARK**  
Danida



**evaluation**

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AQUACULTURE INTERVENTIONS  
IN BANGLADESH**

# **Impact Evaluation of Aquaculture Interventions in Bangladesh**



**Lamans s.a.**  
Management Services

**DECEMBER 2008**

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Annex 3: Inception Report

Annex 4: Intervention Profile

Annex 5: Bibliography

Annex 6: Details of Fieldwork

Annex 7: Interviews Guides and Focus Group Questions

Annex 8: Site Visit Reports

Annex 9: Quantitative Data Analysis

## Abbreviations and Acronyms

<i>ADB</i>	Asian Development Bank
<i>BBS</i>	Bangladesh Bureau of Statistics
<i>CBASC</i>	Community Based Advisory Service Centre
<i>CBFM</i>	Community Based Fisheries Management
<i>CBO</i>	Community Based Organization
<i>Danida</i>	Danish International Development Assistance
<i>DD</i>	Double Difference
<i>DfID</i>	United Kingdom Department for International Development
<i>DKK</i>	Danish Kroner
<i>DoF</i>	Department of Fisheries
<i>EC</i>	European Commission
<i>ET</i>	Extension Trainers
<i>FAO</i>	Food and Agriculture Organization
<i>FFG</i>	Fish Farmers Group
<i>FGD</i>	Focus Group Discussion
<i>GNAEC</i>	Greater Noakhali Aquaculture Extension Project/Component
<i>GoB</i>	Government of Bangladesh
<i>Ha</i>	Hectare
<i>HH</i>	Household
<i>IFAD</i>	International Fund for Agricultural Development
<i>IFPRI</i>	International Food Policy Research Institute
<i>MAEC</i>	Mymensingh Aquaculture Extension Project/Component
<i>NGO</i>	Non Governmental Organization
<i>NRDS</i>	Noakhali Rural Development Society
<i>PBAEC</i>	Patuakhali and Barguna Aquaculture Extension Project/Component
<i>PL</i>	Prawn Larvae
<i>PRSP</i>	Poverty Reduction Strategy Paper
<i>RFLDC</i>	Regional Fisheries and Livestock Development Component
<i>Tk</i>	Taka (Bangladeshi unit of currency)
<i>UNDP</i>	United Nations Development Programme
<i>USAID</i>	United States Agency for International Development
<i>USD</i>	United States Dollar
<i>WB</i>	World Bank
<i>WFP</i>	World Food Program

### Bangladesh Taka to USD Historical Exchange Rate

	1995-99	2000-04
Average	0.02229	0.01810
High	0.02463	0.01967
Low	0.01955	0.01608

### Bangladesh Taka to DKK Historical Exchange Rate

	1995-99	2000-04
Average	0.14367	0.13386
High	0.16300	0.16670
Low	0.12720	0.09395

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# Glossary and Impact Assessment Terminology

## Glossary

<i>Char</i>	Emergent land from the river sediment deposit/accretion process areas
<i>Gher</i>	Enclosure for combined production of vegetables, rice, fish and prawns made by modifying rice fields by building higher dikes around the field and excavating a canal several feet deep inside the periphery of the dikes to retain water during the dry season
<i>Jalmohol</i>	Public water body that could be leased out by government for revenue (also spelt Jolmohal or Jalmohal)
<i>Thana</i>	Sub-district administrative unit now known as Upazila
<i>Union</i>	Sub-Upazila administrative unit
<i>Upazila</i>	Sub-district administrative unit, formerly known as Thana

## Impact Assessment Terminology

- **Average Treatment Effect:** The average treatment effect is an econometric method for testing a natural experiment (also known as a quasi-experiment). Once a policy change occurs in a population, a regression can be run controlling for the treatment. A double difference measurement is then used to calculate the effects of the treatment on the average outcome. This is the average treatment effect.
- **The Comparison Group:** Households (HHs)/individuals who did NOT participate themselves, but who possessed similar observable characteristics to those of the treatment group.
- **Propensity Score Matching:** A technique to select members of the comparison group through estimation of a statistical model based on the probability of participation.
- **Pipeline Approach:** A technique for comparison group selection where the comparison group is composed of individuals who have been selected (eligible) to participate, but have not (yet) been involved or benefited from intervention activities. This assumes that such a pipeline exists, that there has been no change in selection criteria, and that applicants have not been ranked for participation.
- **Double Difference Measurement:** The double difference measures the difference in the observed change between the treatment and comparison group, based on baseline and end-data. Thus the double difference eliminates external determinants of the outcome in cases where these are the same for the treatment and comparison group during the intervention period. The double difference approach assumes common time effects across groups and no composition changes within each group.
- **Contamination:** Contamination can arise from two sources – “own” and “external”. Contamination can come from the intervention itself due to spill over effects (own contamination). This type of contamination can occur if the comparison group is selected from a geographical area too close to the intervention area. Comparison groups from distant locations can also be contaminated through interventions by other agencies (external contamination).
- **Selection Bias:** Bias introduced from the way beneficiaries have been selected. When beneficiaries are not randomly selected, but some kind of selection process has taken place, then the comparison group should not be randomly selected either, but rather be drawn from a population with the same characteristics as the group of participants.



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# Executive Summary

*“Mach ar bhaath Bangali baanaay”*  
*“Fish and rice make a Bengali”*  
*(Traditional Bengali saying)*

## Background

It is hard to over-emphasise the importance of fish to Bangladesh and Bangladeshis. Bangladesh is situated on a major river delta adjacent to the Bay of Bengal, much of its land mass is low lying, and it has high levels of precipitation. All of these factors contribute to its suitability for aquaculture and the importance of fisheries. Recognizing this potential, Danida has been a long-term supporter of aquaculture in Bangladesh since the 1970s. This support has evolved over the years, from an emphasis on the technical aspects of aquaculture, to a broader development scheme emphasising the empowerment of women and sustainability.

Fisheries and aquaculture in Bangladesh have changed dramatically since Danida's involvement. In the 1970s and 1980s fisheries were dominated by small scale enterprises operating by catching fish, while aquaculture was practised on a low-level, ad-hoc basis. Since then aquaculture has become a key provider of fish for the urban consumer and of shrimp for the export market. Since the 1990s commercial aquaculture operations – hatcheries, producers, and processors – have expanded rapidly. During the same period the once dominant inland open water capture fisheries have declined. In 1990, Bangladesh produced an estimated 200,000 tons of fish from fresh and brackish water aquaculture; just above 20% of total fish production in the country. By 2005 fish and shellfish production from aquaculture had gone up to nearly 900,000 tons, a 450% increase, contributing some 40% of the total amount of fish produced in the country. (Asian Development Bank (ADB), 2005).

Danida has not been involved in aquaculture for the sake of aquaculture production increases alone; rather its goal has been to improve the socio-economic position and physical well-being of poor farmers involved in aquaculture. Danida has done this by working with Bangladeshi government and non-governmental (NGO) partners to build the capacity of poor farmers to improve the quality and quantity of their aquaculture production. In addition, Danida supported others involved in the sector such as nurseries, net makers, etc. Danida has also placed an emphasis on involving and empowering women, particularly on the poorest of the poor women.

From 1989 to 2006 Danida's support for the three main aquaculture extension interventions in Bangladesh (implemented within the Regions of Mymensingh, Noakhali, and Patuakhali) amounted to nearly DKK 145 million and reached approximately 200,000 households (HHs). In order to assess the difference this support made in the lives of participants, Danida contracted a consortium comprising Orbicon A/S (Denmark) and Lamans s.a. Management Services (Greece), together with a team of Bangladeshi subcontractors, to undertake an impact evaluation of the interventions. This included reviewing available databases and surveys, carrying out 36 Focus Group Discussions (FGDs), six workshops, 21 interviews, and 17 site visits, involving close to 400 women and men.

## Challenges of an Impact Evaluation

Impact evaluations differ from other types of evaluations because they depend heavily on the availability, and quality, of quantitative data sets. The quantitative data is needed to measure where both groups started from (the “baseline”) and where they ended up, in terms of income, health, or women’s empowerment. By measuring the changes in the two groups over time, one that participated in the intervention and one that did not, the evaluation can measure how much of the change observed for participants was due to the intervention, versus other external factors such as regional economic growth or the introduction of electricity. Baseline data for both groups should include information on characteristics such as household size, to ensure the participants are compared (matched) to similar non-participants.

Unfortunately, in Mymensingh, all of the detailed data covering the baseline of over 100,000 beneficiaries had been lost. The only data available to the Evaluation (from a third party survey) that met the basic criteria for an impact evaluation covered only 110 participating and non-participating households. In Noakhali the historical baseline data that was available to the Evaluation only covered participants. Consequently the Evaluation was limited by a small number of households in Mymensingh, and no real baseline information on non-participants in Noakhali. Despite these challenges and limitations, the Evaluation managed to carry out a theory-based impact analysis (Patuakhali was dropped from the Evaluation following the devastating cyclone Sidr which struck just before the Evaluation fieldwork).

## Major Findings and Conclusions

The premise of the interventions was that improved capability of households to increase fish production should lead to an increase in HH income for participants. In addition, increased production and support to others involved in the sector (nursers, net makers, etc) should stimulate employment in the aquaculture sub-sector. The Evaluation found that both interventions dramatically increased the value of fish produced. It also found that employment in the aquaculture sub-sector and at the HH level had increased, however, a lack of data made it impossible to quantify these changes. The Evaluation was able to link increased value of fish production with increased household income. Consequently the Evaluation concluded that the increase in the value of fish production from aquaculture supported by Danida, and to some extent from sub-sector employment catalysed by Danida, resulted in an improvement in the socio-economic position and physical well-being of participants. Therefore the interventions successfully achieved their impact.

However, when the Evaluation looked at income, consumption, assets, housing, and nutrition and health, and compared participants with non-participants, over the long-term there were no significant differences – both groups experienced substantial, positive change. The Evaluation was unable to measure any impact that was due exclusively to the interventions.

- Household income for participants in Noakhali increased by an average of 25%. In Mymensingh consumption expenditures dropped for both groups in the short-term and increased for both in the long-term.

- The value of assets for both groups fell in the short term and rose in the long-term in Mymensingh. In Noakhali a lack of data prevented analysis.
- No quantitative data existed on housing but FGDs found that both groups improved their housing in Mymensingh (participants with aquaculture money, non-participants with other sources), while in Noakhali neither group improved their houses as the housing quality was already fairly high.
- Both groups in the two areas enjoyed nutrition and health improvements including improvements in diet, increased income for health expenditures, and decreased health spending due to nutrition. However, the impacts were due to water and sanitation infrastructure improvements as well as the interventions.

To determine why there were similar improvements in the socio-economic status of comparable non-participants the Evaluation examined the long-run analysis in Mymensingh. This showed that non-participants “caught-up” to participants, and increased their relative (but not absolute) value of fish production similarly. For non-participants to “catch-up” there had to be an external influence on their aquaculture practice. The techniques promoted by the interventions were very simple and had very visible short-term payoffs (an average of 151% production increase in two years). It would be easy and desirable for non-participants to adopt the aquaculture practices of participants and experience similar relative production and income gains and the interventions covered almost every Union in their regions. Consequently it is likely that non-participants came into contact with the interventions and successfully adopted their simple techniques. This could provide some explanation on why the interventions achieved positive impacts with participants, but that there was no significant difference in impact between participants and non-participants.

Another part of the answer for similar impacts was overall economic improvements in Bangladesh, and local improvements in infrastructure and services. In addition there were a range of other organisations providing development assistance. All of these would have influenced improvements in income, consumption, assets, and health for participating and non-participating HHs alike. However, the catalytic effects that the interventions had on the aquaculture sub-sector as a whole also have to be factored into the picture of general economic development. The interventions enabled and supported a period of unprecedented growth in aquaculture production that affected participants and non-participants alike.

The interventions had substantial impacts on the empowerment of women including improving the decision-making roles of women, their mobility, and control over credit. These changes were the result of participation in the activities of the interventions and were linked to increases in consciousness and self-confidence.

### **Design, Delivery, and Sustainability**

The interventions used methodologies and protocols for aquaculture production that were simple, effective, and appropriate for the context. Training was found to be effective and participants used their training and demonstrated more advanced knowledge of aquaculture than non-participants. However, restrictive gender roles meant that women were able to use only a small portion of their new knowledge and skills. Credit was provided appropriately and the hatchery and fry components of the interventions were well-managed.

Danida's investments in aquaculture are generally sustainable: new aquaculture practices are still being used; feed, prawn larvae, fingerlings, fertilizer, and labour were all generally available; national demand continues to be strong and the interventions are trying to address international demand issues for prawns. Challenges to sustainability may occur from the ongoing decline in fish prices, and flooding and disease. Extension services from Government and other organisations have decreased since 2004 in Mymensingh. However, the institutional and policy environment for aquaculture is well developed and quite supportive of the directions taken by the interventions.

## Lessons Learned and Recommendations

### Lessons Learned

1. Relatively small amounts of training and credit can produce significant improvements in fish production by poor people with pond access.
2. A large-scale intervention can successfully catalyse significant changes in an economic sub-sector on a regional basis and in the lives of the people active in that sub-sector.
3. Expected results need to be clearly linked by causality and the linkage needs to be well understood: knowing how much aquaculture production is necessary to significantly increase HH income and well-being.
4. A micro-level intervention carried out on a small scale can have macro-economic effects which need to be understood and factored into planning.
5. There can be contradictions between an intervention's reach, the desired level of results, and the profile of the beneficiaries which needs to be minimised and mitigated.
6. Examining the context of the poor can lead to innovative programming that addresses their needs in a real way and involves them in the sector being targeted.
7. Practical changes in women's lives such as receiving credit or going to meetings can influence strategic improvements in mobility and HH decision-making.
8. Sustainability is enhanced when private sector forces and actors are brought into implementation without necessarily making them beneficiaries.
9. Actors such as NGOs bring their own interests to the intervention which may act counter to the aims and objects. These risks need to be analysed and mitigated.
10. Danida's model of supporting and developing government and NGO extension often builds up unsustainable levels of activity which dramatically decrease after funding ends.
11. A strong focus on production amounts (tons of fish produced) can lead to a lack of attention on product and supply chain quality issues.
12. A negative set of circumstances for direct beneficiaries (decreased fish prices) can be a positive factor for the poor who are indirect beneficiaries (increased fish consumption).

### Recommendations

Current and future interventions intending to catalysing widespread economic growth should examine the following aspects of programming:

- A. **Scope:** strengthen or collaborate with all the components of the production process.
- B. **Size:** ensure interventions are large enough to bring about economic development on a meaningful geographic scale.
- C. **Length of time:** ensure that commitment to an intervention is long-term.

- D. **Appropriate Partnerships:** involve all relevant stakeholders from Government, NGOs, and the private sector, as partners, beneficiaries, and implementers.
- E. **Technical Approach:** implement using simple but effective aquaculture production techniques that are readily adopted and demonstrate results.

Programming could also be improved through consideration of the following:

- A. Support the type of learning and innovation, displayed in Noakhali, that improves targeting of the poor. Support the type of learning and innovation, displayed in Noakhali, that puts in place a long-term strategy for sustainability.
- B. Ensure that the causal chain of results is informed by experience and analysis and reflects reality in the linkages between results levels. Analyse the macro-economic effects of wide-spread micro-level interventions and integrate these into project planning.
- C. Develop a model of support to government and NGO extension that is sustainable and does not feature dramatic increases in activity and results during implementation, but which drops off with the cessation of external support. Increase the use of private sector actors as extension agents.
- D. Be clear and realistic about the expected role of women and the benefits that they will derive from the program. Work with women, regardless of the restrictions they may face with respect to the use of credit and application of training, for the empowerment benefits it brings them.

To improve the success and utility of future impact evaluations it is recommended that:

- A. All quantitative information should be analysed before starting the qualitative component of supporting fieldwork. Fieldwork should not even be scheduled until all the quantitative data required or expected is in the possession of the Evaluation.
- B. Impact assessment criteria and methodologies should be built in from the start of interventions.
- C. The data required for monitoring and evaluation should be retained by Danida and stored centrally to ensure its availability for performance measurement and accountability purposes.

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# 1 Introduction

Danida has supported aquaculture in Bangladesh since the 1970s with the long-term development goal of strengthening the socio-economic position and physical well being of poor farmers. This was to be achieved through increased production of fish and prawns for consumption and marketing, in turn generating employment, raising incomes, and improving general nutritional status. Over the years the support has shifted gradually from a merely technical intervention towards a broader development scheme emphasising the empowerment of women and sustainability.

From 1989 up to 2006 Danida's support for the three main aquaculture extension interventions in Bangladesh (implemented within the Regions of Mymensingh, Noakhali, and Patuakhali) amounted to nearly DKK 145 million and reached approximately 200,000 households (HHs) through the Mymensingh Aquaculture Extension Project/Component (MAEC), the Greater Noakhali Aquaculture Extension Project/Component (GNAEC), and the Patuakhali and Barguna Aquaculture Extension Project/Component (PBAEC). The interventions were originally 'projects' and are still referred to as such by the Government of Bangladesh. Officially however, they became 'components' of the Agricultural Sector Programme Support in 2000.

The most long-standing of the interventions was MAEC, which began in 1989 and consisted of three phases: Phase I 1989-93, Phase II 1993-2000, and a consolidation phase 2000-03. Following the initial success of MAEC, similar interventions were designed for the Patuakhali, Barguna and Greater Noakhali districts, starting in 1997-98. These interventions terminated in 2006; however, supporting follow-up activities were included in Danida's Agriculture Sector Programme Support, Phase II that was approved in 2007.

## 1.1 Rationale, Purpose, and Objectives

The Evaluation was carried out for two reasons. Firstly, Danida's investment in aquaculture has been carried out over three decades with a significant amount of resources. Therefore the Evaluation was consistent with the policy direction of documenting the long-term impact of substantial development projects or programmes in which Denmark has played a key role. Secondly, an *Impact* Evaluation was planned, due to the increased prominence of this type of evaluation globally, and Danida's decision to undertake a small number of impact evaluations to test the methodology.

The purpose of the Impact Evaluation was therefore to investigate practical considerations concerning the measurement of impact and to demonstrate results of Danida's investment in aquaculture in Bangladesh.

The objective of the Evaluation was to assess the impact of Danida-funded Aquaculture Interventions on the socio-economic position and physical well being of people within the intervention areas in Mymensingh, Noakhali and Patuakhali. More specifically, the Evaluation addressed the following questions:

- What has been the impact on incomes?
- What has been the impact on living standards in general?

- What has been the impact on health?
- What has been the impact on women's empowerment?

The Evaluation also attempted to identify channels through which these impacts have occurred and to establish the determinants of change, along with reasons for smaller than expected or unintended impacts.

An *Impact Evaluation* differs from a traditional summative of formative evaluations due to its concentration on the final long-term results of the intervention. In trying to measure long-term change with beneficiaries it uses more rigorous statistically based methods than might be found in other evaluations. Issues of implementation and outputs are of secondary importance and are only really considered to explain impact or lack thereof.

In terms of a forward-looking perspective, the Evaluation draws lessons learned and identifies key operational experiences that may be used for future interventions. The Evaluation also draws lessons learned for the future implementation of impact evaluations. See Annex 1 for the Evaluation Terms of Reference.

## 1.2 Scope

The following sections define the scope of the Evaluation:

### Time Period

The Evaluation covers the intervention period starting in 1989 in Mymensingh up to completion of the intervention in Noakhali in 2006.

### Geographical Coverage

The Evaluation covered all intervention areas within Mymensingh Region (seven Districts) and Noakhali Region (three Districts). The Patuakhali and Barguna Region was originally included in the Evaluation coverage. However, following the devastating impact of cyclone Sidr, a decision was taken not to undertake fieldwork there.

### Interventions

The interventions of MAEC and GNAEC that were covered by the Evaluation were those concerning carp polyculture in ponds owned or accessed by HHs, integration of prawn, gher farming, and service providers. Interventions concerning community based fisheries management (CBFM) were not included in the scope of the Evaluation.

### Target Groups

The primary target group included in the Evaluation in both areas was men and women with access to ponds; with special attention to landless, marginal farmers, and people with access to fish and prawn cultivation through leased or their own ponds or gher. Following the Joint Annual Sector Reviews of 2002 and 2003 GNAEC widened the target group to the hard core poor for participation in rice-fish culture or community based aquaculture. Secondary target groups included in the Evaluation were fry traders, entrepreneurs involved in hatchery development, and landless labourers who would become engaged in related services, e.g. net-making, nursery, harvesting, etc. Elements of the aquaculture supply and marketing chain such as feed mills were also included.

### 1.3 Team

The Evaluation Team comprised six international and seven national consultants. Their expertise included aquaculture techniques, socio-economics, sociology, econometrics and statistics, gender, and women in aquaculture. See Annex 2 for a diagram of the team structure.

### 1.4 Schedule

The Evaluation commenced in January 2007 and was completed by June 2008. The inception mission was carried out in March 2007 and the Main Fieldwork Period in Bangladesh was undertaken from December 2007-February 2008. See Annex 3 for a copy of the Inception Report. Following the completion of fieldwork activities, a team workshop was held in Bangladesh in early March 2008. The Draft Evaluation Report was submitted in early April 2008, and was followed by a stakeholder workshop in Bangladesh in late April 2008. A Draft Final Report was submitted in July 2008.

### 1.5 Organization of the Report

This report is structured as follows:

- Chapter 1* Profiles the Evaluation by describing the objectives, scope, constraints, the Evaluation team, and the work undertaken.
- Chapter 2* Profiles the aquaculture interventions by describing the context, planned results, and implementation modalities.
- Chapter 3* Explains the methodologies employed in the Evaluation and includes the challenges and limitations experienced.
- Chapter 4* Identifies the Evaluation findings with respect to intervention impact, including income, consumption expenditures, assets, housing, health, and nutrition.
- Chapter 5* Sets out the Evaluation findings with respect to the determinants of change at the impact level including the value of fish production, employment, sources of HH income, support for other livelihood activities, replication, and external determinants of change.
- Chapter 6* Identifies the Evaluation findings and results achieved as they related to women's empowerment.
- Chapter 7* Describes the Evaluation findings related to design and delivery issues.
- Chapter 8* Describes the Evaluation findings and results related to sustainability.
- Chapter 9* Sets out the lessons learned from the aquaculture interventions with regard for their applicability to development cooperation in general.
- Chapter 10* Provides a series of recommendations to inform future programming.

A list of annexes is shown with the Table of Contents.



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## 2 Background

### 2.1 Bangladesh – Overall Development Context

During the past two decades Bangladesh has registered positive development on most key socio-economic indicators. In the United Nations Development Programme's (UNDP) Human Development Report 2007/2008 (refers to 2005 data) Bangladesh is ranked number 140 on the Human Development Index, which places the country at the lower end within the group of medium ranked countries. The report shows that Bangladesh's score on the index has increased from 4.2 in 1990 to 5.4 in 2005 and that Bangladesh "graduated from the Low Human Development category to the Medium Human Development category".

Poverty has declined remarkably in Bangladesh. The Poverty Headcount Ratio in Bangladesh (i.e. the proportion of the population falling below the national poverty line) decreased from 59% in 1990 to 41% in 2005.

In terms of health and nutrition the positive development trend has also been notable. The "under five mortality rate" (per 1,000) decreased from 149 to 77 and the infant mortality rate (per 1,000 live births) declined from 100 to 56 between 1990 and 2005. During the same period the prevalence of child malnutrition decreased from 66% to 48%. Average food intake per capita increased from 886 grams in 1990 to 947 grams in 2005. The general improved health condition among the population is also evident from life expectancy at birth, which increased from 54.8 to 63.5 years. Some of the improvements in the health may be explained by access to improved sanitation, which increased from 23% in 1990 to 48% in 2005.

Gender equality in Bangladesh has also improved significantly. While the ratio of girls to boys in primary and secondary school was 0.77 in 1990 it had increased to 1.05 in 2005. A similar trend was seen in the proportion of women employed in the non-agricultural sector; it increased from 18% in 1990 to 24% in 2005.

From a development perspective, it is also interesting to note that while aid per capita in Bangladesh was halved from 1990 to 2005, the investment rate increased from 17% to 24% of the Gross Domestic Product (GDP) during the same period (data from IMF and Bangladesh Bureau of Statistics). Much investment has been targeted to infrastructure and communication facilities.

### 2.2 Fisheries in the Agriculture Sector

The agricultural sector, including the fisheries sub-sector, contributes about 25% of the GDP, generating more than two-thirds of total employment and contributing a quarter of total export earnings. Shrimp/prawns alone are the second largest export earner.

The target for agricultural growth, set out in the Poverty Reduction Strategy Paper (PRSP), prepared by the Government of Bangladesh (GoB) in 2005, is 4% per year to support an overall economic growth rate of 6-7% per year. The National Strategy for the Fisheries and Livestock sub-sectors, which was detailed in the PRSP, identifies agriculture and rural development as the highest priority sectors for rapid poverty reduction in

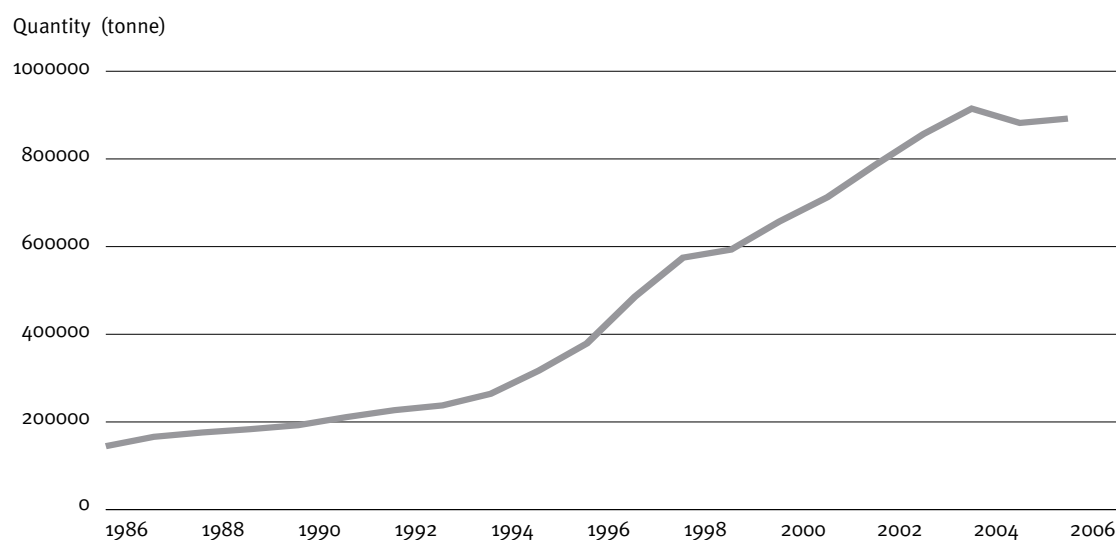
Bangladesh. Agriculture and the rural economy are recognized as the key drivers of a pro-poor growth strategy. The overall policy is for the Government to create an enabling environment and to play a supportive role in the development of the sector. The PRSP states that the dynamic potentials of the emerging sub-sectors of fisheries, poultry and livestock will be given critical policy attention, and that GoB is committed to ensuring input supplies, credit delivery, technological support and marketing services. Along with the GoB's pro-poor programme, the private sector and NGOs are to be supported, so that they can play a more proactive role in transforming agriculture and the rural economy.

Overall, the fisheries sub-sector in Bangladesh contributes 6% to GDP and export earnings and employs about 10% of the total labour force. Throughout the 1970s and 1980s the fisheries sub-sector was dominated by small scale enterprises operating in the capture fishery sector. Since then aquaculture has become the key player in providing fish for the urban consumer and shrimp for the export market. From the 1990s and onwards commercial operations – hatcheries, producers, and processors – have expanded rapidly.

### 2.3 Aquaculture in Bangladesh

In 1990, Bangladesh produced an estimated 200,000 tons of fish from fresh and brackish water aquaculture; just above 20% of total fish production in the country. By 2005 fish and shellfish production from aquaculture had gone up to nearly 900,000 tons; contributing some 40% of the total amount of fish produced in the country. Thus during the period from 1990 to 2005 there was a 450% increase in aquaculture production. It is estimated that in Bangladesh around 400,000 ha of freshwater ponds and more than 900,000 households are involved in aquaculture (Asian Development Bank (ADB), 2005).

**Figure 1 Total Fish Production from Aquaculture in Bangladesh**



Source: FAO Fishstat

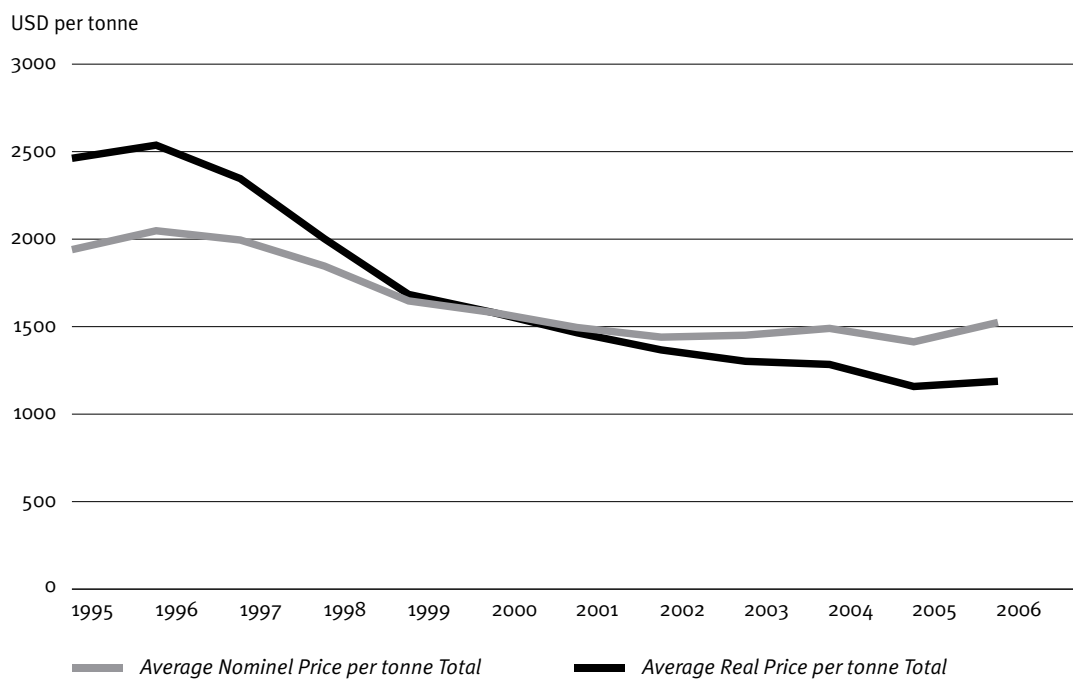
The main expansion of fish production in Bangladesh has come from a rapid growth in aquaculture, including freshwater pond and shrimp/prawn aquaculture. At the same time,

inland open water capture fisheries have declined. Floodplain aquaculture has recently emerged as a potential growth area with particular significance for poverty reduction goals.

## 2.4 External Support for Aquaculture

The tremendous increase in aquaculture production during the past two decades is in large part a result of extensive donor support for implementation of aquaculture programmes by government agencies, NGOs, and private sector entrepreneurs. A large number of NGOs are active in Bangladesh with the mission of alleviating the poverty of the rural farmers through various income-generating activities of which aquaculture is an important element. Between 1985 and 2005 the 10 major donor's active in Bangladesh in the aquaculture sector spent or committed USD 317 million in grants or loans. These donors included Danida, World Bank, ADB, the International Fund for Agricultural Development (IFAD), and the Department for International Development (DfID), with the World Bank being the single largest donor. Danida was the fourth largest donor for grants. National government organizations were the main partner, or named recipient, of 83% of the funds, although in many cases some of these funds were used for technical assistance teams, consultants or passed on to NGOs.

**Figure 3 Price Development for Aquaculture Species, including Prawns**



Source: FAO Fishstat

The significant increase in aquaculture fish production in Bangladesh over the past two decades has led to a substantial decline in national fish prices. This has contributed to increasing national fish consumption, which during the period from 1991/2 to 2005 increased by 22%; from 34.5 to 42.1 grams per day per capita. Within the same period, total per capita food intake only increased by 7%.

**Figure 2 Summary of Funding to Aquaculture Related Activities and Projects according to the Main Receiving Agencies from Major Donors during 1985-2005**

Agencies receiving fund	Major Donors											Total in million USD
	WB	DFID	ADB	Danida	WFP	IFAD	EC	USAID	UNDP	FAO		
National Government	87.01	39.23	46.23	31.90	18.87	13.7	12.83	4.07	10.26	--	--	<b>264.10</b>
Direct Implementation	--	3.15	--	--	--	--	--	--	--	--	6.8	<b>9.95</b>
International Organizations	--	29.86	--	--	--	0.57	--	8.60	0.50	--	--	<b>39.53</b>
NGOs	--	3.81	--	--	--	--	--	--	--	--	--	<b>3.81</b>
<b>Total</b>	<b>87.01</b>	<b>76.05</b>	<b>46.23</b>	<b>31.90</b>	<b>18.87</b>	<b>14.27</b>	<b>12.83</b>	<b>12.67</b>	<b>10.76</b>	<b>6.8</b>		<b>317.39</b>

Source: Study Report on Donor Funding and NGO Activity in Aquaculture in Bangladesh, The World Fish Centre (2005)

## 2.5 Danida's Involvement in Aquaculture Support

Danida has supported aquaculture in Bangladesh since 1976, when the Aquaculture Experiment Station in Mymensingh was initiated. This later became the Freshwater Aquaculture Research Station. This research was piloted through the formulation and implementation of MAEC with the aim of increasing production of fish protein and raising the socio-economic status in selected Upazilas (sub-districts).

Following the initial success of MAEC, similar interventions were designed for the Greater Noakhali area, GNAEC, and for Patuakhali and Barguna, PBAEC. As an additional feature, these interventions included a central prawn cultivation component and an expansion of activities to non-pond culture, including paddy field rice-fish culture, juvenile prawn nursing, and cage culture (Prawn was introduced with carp polyculture in the early stages of the Mymensingh intervention). However, prawn cultivation never became widespread due to a combination of factors including a limited supply of juveniles, marketing difficulties, and the relatively high cost of harvesting) Moreover, PBAEC included a component for CBFM in closed and semi-closed public water bodies (Jalmohols).

Figure 4 summarizes key features of the three Danida-funded aquaculture extension interventions.

**Figure 4 Key Data of MAEC, PBAEC, and GNAEC**

	MAEC Phase I	Phase II	Consolidation Phase	PBAEC	GNAEC
Duration (Years)	4	7	3.5	12	8
Start - Closing Date	July 1989- June 1993	July 1993- June 2000	July 2000- Dec 2003	July 1994- Sept 2006	July 1998- Sept 2006
Number of Districts	1	7	7	2	3
Number of Upazilas	6	32	43	12	15
Primary Beneficiaries (Number of individuals/HHs)	3,850 (Individuals)	53,850 (Individuals)	49,850 (Individuals)	63,382 (HHs)	35,748 (HHs)
Total Danida disbursement (in 000sDKK)	9,542	45,516	13,293	40,745	42,031

*Note: There are discrepancies in the documents regarding the start dates and actual disbursements for PBAEC. This table uses the dates from the draft PBAEC Component Completion Report, August 2007.*

This Evaluation is focussed on the analysis of the impact of the interventions in Mymensingh and Noakhali. These two interventions will be briefly presented in the following sections.

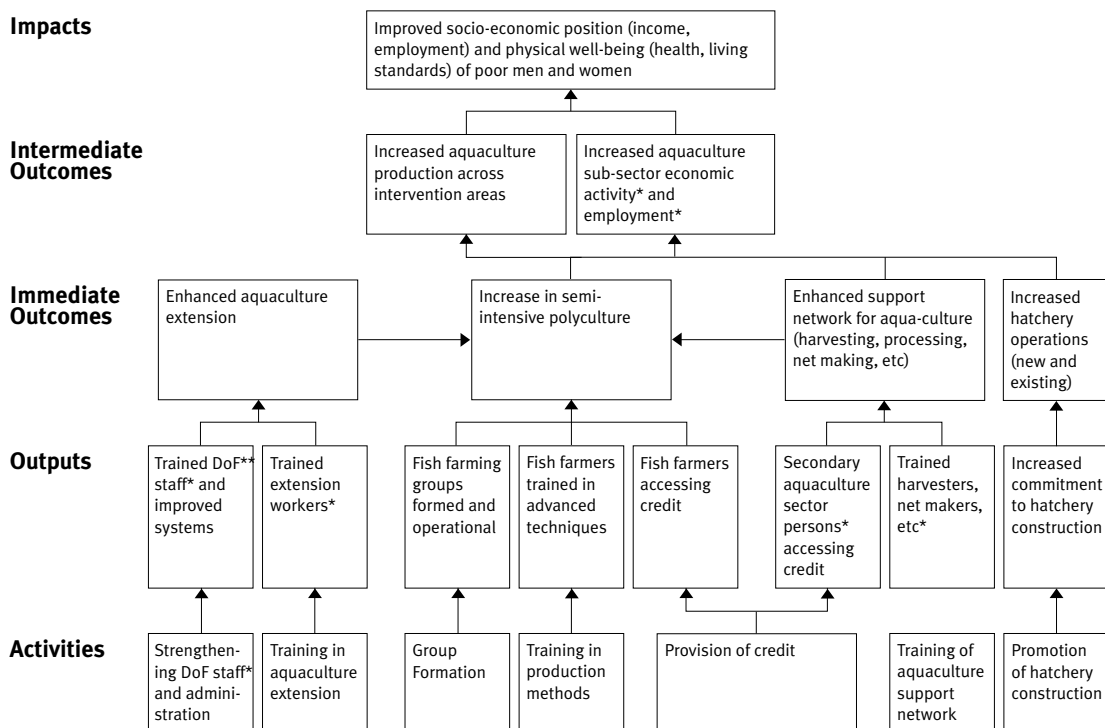
## 2.6 Content of Danida-funded Aquaculture Interventions

The overall and long-term development objectives were identical for MAEC and GNAEC:

- To strengthen the socio-economic position and physical well-being of the target group of poor men and women belonging to landless and marginal HHs, thus enabling them to improve their participation in social and economic development.
- To enhance opportunities for productive employment of target group members, through increased aquaculture production in the target area.

Although MAEC and GNAEC shared the same overall long-term development objectives, the interventions within the two regions were quite different. Nevertheless, the Evaluation has made an attempt to synthesize the two intervention approaches into one “overall” logic model that the Evaluation Team believes captures the intent and scope of the Danida-funded aquaculture interventions. In particular, the model is intended to illustrate key linkages and causalities that were expected to lead to fulfilment of the objectives of the interventions. The logic model is presented in Figure 5 below.

**Figure 5 Logic Model**



\* Includes women and men  
 \*\* Department of Fisheries

The logic model will be the point of reference for the analysis in the following sections and in particular for determining the causality of any detected impact from the interventions. More specific features of the interventions in Mymensingh and Noakhali are presented below.

### Mymensingh

MAEC was implemented in three phases and covered a total of 43 Upazilas and 369 Unions in the Greater Mymensingh, Gazipur, and Tangail Districts.

*Phase I* (1989-93) was a pilot project, with the aim of developing an extension system, and to spread the results of Danida-supported aquaculture research to pond owners and people with access to ponds, in order to increase the production of fish protein in selected Upazilas of Mymensingh District. *Phase II* (1993-2000) was intended to increase fish production and was an extension of Phase I programming. It was implemented through a “crash” programme in selected Upazilas of seven Districts including Mymensingh. *Phase III* (2000-03) was a Consolidation Phase, which intended to finalize the approach of partner NGOs and the Department of Fisheries (DoF) as initiated in Phase II, and to ensure the self-sustaining capacity of aquaculture extension at Upazila and farmer levels. This phase was extended (at no-cost) for an additional year to help ensure a well-planned phase-out and adequate documentation.

**Figure 6 MAEC Primary Beneficiaries receiving training with credit or only training**

	Phase I	Phase II	Phase III	Total
Pond Fish Farmers	3,850	43,000	34,850	81,700
Rice Fish Farmers	--	800	2,950	3,750
Service Providers	--	10,050	12,050	22,100
Total	3,850	53,850	49,850	107,550
Planned	3,500	25,000	48,000	76,500

As Figure 6 shows, a total of 107,550 farmers (of whom 45% were women) received training with credit or training only. This was 40% more than the 76,500 originally planned. The beneficiaries belonged to three different categories: *Demonstration Farmers* received training and credit (interest free) and their ponds were used to demonstrate aquaculture technology for other farmers (2,790 persons, 32% women); *Credit Farmers* received training and credit with interest (71,580 persons, 47% women) and; *Contact Farmers* received only training but no credit support since they were able to undertake fishpond culture with their own funding or could afford/arrange to start/continue fish culture without credit (33,180 persons, 41% women). The inclusion of service providers (fish seed traders, harvesters, and net makers) as primary beneficiaries was started in 1998. As a result 22,138 service providers (55% women) were among the MAEC beneficiaries within the credit farmer category.

### Noakhali

GNAEC was an expansion of Danida’s successful intervention in the promotion of small-scale aquaculture in Mymensingh. The initial design of GNAEC owes much to the model developed in the second phase of MAEC.

GNAEC operated in the Districts of Noakhali, Feni, and Lakshmipur. Until 2002 its main focus was on the promotion of improved carp polyculture in ponds of small-scale farm HHs. There was an intensive training programme using a HH approach; training both men and women from the same HH (this was an important difference from MAEC which made use of an individual training approach). The farmers were divided into Fish Farmers Groups (FFGs); some were mixed and others only for men or women. Credit was provided to the women. The field activities were carried out through contracted NGOs.

From 2002 onwards the intervention emphasized a more explicitly pro-poor strategy, centred on the promotion of freshwater prawns. Prawn culture was piloted in rice fields, under an integrated farming system that also included carp, small indigenous fish species, and vegetables. The pro-poor initiatives of the intervention sought to include disadvantaged groups in this system and involved:

- Female-headed HHs in the char lands, many engaged in the nursing of prawn juveniles.
- Settlement villages, through the improved culture of community ponds.
- Inshore fishers in Hatiya Island, to provide fish meal for the prawn feed industry.
- Female fish driers to provide fish meal for the prawn feed industry.
- Landless HHs using multiple ownership ponds.
- Members of Labour Contracting Societies.

A total of 35,750 HHs were trained under the original approach, plus 11,100 under the pro-poor programme. This was 47% more than the 25,000 HHs originally targeted. In addition, a total of 2,000 secondary beneficiaries, mainly service providers, such as fry traders and nursers, were also provided training through GNAEC.

In the late part of GNAEC the intervention's extension strategy included promotion and capacity-building of Community Based Organizations (CBOs), with the aim of:

- Providing technical advice to members and clients.
- Delivering low cost farm inputs.
- Representing their members/communities on various issues.

### **Modalities**

The overall modalities used by the MAEC and GNAEC interventions can be summarized as follows:

- Group formation among pond operators.
- Development of sustainable integrated aquaculture practices and production through training, technical advice, and awareness raising.
- Preparation of training and information material.
- Establishment of credit delivery services and disbursement of credit.
- The empowerment of women/gender equality programming including gender training, awareness raising, etc.
- Impact and operations monitoring.
- Research, baseline studies, socio-economic studies, and resource surveys.
- Promotion of hatchery construction and some construction of hatcheries.



The implementation modality set-up for MAEC and GNAEC was based on a tripartite arrangement between Danida, DoF and the NGOs. In MAEC the NGOs were added as partners only from 1997.

See Annex 4 for more detail in the Intervention Profile.

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## 3 Methodology

During the inception period, the Evaluation made strong efforts to identify and obtain access to the data required to conduct a theory-based impact evaluation. A number of challenges were encountered at that time with regards to both the availability and quality of data sets in Mymensingh and, to a lesser extent, in Noakhali. In particular, it was difficult to establish a reliable comparison group since comparable HH data on farmers who did not participate in MAEC or GNAEC was limited.

Despite these challenges and limitations, the Evaluation managed to obtain access to data sets for both Mymensingh and Noakhali with sufficient detail and quality to carry out a theory-based impact analysis. The data collection approach and analysis are described below.

### 3.1 Data Collection

The data collection process was spread over a period of 10 months, from March 2007 to January 2008. The initial problems with data collection prolonged the inception period. Weather conditions in Bangladesh resulted in some postponement of the main fieldwork activities. The following main data collection methods were applied:

#### Document Review

The document review process was initiated during the inception period and continued throughout the implementation period, as new documents and material were made available to the Evaluation.

At the start of the assignment, Danida provided a number of relevant documents to the Evaluation. Other important providers of documentation included the Royal Danish Embassy in Dhaka, the GNAEC Office in Noakhali, NGOs in Mymensingh and Noakhali, the International Food Policy Research Institute (IFPRI), and the Bangladesh Bureau of Statistics (BBS) as well as other stakeholders met during implementation. See Annex 5 for a Bibliography.

#### Survey Data

Survey data was available in both Mymensingh and Noakhali for HHs engaged in aquaculture, including those who owned a pond and those that did not. There was no survey data available for the range of services providers who were also beneficiaries of the program. Consequently the quantitative data analysis focuses exclusively on HHs involved in the cultivation of fish and prawns.

#### Mymensingh

Quantitative data was collected in Mymensingh through a series of surveys undertaken by IFPRI. The data sets obtained from IFPRI related to a 1996/97 four-round survey and 1996 HH census, together with a 2006/07 follow-up survey carried out in Mymensingh and Kishoreganj Districts (Gaffargaon, Pakundia, and Kishoreganj Upazilas, respectively). Combining two of the IFPRI data sets provided the opportunity to carry out both *short-run* (2 years) and *long-run* (10 years) impact assessments of the Danida-funded aquaculture interventions in Mymensingh. The HH census and surveys were conducted in villages where MAEC had already been implemented as well as in

comparable villages where MAEC had not yet started in 1997. However, by 2007, MAEC was active in all villages.

#### *Short-run Data*

A total of 330 HHs were selected from the census villages located within the Districts of Mymensingh and Kishoreganj for the 1996/97 four-round survey. The HHs were categorised as follows:

- 110 MAEC-participating HHs (Category A), HHs that had already received treatment. The treatment year is not known, but since MAEC interventions started from 1993 (Figure 6) it must be expected that most Category A HHs had received treatment during 1994-95.
- 110 MAEC “likely participating” HHs in villages where the project had not yet started but was supposed to be implemented from 1998 (Category B).
- A sampling of 110 other HHs in both types of villages (A and B) to represent the general population (Categories C1 (from the same villages as A) and C2 (from the same villages as B)).

Detailed HH information, obtained from the four-round survey, was collected on demographic characteristics, agricultural production, other income-earning activities, expenditure patterns, time allocation, nutrient intakes, and nutrition, micronutrient, and morbidity status. Family background data were collected individually from males and females from the second survey round. Both men and women were asked about family background, marriage history, premarital assets and inheritance; women were asked about transfers at marriage and indicators of their mobility and empowerment.

#### *Long-run Data*

During 2006/07, IFPRI carried out a re-survey of the 330 HHs covered by the 1996/97 four-round survey. This provided a total of 279 comparable HH observations across the two surveys.

**Figure 7 Panel Data for Long-run Analysis**

Category	MAEC	Panel 1: Full Sample		Panel 2: With Pond Access	
		1996/97	2006/07	1996/97	2006/07
A	Yes	93	93	93	93
B	Yes	0	44	0	44
	No	96	52	96	52
C1	No	43	43	23	23
C2	No	47	47	9	9
Total Observations	279	279	221	221	

Figure 7 provides an overview of the data available for the long-term analysis. Considering the full sample (Panel 1), 93 HHs were already participating (Category A) in MAEC at the time of interview in round one, whereas 96 were MAEC “likely participants” (pipeline) in villages where the project had not yet started (Category B).

Out of the 96 Category B HHs, only 44 indicated in the 2006/07 survey that they had “Withdrawn from NGO assistance the last 10 years”. This is an indication that not all B HHs became MAEC participants. Impact was therefore tested for two Category B groups: 1) All Category B HHs, and 2) Only those Category B HHs that withdrew from NGO assistance.

Some 43 and 47 non-participating HHs were categorized as C1 and C2 HHs in both survey years. Since the objectives of MAEC started out with a focus on HHs with pond access, Panel 2 excludes HHs with no access to pond production. Some HHs with pond access in 1996/97 did not have use rights in 2006/07; these are also excluded in the “with pond access” samples. This reduced the number of control HHs in Categories C1 and C2 substantially.

#### **Noakhali**

A combination of two recently collected survey data sets provided an opportunity to carry out a theory-based impact evaluation of GNAEC. The two data sets were from the study on “Impact Evaluation of Fish Farmer Group (FFG) under Greater Noakhali Aquaculture Extension Project (GNAEP)” (2006), and the “Baseline Study for Agricultural Sector Programme Support Phase II (ASPS II), Regional Fisheries and Livestock Development Component (RFLDC), Noakhali and Barisal” (2007). In order to strengthen the analysis, efforts were made to trace back HH information from the two above-mentioned studies to GNAEC FFG *Databases* from 2000-04 (for GNAEC participants) and to the *Baseline Pond Census* from 2000-02 (for GNAEC participants and non-participants).

Given data availability and the time dimension (data from FFGs were available from 2000 while data from the pro-poor initiative were only available from 2004 onwards) the Evaluation focussed on measuring impact from the original approach, specifically for HHs that participated in the FFGs from 2000-04. This approach allowed for more direct comparability to Mymensingh.

#### *FFG Impact Evaluation Data*

This is an end of intervention survey data set containing information only on GNAEC participants who received training through FFGs. In addition to 2006 HH information the FFG Impact Evaluation used recall questions to obtain information on HH status prior to participation in the FFGs. Training in FFGs was carried out over a period of one year.

During July-August 2006 data was collected on a total of 600 GNAEC HHs participating in FFGs. The selection of HHs used a three-stage stratified random sampling approach. First, at least 120 HHs were selected from each of the following four different geographical areas: 1) “Area 1 – Charland” (Southern part of Noakhali Sardar and Ramgati), 2) “Area 2 – Fertile, but waterlogged” (Parts of Begumgonj, Senbagh and Lakshmipur Sardar), 3) “Area 3 – Resource rich and well irrigated” (Dagonbhuiyan and Feni Sardar) 4) and “Area 4 – Rich but water flashed” (Parshuram and Chagalnaiya). Second, within each area, participants covering at least two FFG cohorts, 2000-04, were

chosen. Third, the distribution of male and female participants was selected to represent the NGO records on the sex of pond operators.

#### *RFLDC Baseline Study Data*

The RFLDC data, collected as baseline information form ASPs-II, included information on both GNAEC-participating HHs and non-participating HHs. This made it possible to establish a treatment group as well as a control group for the impact analysis.

The RFLDC Baseline Study was carried out during May-June 2007 and covered a total of 909 HH in Noakhali. They were selected following a slightly different sampling approach than the FFG Impact Evaluation. First, 11 Upazilas were selected based on components, poverty status, and agro-ecological zones. Second, within each of the 11 Upazilas, one Union was selected on the basis of the following criteria: a) advanced, with good communication possibilities, b) moderately remote, and c) remote. Third, villages or clusters of villages with at least 200 HHs were randomly selected from each selected Union. Around 90 HHs from each Upazila and 30 HHs from each Union were selected.

In order to facilitate meaningful comparisons of the RFLDC Baseline Study data with the FFG Impact Evaluation data, the area definitions from the latter were imposed on the RFLDC data.

**Figure 8 Data Overview, Noakhali**

Panel 1: Including all HHs with Pond Access

	A: FFG Impact Evaluation		B: RFLDC Baseline Study		Total	
	Yes	No	Yes	No	Yes	No
Observations	564	0	101	667	665	667

Panel 2: Including only Pond Owners

	A: FFG Impact Evaluation		B: RFLDC Baseline Study		Total	
	Yes	No	Yes	No	Yes	No
Observations	502	0	97	430	599	430

Figure 8 provides an overview of the data available for the impact analysis after data cleaning. A total of 1,332 HH observations are available (Panel 1). Out of these, 665 HHs participated in GNAEC while 667 HHs were non-participants. Restricting the analysis to pond owners only limited the number of data observations which were used for the treatment analysis to 1,029 (Panel 2).

#### *Baseline Pond Census and FFG Databases*

The Evaluation also attempted to trace the above 1,332 HHs back to baseline surveys (Baseline Pond Survey and FFG database) using the name of the respondent, the name of the respondent's father, and location of the HH (at the union and village level). This was done in order to be able to apply a double difference methodology. However, the use of the respondent's name allowed tracing of only 18% of the sample. Adding HH location to the search criteria reduced this problem, but reduced the number of HHs that the Evaluation was able to match with baseline information to 5%. Unfortunately almost all of the observations that were able to be traced came from the FFG impact data, limiting the scope of the double difference estimator. However, the HHs that the Evaluation was able to trace back showed a high degree of conformity between the recall information given in the survey in 2006/07 and the baseline information. In view of this, the Evaluation feels justified in using the recall information in the FFG impact survey as the basis for the calculated before-after estimates.

#### **Focus Group Discussions**

A total of 36 Focus Group Discussions (FGDs) were conducted with farmers in Mymensingh and Noakhali. Eight to 12 farmers attended each FGD, providing a total attendance of 339 farmers in the FGDs.

In Mymensingh, 20 FGDs were conducted within three different Upazilas: Gaffargaon and Pakundia, both covered by MAEC and by the IFPRI 1996/97 and 2006/07 surveys, and Bajitpur, which was not covered by MAEC, and therefore served as a comparison group outside the intervention area.

In Noakhali, 16 FGDs were conducted, four in each of the following four Upazilas: Raipur (Keroa Union), Begumgonj (Durgapur Union), Subornachar (Char Clark Union), and Feni Sardar (Sarishadi Union). The four Unions were located in three different Districts (Lakshmipur, Noakhali and Feni) and covered three of the four different geographical areas referred to in the FFG Impact Evaluation ("Area 1 – Charland", "Area 2 – Fertile, but waterlogged" and "Area 3 – Resource rich and well irrigated"). Since the implementation of GNAEC in the Noakhali Region was widespread, covering basically all Unions, those Unions with relatively low GNAEC coverage were preferred for the FGDs. This was to try to limit contamination of comparison group farmers.

Within each of the selected locations in Mymensingh and Noakhali, FGDs were conducted with four different groups of farmers:

- Women who had participated in the Danida-funded aquaculture activities.
- Women who had not participated in the Danida-funded aquaculture activities.
- Men who had participated in the Danida-funded aquaculture activities.
- Men who had not participated in the Danida-funded aquaculture activities.

In Mymensingh the selection of MAEC-participating farmers for the FGDs was based on NGO participant lists from 1998-2003. This ensured high comparability with the long-run survey data analysis, based on MAEC participants enrolled after 1997 (Category B HHs). Non-MAEC participants for the FGDs were selected on the basis of information provided by NGOs and DoF. Age was initially used as another criterion for selection of FGD participants in Mymensingh based upon an initial analysis of the quantitative data. However, data on the birthdates of participants was limited and non-existent for non-participants; consequently this criterion was not applied in Noakhali.

In Noakhali, GNAEC-participants for the FGDs were all selected from the 2000-04 FFG cohorts in order to ensure high comparability with the FFG Impact Evaluation data. The GNAEC FFG databases from 2000-04 were used for random selection of the GNAEC-participating farmers. Non-GNAEC-participating farmers for the FGDs were selected based on information provided by the implementing NGOs and villagers.

In addition to the farmer FGDs, a number of FGDs were conducted with other key stakeholder groups:

- Service Providers (net makers, nursers, etc.) (Mymensingh and Noakhali).
- Community Based Organisations (CBOs) (Noakhali only).
- Extension Trainer's (Noakhali only).
- Department of Fisheries (DoF) District Offices (Mymensingh and Noakhali).

See Annex 6 for full list of FGDs. See Annex 7 for a list of FGD questions.

#### Site Observations

Site observations were carried out within Mymensingh and Noakhali to provide more in-depth information on the results and sustainability of intervention activities:

- *Pond sites.* From the farmer FGDs a number of cases were selected for follow-up visits at the HH pond sites. This included participating and non-participating farmers, both male and female.
- *Fish markets.* Visits were carried out to fish markets in both Mymensingh and Noakhali.
- *Hatcheries.* Visits were made to one tilapia hatchery in Mymensingh and two prawn hatcheries in Noakhali, supported by MAEC and GNAEC respectively.
- *Other aquaculture-related activities.* Visits were made to feed mills, fish dryers, and nurseries in Mymensingh and Noakhali.

See Annex 8 for Site Visit Reports.

#### Key Informant Interviews

The following key informant interviews were conducted:

- DoF Management and Staff: 4
- Union Councils: 2
- Danida Bistandsfaglig Tjeneste (Danida department providing technical advisory services for development assistance): 1
- Danida Senior Advisors – MAEC and GNAEC: 3
- Donors/NGOs: 5
- Aquaculture related institutions: 2
- Private sector actors (hatchery and feed mill owners): 3

See Annex 6 for full list of interviews. See Annex 7 for a list of Interview Questions.

### 3.2 Data Collation and Analysis

The following section presents the main methodology applied to data collation and analysis. (See Annex 9 for a detailed account of the quantitative data collation and analysis process.)

#### Survey Analysis: Mymensingh

The available data sets provided the opportunity to carry out both *short-run* (2 years) and *long-run* (10 years) impact assessment of MAEC.

The *short-run analysis* combined four-round survey data collected from early 1996 (round 1) to late 1997 (round 4) with the Household Census Data from 1996. Category B HHs were supposed to enter MAEC and therefore fulfilled the criteria for participation. They were used as a “pipeline” group (comparison group) and compared to the treatment group composed of category A HHs. This allowed the application of a pipeline approach, together with different techniques for matching of participating HHs from Category A with non-participating HHs from Category B. The double difference method for the short-run analysis could not be applied since Category A HHs were already involved in MAEC and therefore did not represent a true baseline.

The *long-run analysis* combined different approaches for matching of HHs with the standard double difference method. This method compared samples of participants (treatment group) and non-participants (comparison group) before and after the interventions. The difference between the mean differences was the estimate of the impact of Danida funded aquaculture interventions. Outcomes have been compared before and after a change for a group affected by the change (treatment group) to a group potentially not affected by the change (comparison group). The comparison group was used to “difference out” any confounding factors and isolate the treatment effect.

Using the 1996/97 survey as “before the intervention” data and the 2006/07 survey as “after the intervention” data, the mean difference between the “before” and “after” values of outcome variables was calculated for a treatment (Category B HHs) and a comparison group (Category C HHs with pond access). Given that matching methods helped to control for time-varying selection bias and that the double difference approach eliminated all time-invariant additive selection bias, a combination of the two approaches made it possible to eliminate observable heterogeneity in factors relevant to subsequent changes over time.

#### Outcome Variables

Based on the MAEC main objectives and data availability, the analysis has been focussed on the following outcome variables:

- Value of Fish Production.
- Consumption Expenditure.
- Value of Assets.
- Empowerment of Women.

It was decided to use HH consumption expenditures and value of assets as proxies for socio-economic welfare. The IFPRI consumption expenditure aggregates excluded costs, which tended to be more lump sum expenditures like dowry, health expenditures, weddings, funerals, durable goods, housing, and housing repair. Several other proxies representing socio-economic welfare were tried (including HH income), but were excluded because of missing data and traditional measurement problems with income data. The



level of detail on nutrient intakes (including micronutrients) and general nutrition was unfortunately not well covered in the follow-up survey in 2006/07. Data on the empowerment of women was only collected in the fourth round of the 1996/97 survey (using a female questionnaire). This questionnaire included recall questions to determine any changes in the mobility of women from the first survey round in early 1996.

#### *Control Variables*

The following HH characteristics were used as control variables for the matching of participating with non-participating HHs:

- Location.
- Education.
- Age.
- Size of HH.
- Amount of Land Owned.

For the control variables a comparison between Categories A, B, and C HHs were made to detect any biases between the categories.

#### *Robustness Check*

Comparison of the 1996/97 with the 2006/07 survey data faced a number of potential contamination factors that could bias the results. These included:

- HHs involved in other NGO programmes.
- HHs affected by negative shocks (e.g. flooding, death, crime, loss of property).
- HHs affected by positive events (e.g. increase in HH employment level, new remittances, large gifts, scholarships).

A robustness check was therefore carried out for the long-run analysis, excluding HHs with involvement in other NGO programmes and HHs affected by major shocks and events during the 10-year period. Although treatment effects on fish production value, consumption expenditures and assets became more positive when HHs with these characteristics were excluded from the sample, the overall conclusions on the long-run treatment effect remained almost the same. The robustness checks however constrain the data significantly and make the conclusions only suggestive.

A comparison of village characteristics (location) found very few differences between the access of Category A and B HHs to services and infrastructure.

#### **Survey Analysis: Noakhali**

The GNAEC impact analysis was attempted at two levels:

1. A cross-sectional analysis based on FFG Impact Evaluation data in combination with RFLDC Baseline Study data. This analysis relied exclusively on different techniques of matching of GNAEC-participating with GNAEC non-participating HHs.
2. A panel analysis using the combined FFG Impact Evaluation and RFLDC Baseline data set in combination with data from the GNAEC FFG databases and the Baseline Pond Census. This analysis would have enabled the combination of matching and double difference estimation methods, similar to the long-term analysis for Mymensingh.

Unfortunately, back-tracing of HHs to baseline data information was possible only for a limited number of HHs, and mainly to the FFG database for GNAEC-participating HHs (see Section 3.1). Very few HH observations could be traced back to the Baseline Pond Census.

For those HHs where back-tracing was possible in the panel analysis, there was a high degree of correlation between the recall information provided in the FFG Impact Evaluation data and the baseline information. Therefore, the Evaluation used the recall information from the FFG Impact Evaluation with some confidence as basis for the calculated before-after estimates for GNAEC participants. On the other hand, the Evaluation was not able to establish a reliable baseline for GNAEC non-participants, which made the use of double difference estimation impossible.

The Evaluation has attempted to make the data sets from the FFG Impact Evaluation and the RFLDC Baseline Study comparable. Information was extracted from the two detailed questionnaires only when the questions were posed in a similar and comparable way.

Difficulties were encountered especially with comparisons of location when the definitions used in the FFG Impact Evaluation were imposed on the analysis. In addition, the criterion of high questionnaire comparability limited the number of dependent variables that could be subjected to analysis.

#### *Outcome Variables*

Given the main objectives of GNAEC, the analysis was focussed on three outcome variables:

1. Value of Fish Production.
2. HH Income.
3. The Empowerment of Women.

The two surveys (in combination) unfortunately included limited information concerning socio-economic welfare and, although income data is usually subject to issues of missing data and traditional measurement error problems, the Evaluation chose to use HH income (on an annual basis) as a proxy for socio-economic welfare in the absence of better options.

With regards to assets, the data sets only contained information on whether HHs had one of eight selected (comparable) assets and not the value of the assets. Instead wealth was included as a control variable (see below).

On the positive note, data were available for different income sources such as agriculture, aquaculture, livestock, wage work, remittances, and other non-farm activities. This facilitated a distinction between income obtained from aquaculture and from other sources.

#### *Control Variables*

The following observable HH characteristics have been included as control variables in the subsequent analysis:

- Location.
- Education.
- Occupation.
- Wealth.

- Size of HH.
- Pond size.
- Land owned.

For the control variables a comparison between the participant and non-participant group was made to detect any biases.

#### *Robustness Check*

As in the Mymensingh survey data analysis the robustness of the results obtained was controlled by eliminating HHs from the data analysis set with potential contamination bias. Robustness checks were carried out with regards to three potential biases:

1. HHs involvement in other NGO programmes. All HHs that received other NGO assistance than from GNAEC were excluded.
2. Differences in proximity of HHs between the two data sources. All HHs from Area 5 (other Noakhali Upazilas) in the RFLDC Baseline Survey were excluded.
3. Differences between the treatment and comparison groups in the combined surveys. All data from the FFG Impact Evaluation were excluded.

The robustness checks carried out for these HH factors did not lead to different conclusions on treatment effects from GNAEC.

#### *Significance Levels*

For the treatment analysis, different significance levels were used to measure the statistical strength of the findings. Significance is the risk of concluding a relationship between data that does not exist. The Evaluation used 1%, 5%, and 10% levels of significance as cut-off points, which meant that there are 1%, 5% and 10% or smaller chances that an inferred relationship was due to chance.

The use of different sample splits for similar empirical models strengthened the use of these tests (given similar results were obtained). Given that significance testing was based on errors from random samplings, the quantitative analysis for Mymensingh was, in general, better suited for these tests than the data used for Noakhali.

#### *Methodological Concerns*

Most methodological concerns relate to the treatment analysis for Noakhali data, which was mainly based on matching estimators. Several studies have shown that difference-in-difference matching methods, as applied for the Mymensingh long-run analysis, are more reliable than cross-sectional matching methods.

A general concern related to matching estimators is the selection of control variables used for estimating the propensity score. There is no theoretical basis for how to choose this particular set of controls and studies have shown that the selection of variables for estimation of the propensity score can make a substantial difference to the results. However, it has also been found that using a rather large set of conditioning variables, as was done in the Noakhali analysis, improves the validity of the performance matching estimators.

Matching estimators perform best when the same survey instrument is applied between treatment and comparison units and the treatment and comparison groups are located in

the same geographical areas. This means that if the villages and HHs selected in the FFG Impact Evaluation differed significantly from those in the RFLDC baseline study in terms of poverty level, infrastructure, and market access etc., this may have biased the results, if interventions worked through these channels. In the case of Noakhali, around 68% of the RFLDC data were collected from areas that were not covered by the FFG Impact Evaluation. This might have weakened the robustness of the estimates obtained. Moreover, matching estimators are not well suited to compensate for biases caused by differences in how variables are measured across surveys, which is also a problem faced in the Noakhali data.

To address these methodological concerns with the Noakhali data the Evaluation only used highly comparable questions for the construction of the variables, and most importantly did numerous robustness checks of all the results using only the RFLDC data (which contain both treated and control households). This was mainly done in order to “overcome” the common support problem surrounding the location variable. A positive finding is that the coefficient estimates do not change much using this robustness check. On the other hand the coefficients are often less well determined (in a statistical sense) making the conclusions from the Noakhali data relatively less reliable as compared to the IFPRI (Mymensingh) data.

For Mymensingh, the Category C HH data (C1 and C2) limits certain aspects of the long-run analysis. First, when excluding HHs with no pond access from Category C, the number of observations in Category C decreased substantially. This increased the variance in the tests and made it more difficult to demonstrate any significance treatment effects through the data testing. Second, the observations in Category C include rather large variations in pond production. This was due to the fact that pond size varied much more within Category C HHs than within Category A and B HHs. In view of these shortcomings, the Mymensingh data sets were better suited for the short-term treatment analysis than for the long-term analysis.

As for the MAEC long-term analysis, it must also be noted that the double difference estimates are not as reliable when outcomes are compared over a long time horizon as many events are likely to have taken place which would also influence the impact variables. To address this potential problem the Evaluation used information from the 2006/07 survey concerning the shocks (negative) and events (positive) the household experienced from 1996/97 to 2006/07 together with information about whether the household had been engaged in other NGO projects. The addition of these factors to the analysis did not change the overall results.

The comparison of results between Mymensingh and Noakhali also encounters limitations. First, the outcome variables are not identical. Second, the time dimension between the short-term analysis 1996/97 in Mymensingh and the Noakhali analysis is problematic. This is particularly relevant to the analysis of women’s empowerment, which was covered in the four-round survey but not in the 2006/07 follow-up survey in Mymensingh. Third, it should be noted that the analyses are not based on similar control variable measures. Fourth, differences in interventions between the two areas also make comparisons difficult. Consequently the Evaluation did not pursue any direct quantitative comparison between MAEC and GNAEC.

For the IFPRI data there were also concerns about the representativeness of the data given the small sample size. The data is of high quality by international standards and

the Evaluation believes them to be highly reliable. For the short-run data the pipeline approach used insures a high comparability between treated (A-group) and comparison (B-group) HHs. The findings of the FGDs also show that with adoption of the promoted techniques and protocols, substantial changes in fish production, consumption, and related income are possible within a two-year time frame. This makes the conclusions drawn from the short-run data fairly strong. However, it is unlikely that assets would change substantially in this short timeframe. With respect to representativeness, the small sample size is problematic, however, based upon an examination of the Upazilas covered by the data, there is nothing that would lead the Evaluation to believe that the data do not represent a correct and reliable picture (in the statistical sense) of the impact of MAEC in the Upazilas considered.

#### **Focus Group Discussions (FGDs), Interviews, and Site Observations**

All key information gathered from focus groups, interviews, and site observations has been entered into a common scheme, structured according to the evaluation questions. Each data entry was given a unique logbook number to facilitate tracing of the data source.

#### **Synthesis of Data**

In early March 2008 all collected data and information was synthesized and discussed during a five-day team meeting in Dhaka, at which most of the international and local evaluation team members were present. The discussions were structured by the evaluation questions and the quantitative and qualitative findings related to each theme. In particular, the results from the quantitative data analysis were assessed in view of the qualitative findings in order to determine causality. Finally, based on the team discussions, the main conclusions, lessons learned, and recommendations were drawn.

One of the issues to be covered in the Terms of Reference was corruption. While the Evaluation noted a few anecdotal situations that could be indicative of petty misuse of resources, there was insufficient evidence to begin exploring the issue of corruption, in the context of an impact evaluation occurring years after completion of implementation. Consequently the issue of corruption was not considered.

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## 4 Intervention Impact

The Evaluation considered several different dimensions of the impact of the interventions based on the logic model found in Figure 5. Impact was defined as the socio-economic position and physical well-being of poor women and men. The Evaluation examined the changes in HH income and consumption, various types of assets including land ownership, housing, and consumer goods, and nutrition and health. Since the specified impact beneficiary group was poor women and men, this chapter also considers the profile of those benefitting from the interventions. In order to demonstrate impact of MAEC and GNAEC the Evaluation would have to find that poor male and female participants realized greater benefits in these dimensions of impact than comparable non-participants did. The reasons why these benefits did or did not occur for either group will be explored in Chapter 5.

### 4.1 Changes in Household Income and Consumption Expenditures

The first area of impact the Evaluation considered was HH income and expenditures. The survey data available for Mymensingh did not include data on HH income. As an alternative, data on consumption expenditures was used as a proxy for income, since data showed that the majority of the HHs had very limited or zero savings. The available data for Noakhali did allow the Evaluation to undertake an assessment of the impact of GNAEC on HH income.

#### *Mymensingh*

The survey data showed that there was a short-run decrease in the real value of HH consumption expenditures per capita for both participants and the comparison group. The percentage change for MAEC participants was -21% versus -10% for the comparison group. Figure 9 below provides elaboration.

**Figure 9 Short-run Changes in HH Consumption**

HH Consumption Expenditures in Taka Per Capita	Short-run	
	Participant	Comparison Group
1996 Round 1	1,206	1,200
1997 Round 4	954	1,077
Change 1996-97	-252	-123
Percentage Change	-21%	-10%

In the long-run analysis there was an increase in the real consumption expenditure value per capita for participants of 42% and the comparison group of 49%.

**Figure 10 Long-run Changes in HH Consumption**

HH Consumption Expenditures in Taka Per Capita	Long-run	
	Participant	Comparison Group
Long-run Baseline	1,139	1,010
2006/07	1,613	1,507
Change 1996/97-2006/07	475	497
Percentage Change	42%	49%

Data from FGDs with service providers in Mymensingh indicated substantial increases in HH income (50% to 200%) for those involved in a range of aquaculture support activities. There was no quantitative data available on the levels of income increases.

#### *Noakhali*

The average HH income of GNAEC participants increased in real value by 25% (2,875 Tk) per capita, from 11,698 Tk to 14,573 Tk. Data on HH income for non-participants was only available for 2006/07; the per capita average was 11,093 Tk. The data from FGDs in Noakhali indicated equal increases in HH income for GNAEC participants and non-participants.

Examining the effect of the introduction of combined freshwater prawn cultivation and carp polyculture, the survey data showed the largest average increases in HH income were with those HHs that were undertaking prawn cultivation prior to GNAEC and continued with it. The data are summarised in Figure 11.

**Figure 11 Species Change Versus Change in HH Income in Taka**

Species Change (HH Numbers)	Change in HH income
No Prawns to No Prawns (181)	2,534
No Prawns to Prawns (243)	3,179
Prawns to No Prawns (3)	-3,023
Prawns to Prawns (150)	4,616

Data from FGDs with service providers in Noakhali also showed similar substantial increases in HH income for those involved in a range of aquaculture support activities. There was no quantitative data available to calculate how much HH incomes had increased for this group.

### Average Treatment Effect of MAEC and GNAEC on HH Income and Consumption Expenditures

For Mymensingh, there was a statistically significant negative short-run treatment effect on consumption expenditures at the 5% level; average consumption per capita declined by 176-180 Tk. In the long-run analysis the range of change was from 20 to -397 Tk per capita, which was not statistically significant. The Evaluation was not able to determine the cause of the short-run negative effect on consumption expenditures. Both treatment and comparison groups experienced decreased real consumption expenditures. The reason for the decrease was therefore likely an environmental or seasonal factor that had a negative effect. It is possible that some aspect of MAEC participation caused this negative effect to be more pronounced for participants versus the comparison group.

The treatment results for Noakhali (when not allowing for differences in assets) show similar positive results as for the fish production values by using different matching estimators. The treatment effect on HH income is positive at the 1% level and ranges from 2,671 to 3,025 Tk per capita per year, depending on the matching estimator applied. The before-after estimate for the treatment group (2,807 Tk) is also within this range. However, when using controls for pond size and land ownership and different types of assets, the treatment results were generally not well-defined. In two of the three estimates, the treatment effect became insignificant (308 and 449 Tk respectively), while the third one is still positive at the 1% level (3,050 Tk). The treatment results for the introduction of prawn cultivation appeared to increase HH income; however, the results were not statistically significant at the 10% level.

## 4.2 Changes in Assets

The second area of impact that the Evaluation explored was assets, including land, animals, durable goods, and capital equipment (but not housing which was considered separately). The Evaluation was only able to carry out a treatment analysis of data on assets from the Mymensingh survey. The data sets for Noakhali did not contain sufficient information on assets for this purpose. As an alternative, assets were used as a control variable for the Noakhali sample.

### *Mymensingh*

Taking into account the value of all HH assets, MAEC participating HHs and HHs from the comparison group experienced similar trends in average real asset value development. These changes are shown in Figures 12 and 13.

In the short run, from early 1996 to late 1997, all groups experienced a decline in per capita assets. This decline mirrors the decline in consumption and was likely part of the same negative effect of the unknown environmental or seasonal factor. In this case the decline was slightly larger for the non-participants versus participants. In the long run, both the MAEC participants and the comparison group experienced increases in per capita assets; however, the increase for the comparison group was larger than that of the MAEC participants.



**Figure 12 Short-run Changes in Value of Assets**

Assets Value in Taka per Capita	Short-run	
	Participant	Comparison Group
1996 Round 1	8,858	6,607
1997 Round 4	7,472	5,307
Change 1996-97	-1,386	-1,300
Percentage Change	-16%	-20%

**Figure 13 Long-run Changes in Value of Assets**

Assets Value in Taka per Capita	Long-run	
	Participant	Comparison Group
Long-run Baseline	5,957	7,411
2006/07	11,851	17,474
Change 1996-2007	5,894	10,064
Percentage Change	99%	136%

MAEC participants in the FGDs confirmed the long-run increases in assets. In addition, the male participants associated some of the asset increases with additional income from aquaculture. Almost half of them stated that they used additional income from aquaculture to lease or buy additional land. For non-participants the FGD data was very similar. A majority stated that there had been significant increases in consumer and HH goods; in addition there had been increases in, and access to, water and sanitation infrastructure. Service providers also mentioned similar increases during the FGDs, including the leasing of additional ponds for nursing and purchase of livestock and consumer goods.

#### *Noakhali*

Overall the data for GNAEC participants showed a decline across all asset types; as shown in Figure 14 below.

**Figure 14 Change in Levels of Ownership of Assets**

Asset Type	% Owning Before	% Owning After
Rickshaw	7	6
Bicycle	39	28
Radio/TV	50	33
Diesel Engine	14	10
Sewing Machine	9	6
Number of Cattle	1	0.6
Number of Buffalo	0.06	0.02
Number of Sheep/Goats	0.8	0.4

The information provided from FGDs with GNAEC participants did not support these data. Many male GNAEC participants stated that they had increased their asset base of consumer and HH goods. A small minority stated that they had used some of the additional aquaculture income to purchase or lease land. The non-participant FGD data was very similar; most had increased their asset base and a minority had used aquaculture income to purchase or lease land.

This discrepancy between the GNAEC data and FGD information may be due to flooding in the Noakhali area, once in 2004/05 and twice in 2007. Consequently the survey may have captured the damage to HH from flooding, as the destroyed assets may have not been replaced. This would contrast with the more long-term perspective of the FGDs, which would track the evolution of assets over time.

The FGD data for service providers showed general increases in assets. This included purchases of land and leasing of additional ponds for nursing activities.

#### **Average Treatment Effect of MAEC on Assets**

Analysis of the short-run survey data for Mymensingh indicated a positive treatment effect on assets. The matching estimators showed increases in average real asset values ranging from 341 to 2,736 Tk per year per capita. However, none of these values were statistically significant at the 10% level. For the long-run analysis, the picture is reversed. The results were negative, ranging from -3,985 to -7,954 Tk per capita, for all estimators, however none of the results were statistical significant at the 10% level.

The survey data for Noakhali only permitted an analysis of changes in asset ownership for GNAEC participants and without indication of asset values, so the GNAEC treatment effects on assets could not be measured.

### 4.3 Changes in Housing

The Evaluation also examined impact in terms of the changes in housing for participants and non-participants. This analysis is based on FGD data only.

In Mymensingh FGD data from MAEC participants showed that the majority had improved their houses with proceeds from aquaculture. Service providers, such as nurseries, had also improved their houses. Improvements included installation of tin roofs to replace thatch, installation of cement floors to replace mud, and changing walls from tin to bricks. FGD data from non-participants showed that the majority had also improved their houses in similar ways but that only a minority had used the proceeds from aquaculture to do so. It appeared that for participants aquaculture could provide a substantial amount of cash at harvest time, and that this could be used for a “significant” investment such as improving a house or investing in land.

In Noakhali the FGD data showed no significant changes in housing for either GNAEC participants or non-participants. Only a minority of participants had improved their houses using aquaculture income and these tended to be in relatively poor areas where there were new settlements (Char lands). In these cases there was more improvement in housing using aquaculture proceeds for participants than for non-participants. In contrast the FGD data showed that service providers had used aquaculture proceeds to construct new houses.

### 4.4 Change in Other Living Standards

The Evaluation also considered impact in terms of other standards of living, specifically spending on education and clothing. This was based on FGD data and the changes were linked to aquaculture income. The conclusions were the same for both Mymensingh and Noakhali and for participants and non-participants and for service providers. All stated that they had increased spending on education for their children. In Noakhali there was an additional emphasis on secondary and tertiary education that was not found in Mymensingh. There was also a difference between male and female FG members in the two areas; male members (participants and non-participants) stated that they had increased spending on clothes for family members with aquaculture proceeds.

#### **Extra Source of Income**

Thanks to the extra income provided by aquaculture, Milen (38) with her husband and two sons, now own the land their house is built on. Milen and her husband also work in agriculture. Getting involved in aquaculture has enabled them to buy some land, send their youngest son to school, and buy more food and clothes.

## 4.5 Changes in Nutrition and Health

Impact on nutrition was also considered by the Evaluation. In Mymensingh there was a consensus across the various FGDs of MAEC participants that HH fish production had generally increased fish consumption and food security. FGD members also stated that the overall nutritional status of HHs had improved due to changes in their diet from fish, eggs, rice, and vegetables. Members stated that they were now able to feed their families three meals per day. For non-participants there was also a consistent increase in fish consumption, but it was not clear how much was from HH sources and they did not make as much reference to increased food security. Non-participants also reported increases in diet and nutritional status. They made more reference to an increase of meat in their diet than did participants.

The information on nutrition provided by the FGDs in Mymensingh was supported by nutrition data collected by IFPRI (Figure 15), which indicated increases between 13% and 35% in the daily calorie intake per capita from fish consumption. It is interesting to note that the increases took place for MAEC participating households (Household Type A and B) as well as for MAEC non-participating households (Household Type C1 and C2), including many non-pond owners. This supports the argument that the increase in aquaculture fish production has contributed to increased fish consumption, not only for MAEC participants and other households with pond access, but also for consumers in general through the trend of decreasing fish prices.

**Figure 15 Daily Calorie Intake Per Capita from Fish Only**

Household Type	A	B	C1	C2
Fish 1996/1997	44	45	34	31
Fish 2006/07	59	51	40	48

*Source: IFPRI (1998), Quisumbing (2007) and Evaluation calculations.*

For Noakhali the FGD data showed a consensus that fish consumption had risen dramatically for participants (by up to 70% in many groups) and that most was from HH sources. Food security was not mentioned specifically but female FGDs reported that vegetable consumption had also increased. Non-participants cited similar increases in the consumption of fish and vegetables; however, it was not possible to discern the extent that this was from HH sources. It is notable that poultry was frequently cited as a positive addition to the diet of participants in Noakhali but not in Mymensingh.

Finally, the Evaluation examined the impact on health. In Mymensingh the FGD for MAEC participants and non-participants show that there had been improvements in health for HHs. Night blindness, resulting from vitamin A deficiency, was reported as having decreased due to dietary improvements. Participant and non-participant FG members also stated that expenditures on health care had decreased due to improved nutrition. Female FG members in particular stated that this was due to improved access to health facilities. Male FG members stated that another factor contributing to improved health was improved sanitation infrastructure.

The FGD in Noakhali reported similar conclusions from both GNAEC participants and non-participants. Health conditions were widely stated as improving due to dietary improvements and better nutrition, better access to health facilities, and, for women, increased financial resources allowed better access to health care facilities.

#### 4.6 Profile of Beneficiaries

The impact was defined in MAEC and GNAEC documents as being intended for “poor” women and men, who either had a pond or access to a pond. In order to determine if the impacts described in the previous sections occurred with poor men and women as planned, the Evaluation examined the economic and social profile of the beneficiaries.

In Mymensingh three categories of primary beneficiary farmers were defined: Landless (0-0.2 ha), marginal (0.2-0.8 ha) and rich (more than 0.8 ha) farmers. Marginal farmers formed the largest group of participants (77%), followed by the landless (13%), and rich farmers (10%).

In Noakhali, two criteria were initially set for inclusion in the Fish Farmers Groups (FFGs): Land ownership less than 0.8 ha and annual HH income less than 35,000 Tk. However, the Evaluation learned from interviews with NGO staff that in practice three other criteria: pond access, land ownership, and HH creditworthiness (based on a judgement made by the NGO), were applied for inclusion in an FFG.

The Evaluation found clear evidence that the participating HHs from both Mymensingh and Noakhali were better off than the average at the time of entering the interventions. This was in direct contradiction to the aim of targeting primarily relatively poor HHs through the interventions.

With regards to Mymensingh a check of the robustness of the control variables used for the survey data analysis showed that participating HHs were larger, younger, owned more land, and had higher educational levels than non-participating HHs. In addition, it was found that average land area farmed by participants was between 0.7 and 0.8 ha, which was at the very high end when compared to the range (0.2-0.8 ha) for marginal farmers, the largest of the beneficiary groups. These findings are in line with the “MAEP Final Report (2004), which concluded that “MAEP reached ponds above average [size]”.

With regards to the Noakhali data, the robustness check revealed that participating HHs at the time that they entered FFGs appeared to be better educated, had accumulated more wealth on average, had a larger pond income share and pond size, and more land ownership than non-participating HHs.

It should be re-noted that in the last few years of GNAEC, since 2004, there was an explicit recognition of this fact, and a successful, concerted effort to include the poor, including the poorest of the poor, and poor female headed HHs.

### **Targeting the Poorest of the Poor**

The NGO Hasi works with CODEC and seeks to help female heads of households in fisher communities. The women live in isolated areas, are extremely poor, and marginalized. Hasi has given credit to the women to support their livelihoods of drying fish and making nets, baskets, and mats. Hasi also wants to educate these women about their rights and different services, such as health care, and how to access them.

## **4.7 Conclusions**

The Evaluation examined impact in terms of changes in HH income, consumption, assets, housing, spending on education and clothing, nutrition, and health. It also considered if the beneficiaries met the definition of poor women and men. There were differences in impact amongst these different dimensions and between Mymensingh and Noakhali.

### **Income and Consumption**

In Mymensingh the Evaluation was unable to conclude that there was a positive impact on HH consumption for participants versus comparable non-participants, in the short-run or long-run (there was no data on HH income). Consumption expenditure data showed a short-run decrease, -10% to -20%, for both participants and non-participants and the short-run MAEC treatment effect was significantly negative; ranging from -176 to -180 Tk per capita. However, this decrease was likely due to an unknown environmental or seasonal factor that effected participants and non-participants. The data does not lead to the conclusion that the participants would have been better or worse off if they had not participated in MAEC. The Evaluation was also unable to use the quantitative data to clearly demonstrate a positive impact on HH consumption for participants versus comparable non-participants in the long-run analysis. The survey data showed that both groups increased their HH consumption per capita; 42% for participants versus 49% for comparable non-participants. This finding was supported by the FGD data that showed income increased for participants and non-participants alike.

The Evaluation concluded that GNAEC did have a positive impact on HH income for participants, but was unable to conclude that there was a significant difference between participants and non-participants. HH income for GNAEC participants increased 25% which was corroborated by the FGD data. The average GNAEC treatment effect was positive and statistically significant only when not using assets as a control variable, ranging from 2,671 to 3,025 Tk per capita. The largest increases in HH income were for those participants that maintained prawn cultivation or switched into it.

### **Assets**

The Evaluation was unable to conclude that MAEC and GNAEC had a positive impact on the assets of participants versus comparable non-participants. The short-run asset data for Mymensingh showed a decline for both participants and non-participants of -16% to -20%. The long-run analysis showed that both groups increased the value of assets; participants by 99% versus 136% for non-participants. The Mymensingh FGD data supported the indications of overall long-run increases in assets for both groups. In Noakhali, the survey data showed a decrease in the level of ownership of all types of assets for GNAEC participants. However, the Noakhali FGD data showed increases in assets for both participants and non-participants.

**Housing**

The Evaluation was unable to conclude that MAEC and GNAEC had a positive impact on the quality of housing of participants versus non-participants. FGD data showed that the majority of participants in Mymensingh had used proceeds from aquaculture to improve the construction of their houses. However, non-participants had also improved their houses but they had generally not used aquaculture income. In Noakhali the majority of participants and non-participants had not improved their housing.

**Nutrition and Health**

The Evaluation was unable to conclude that MAEC and GNAEC had substantially different direct and indirect impacts for participants versus non-participants in the area of nutrition and health. MAEC and GNAEC participants had increased their intake of fish, thus improving diet, nutrition, and health. Rising incomes had also been used to purchase more nutritional food and for access to health care services, which led to improved HH health. However, non-participating HHs showed similar improvements in diet, nutrition, health, and access to health services.

**Impact on Poor Women and Men**

The Evaluation concluded that while MAEC and GNAEC did work with “poor” beneficiaries, substantial proportions of their beneficiaries were at the margins of what would be considered poor using their own definitions. Given that there was clear evidence that the participating HHs from both Mymensingh and Noakhali were better off than the average at the time of entering the interventions, and that in Mymensingh the average land holding size was just below what was considered rich, the above mentioned positive impacts cannot be said to be occurring mainly with poor women and men.

**Overall Conclusion**

For most of the dimensions of impact the Evaluation was unable to conclude that there was a substantially different change for participants versus non-participants. On a positive note there were long-term improvements in almost every dimension of socio-economic position and physical well-being. However, these changes appeared with both participants and comparable non-participants. In addition, the beneficiary profiles show that substantial proportions of the beneficiaries were at the margins of what could be considered poor. The ease of implementation, desire to work with pond owners, credit-worthiness, and perceived “better/larger” results, all served to bias the selection of those qualified to participate, away from the poor.

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## 5 Determinants of Change

Given that the Evaluation was unable to conclude that there were substantially different changes for participants versus non-participants at the impact level, a thorough examination was warranted of why both groups would have experienced such positive improvements.

### 5.1 Intermediate Outcomes and Linkages to Impact

The first focus of the examination was on the expected causal factors from the logic model at the intermediate outcome level. The results chain from Figure 5 shows that the impact was expected from two intermediate outcome areas:

1. Increased aquaculture production across the three intervention areas. Increased production should lead to increased income from aquaculture and consequently improved socio-economic position of participating HHs.
2. Increased aquaculture sub-sector economic activity and employment. Increased economic activity and employment should also lead to increased HH income and improved socio-economic position of participating HHs.

The Evaluation examined these two areas to establish if results were achieved and the nature of the link between any results and the expected/actual impact on participants.

#### Changes in the Value of Fish Production

Data collected prior to the Evaluation showed substantial increases in the quantity of fish production in Mymensingh influenced by the intervention. The 2004 MAEP Impact Study conducted by Winrock stated that the average yield from aquaculture for farmers with HH incomes of less than 40,000 Tk/year had risen from 1 metric ton/ha to 13.5 metric tons/ha. The FFG Impact Study for GNAEC also showed increases in quantity of fish production. However, in order to better understand the linkage between fish production and improved socio-economic position, the Evaluation examined the value of fish production, to factor in changes in prices.

Based on the available data sets for Mymensingh and Noakhali, the Evaluation carried out an assessment of the effect of MAEC and GNAEC on the value of HH fish production. Data on HH fish production values from Mymensingh and Noakhali are presented below, followed by the results of the survey data analysis of the MAEC and GNAEC treatment effect on fish production.

#### *Mymensingh*

The IFPRI survey data set for Mymensingh allowed the Evaluation to carry out both a short-run and long-run analysis of the effect from MAEC on the value of HH fish production. The data for the short and long-run analyses are shown in Figures 16 and 17 respectively. The short-run value is for carp cultivation only. The 2006/07 long-run value could include prawn as some producers may have shifted to a combined approach. Data was not available on the species cultivated in 2007.



**Figure 16 Short-run Fish Production Values**

Fish Production Value in Taka per Capita	Short-run	
	Participant	Comparison Group
1996 Round 1	1,648	1,467
1997 Round 4	4,137	1,407
Change 1996/97	2,489	-60
Percentage Change	151%	-4%

**Figure 17 Long-run Fish Production Values**

Fish Production Value in Taka per Capita	Long-run	
	Participant	Comparison Group
Long-run Baseline	1,437	1,109
2006/07	2,149	2,050
Change 1996/97-2006/07	712	940
Percentage Change	50%	85%

Figure 16 shows a huge short-run increase in the real average value of fish production (value of home consumption plus value of sales) for MAEC participating HHs. The long-run changes, Figure 17, in the value of fish production per capita from 1996/97 to 2006/07 (measured with a different treatment and comparison group than in the short-run analysis) were also impressive. The FGD data from Mymensingh also indicated substantial increases in the value of fish production, with larger increases for participants versus non-participants. However, quantitative data was available from too few FGD members to permit its use.

#### *Noakhali*

The data from Noakhali, see Figure 18, showed substantial increases in the real average value of fish production per capita for GNAEC participants. Between the time when the participants entered GNAEC (between 2000 and 2004) and 2006/07, the average annual value of fish production rose by 77%, from 1,351 to 2,393 Tk per capita. The survey data does not include baseline information on non-participants.

**Figure 18 Fish Production Change for Noakhali**

Fish Production Value in Taka Per Capita	Noakhali	
	Participant	Non-Participant
Baseline (recall questions, 2000-04)	1,351	N/A
2006/07	2,393	215
Change	1,112	N/A
Percentage Change	77%	N/A

In Noakhali the Evaluation also considered the degree to which the introduction of prawn cultivation changed the per capita value of fish production. The results are shown in Figure 19 below. The group of HHs that engaged in freshwater prawn cultivation and carp polyculture prior to participation in GNAEC, and were still continuing to do so in 2007, had the largest change. Those who switched to prawns after the project began realised a slightly larger average increase in fish production value than those who did not switch to prawn cultivation at all.

**Figure 19 Species Change Versus Change in Value of Fish Production**

Species Change (HH Numbers)	Change in Value of Fish Production in Taka
No Prawns to No Prawns (181)	1,199
No Prawns to Prawns (243)	1,297
Prawns to No Prawns (3)	-173
Prawns to Prawns (150)	1,543

The FGD data from Noakhali indicated a similar picture to Mymensingh, with both GNAEC participants and non-participants increasing the value of their fish production considerably; participants more than non-participants.

*Average Treatment Effect of MAEC and GNAEC on the Value of Fish Production*

The estimation of average treatment effects from the Mymensingh survey data showed that MAEC had a statistically significant impact on the value of fish production in Mymensingh in the short-run analysis. The short-run analyses showed statistically significant increases at the 10% level with the value of fish production increasing between 944 Tk and 3,858 Tk per capita. In the long-run analysis the MAEC treatment effects on the value of fish production were negative but insignificant, ranging between -119 Tk and -576 Tk per capita per year.

The survey data from Noakhali showed an even more positive impact of on the value of fish production. The estimated average treatment effects were positive and statistically significant at the 1% level. The estimated average effect from participation in GNAEC was an increase in the value of HH fish production of between 787 Tk and 1,982 Tk per capita per year. The increase in value for those who shifted to prawn cultivation during GNAEC, compared to those who did not, was not statistically significant at the 10% level.

### **Changes in Employment**

The second intermediate outcome considered by the Evaluation was the effect of the interventions on employment in the sub-sector and “spin-offs” from aquaculture activity. The expected result was that employment would increase for HHs involved in aquaculture, but also for other support activities – harvesting, nursing, net making, etc. The Evaluation examined employment in both these areas.

#### *Employment at the Household Level*

The data from the FGDs showed that some types of employment had increased at the HH level although there was no quantitative data available. In Mymensingh MAEC participants stated that aquaculture-related work had increased within the HH. They stated that external labour was hired for pond preparation and harvesting. Female non-participant FGD members also stated that while work had increased, most of it was done within the family. The FGD data from Noakhali were very similar. Most participants stated that they hired outside labour for pond preparation and harvesting on a seasonal basis. Service provider FGDs supported these findings.

#### *Employment among Service Providers*

The relative emphasis on support network for aquaculture, leading to employment for service providers, differed greatly between MAEC and GNAEC. Approximately 20% of MAEC beneficiaries were service providers in such areas as fish seed traders, harvesters, and net makers. In comparison, only 2% of GNAEC beneficiaries were service providers. Consequently the influence of MAEC on employment in the sub-sector would be expected to be much greater. However, no quantitative data was available for either Mymensingh or Noakhali on the changes in employment opportunities or the spin-off effects of aquaculture promotion.

Service provider FGDs in Mymensingh and Noakhali stated that there was additional employment in the sector, specifically in the supply chain of fingerlings and feed. Male participant and non-participant FGD members supported these findings.

The number of hatcheries has also been increasing steadily since the initiation of the aquaculture interventions. There are now more than 100 tilapia hatcheries in Bangladesh compared to 52 in 1995. The number of freshwater prawn hatcheries had also increased significantly in a short time. In 2007 there were 61 private freshwater prawn hatcheries in Bangladesh; three supported by GNAEC. These hatcheries are generating employment locally, adding to the sub-sector employment generated for service providers.

### **Aquaculture and Overall Household Income**

In order to establish the linkage between increased value of fish production linked to the interventions and improvements in the various dimensions of impact, the Evaluation considered the importance of aquaculture in the overall HH context.

The survey data for Mymensingh did not show how HH income sources have changed over time, either for participants or the comparison group. IFPRI (1998) estimated that income from aquaculture production in Mymensingh in 1997 accounted for no more than 10% of total HH income. The Winrock 2004 MAEC Impact study stated that aquaculture constituted an average of 13% of the target population's annual income. FGD data showed that aquaculture was a relatively minor source of income for most HHs in 2007.

The Noakhali data included specific information on both income sources and occupation and demonstrated that there were differences in the income sources for participants versus the comparison group. In 2006, fishing and/or aquaculture was the main occupation of 19% of participants, but for only 3% of the comparison group. The other occupational differences between participants and the comparison group were agriculture (45% versus 29%) and provision of services such as day labouring (22% versus 49%). For participants the proportion of HH income derived from aquaculture increased from 14% (Baseline) to 21% in 2007. This was offset by a decrease from 32% to 23% in the income derived from agriculture over the same time period.

### **Support of Other Livelihood Activities**

Another employment-related effect that the Evaluation considered was the support that income from aquaculture provided to other types of livelihood activity.

In Mymensingh the majority of MAEC FGD participants stated that they had used the proceeds from aquaculture to invest in other productive livelihoods: buying or leasing land for agriculture, purchasing livestock, and increasing, through purchase or lease, the number and size of ponds for aquaculture. The MAEC-assisted nurseries also stated that they had expanded their nursery operations with their income. A majority of non-participants stated that the financial proceeds from aquaculture were too small to reinvest. However, a minority were able to use the proceeds to support other livelihoods.

In Noakhali there were differences between the GNAEC participants and non-participants and also between male and female GNAEC participants. For male participants the data were very similar to Mymensingh, with the majority using proceeds for land, livestock, and increased aquaculture activities. In contrast, female participants reported fewer opportunities to invest the proceeds from aquaculture in other livelihoods. This may have been due to their relative limited involvement in financial aspects of aquaculture production. For non-GNAEC participants the majority were only able to use financial proceeds to cover certain daily expenses, not for investment in other livelihoods.

### **Aquaculture Income and Health**

A number of causal factors have influenced the observed positive changes in health and nutrition. Aquaculture has played a role in improving diet by increasing the consumption of fish. The increase of income from aquaculture has also enabled participating HHs to improve their diet and nutrition through increased agricultural production. Increased income from aquaculture is used by participants to purchase more nutritional food. These improvements in nutrition have led to positive health outcomes such as less vitamin A deficiency and overall improvements in HH health. These positive outcomes can be linked to a decrease in expenditures on health in the context of increasing HH income for participants.

**Sustenance**

Satter Mandali's success in aquaculture was recently rewarded with the "best fish farmer in the area" prize. Satter's income is based on fish farming, rice, livestock, and selling dry straw. He says that before joining the MAEP he couldn't always afford three meals a day but now his family has always eats at least fish. Satter has also become an advisor to others on fish farming.

**Analysis of Intermediate Outcomes and Linkages to Impact**

The two intermediate outcome areas have important linkages to impact. In terms of the value of fish production the analysis shows a statistically significant treatment effect from both interventions. The estimated average effect from participation in MAEC was an increase in the value of HH fish production of between 944 and 3,858 Tk per capita and for GNAEC between 787 Tk and 1,982 Tk. Therefore, participating in the interventions did make a substantial difference in the financial return from aquaculture.

The linkage of this outcome to the impact is determined in part by the contribution of aquaculture to HH income. Aquaculture became the main source of HH income for some GNAEC participants (19%) but for fewer non-participants (3%). For GNAEC participants the proportion of HH income from aquaculture increased on average from 14% to 21% of total HH income. However, for the majority of FGD members in Myensingh (both MAEC participants and non-participants) aquaculture was a relatively smaller contributor to overall HH income. Agricultural production, rearing of livestock, and service sector employment were often larger sources of income than aquaculture. Even with the dramatic increases in the value of HH fish production, overall HH income would not be expected to increase to the same extent.

The FGDs also showed that participating HHs were able to use proceeds from aquaculture to invest in other productive livelihood practices, much more so than participants. The difference between the two appeared to be that participants were able to get more cash income from aquaculture and the harvest cash flow was suitable for making major investments.

In terms of nutrition and health the Evaluation found that MAEC and GNAEC participants had increased their intake of fish, thus improving diet, nutrition, and health. In addition income from aquaculture had also been used to purchase more nutritional food and for access to health care services, which led to improved HH health.

While the Evaluation found that increased aquaculture production had in turn increased employment opportunities, especially with respect to service providers, that lack of quantitative data prevented any causal analysis of employment outcomes to impact.

Regardless, the Evaluation concluded that the increase in the value of fish production from aquaculture, and to some extent the increase in employment for service providers, resulted in an improvement in the socio-economic position and physical well-being of participants.

## 5.2 The Influence of Replication and External Factors

To determine why comparable non-participants also experienced similar positive changes at the impact level the Evaluation considered two additional issues:

1. Replication/Contamination – Did the protocols and techniques promoted by the interventions spread beyond the direct beneficiary group, causing the same results chain to occur for non-participants?
2. External Factors – Were there external factors that positively influenced non-participants in such a way as to improve their socio-economic position and physical well-being, in a comparable manner to participants?

### Replication

The Evaluation was requested to determine if there was any evidence of positive or negative impact on non-intervention areas. Given the extensive geographical coverage of MAEC and GNAEC, the Evaluation considered that non-intervention areas included non-participating HHs in MAEC/GNAEC Unions.

#### *Mymensingh*

The Evaluation found that there had been some farmer-to-farmer transmission of knowledge and information concerning improved aquaculture practices. In the FGDs from Mymensingh the majority of MAEC participants stated that there was no transmission to non-participants. However, in one male and one female FGD, MAEC participants stated that neighbours and other non-participants in the village visited them to observe their practices, took their advice on improving aquaculture, and sought out credit and training because they saw the increases in productivity. The nursers trained by MAEC all stated that they regularly provided advice when they sold fingerlings to non-MAEC farmers.

Non-MAEC participants for the most part stated that they had not heard of MAEC and had not received advice from MAEC-participants. Most received advice from family members and neighbours. Only a few FGD members stated that they received advice from DoF or from MAEC participants.

#### *Noakhali*

In Noakhali the Evaluation found that there were increased levels of farmer-to-farmer transmission. Almost half of the male GNAEC FGD members stated that they had provided advice on pond preparation, feeding, and disease control to interested non-participant farmers. A minority of the female GNAEC FGD members also stated that they had provided advice to non-participants. GNAEC trained nursers were also cited as transmitting knowledge and improved aquaculture practices to non-participants.

A minority of non-GNAEC participants stated that they had obtained information from GNAEC trained farmers. Others stated that they received information on improved aquaculture practices from relatives, neighbours, the hatcheries, fingerling sellers, and people at the market.

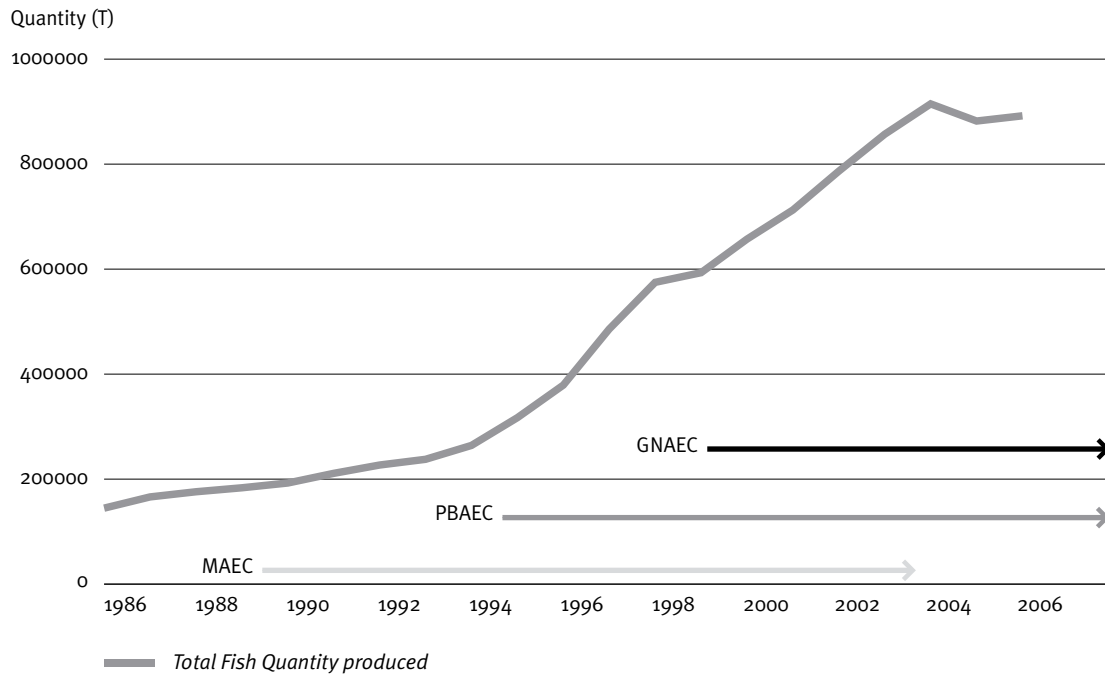
Noakhali and other areas of Bangladesh also benefited from the capacities that had been developed with DoF officers through MAEC. There were many instances of individuals who had gained experience from MAEC and were then shifted to Noakhali, where they continued to promote MAEC technologies and approaches. This also occurred from GNAEC to other areas of Bangladesh in the latter years of the intervention.

**Hope for Aquaculture**

Salma from Char Clark has not yet been involved in aquaculture but she and her brothers have been inspired by their neighbours and their success to join a training program. Salma hopes that aquaculture and hard work will result in positive changes in their lives.

As Figure 20 shows, the timelines of the interventions are clearly linked to the massive increases in aquaculture production. Danida worked directly with around 200,000 HHs through MAEC and GNAEC from 1989 to 2006. The ADB 2005 study estimated that there were more than 900,000 HHs across Bangladesh undertaking aquaculture. The Winrock 2004 MAEC Impact study estimated that there were 1.4 million HHs adopting carp polyculture in the seven districts of Greater Mymensingh. It credits farmer-to-farmer transmission and the role of input suppliers – hatcheries, nurseries, and fry traders. Regardless of which numbers are correct, there has clearly been a substantial expansion of involvement and Danida has played a significant role in this.

**Figure 20 Aquaculture Production Quantities Linked with Intervention Timelines**

**External Determinants of Change**

A possible explanation for the similar positive changes at the impact level for non-participants, with respect to HH income, consumption expenditures, and assets is the historical process of economic development in these two areas. In the comparison group there were increases in HH income that were not due to aquaculture or from the proceeds of aquaculture. In addition there were many other external factors that lead to improved health.

Over the implementation periods of MAEC and GNAEC there have been important improvements in infrastructure, communication systems and networks, and intensification

of agriculture. Perhaps more importantly, there have been substantial government and non-governmental programs, providing rural development inputs, especially credit and training. These positive external factors would have improved economic development and livelihoods at a general level, leading to improvements in income consumption, and assets, for participating and non-participating HHs alike. Overall in Bangladesh, in the period from 1990-2004/05, the poverty head count ratio decreased from 59% to 41% (BBS, 2006). IFPRI (2007) estimates a poverty decline in Mymensingh from 70 to 18% during 1996/97-2006/07.

The Evaluation found that both GoB and NGOs were active in Mymensingh and Noakhali, providing a vast array of social and economic development products and services to men and women. Both participants and non-participants stated that they received services from external parties (other than MAEC and GNAEC). In Mymensingh around 50% of the HHs in the sample received assistance from other NGO projects during the 10 year time period (58% of participants and 42% of non-participants). In Noakhali these figures were lower, with 26% and 14% respectively receiving other NGO assistance.

### 5.3 Conclusions

The positive effects of the interventions on the value of fish production, and to some extent employment within the sub-sector (especially service providers), lead to the observed impacts for participants of increases in HH income (Noakhali), housing (Mymensingh), nutrition and health (both areas), and to some extent assets (both areas). However, given the average proportion of HH income derived from aquaculture, this would not have been the only cause of the observed impact for participants.

The Evaluation also concludes that there are two probable causes for the similar positive changes in socio-economic position and physical well-being of non-participants. Firstly, it is evident that MAEC and GNAEC “contaminated” the Greater Mymensingh and Noakhali Regions through their extensive coverage, their influence on government programs, outreach, and services, and on the programs of NGOs. MAEC and GNAEC also catalysed systemic changes in the Mymensingh and Noakhali regions that brought many non-participants into aquaculture production. Secondly, economic development in Bangladesh, and the two regions in question, has benefitted participants and non-participants alike.

In terms of causal factors it appears that MAEC and GNAEC had more of an effect on the value of fish production and therefore HH income, consumption, and assets, of non-participants involved in aquaculture, than general development. However, economic and social developments, unrelated to MAEC and GNAEC – sanitation infrastructure, health facilities, and awareness of health – have all improved HH health of non-participants.

The impacts for non-participants via contamination or replication started with a substantial intervention effect on the value of fish production for non-participants. This is demonstrated through a comparison of the Mymensingh short- and long-run data. The survey results show significant differences in increased fish production values between participants and non-participants over a two year period, however, non-participants are seen to be “catching-up” over the longer-term. This is clear evidence that non-participants changed something in the way that they practiced aquaculture that lead to dramatically increased production.



The simplicity of the aquaculture protocols and techniques promoted by the interventions, and the very visible short-term “payoff” for adopters, increases the likelihood that while the comparison groups did not participate directly in the interventions, they somehow picked up the basic methodologies and protocols. This seems to be the case even though it was hard to detect at the HH level, especially in Mymensingh. However, it should be kept in mind that MAEC ended several years before the Evaluation took place.

## 6 Women's Empowerment

A cross-cutting series of results implied in the logic model dealt with the empowerment of women. The Evaluation findings on the changes in women's roles decision-making, mobility and credit control are each presented separately, together with a discussion of determining factors.

### 6.1 Changes in Household Decision-Making

There was no survey data available on the involvement of women in HH decision making from Mymensingh.

The matching of survey data from Noakhali shows that, with regards to HH decision-making, GNAEC has had a significant effect on the decision-making roles of women for participants versus comparable non-participants. The treatment analysis was statistical significant at the 1% level. Figure 21 below presents average index values for the involvement of women in decision-making activities. Any involvement in other NGOs is included as a control.

**Figure 21 Proportions of Respondents with Female Participation in Decision-Making**

Type of Decision	Participants % "Yes"		Non-Participants % "Yes"	
Type of Mobility	GNAEC	GNAEC + other NGO	NGO	No NGO
The Production Decision Process	78	75	36	35
Decisions of Medical Care of Family Members	96	96	94	90
The schooling of Children	89	96	65	71
Number of Observations	107	248	91	574

On average, there is little difference in the involvement in medical decision-making between participants and non-participants. However, there are large differences between GNAEC participants and non-participants in terms of decision-making regarding production processes and also some difference in schooling decisions. This indicates that GNAEC overall had a much stronger impact on the empowerment of women in decision-making than other NGO and credit programmes implemented in the same period. Selection bias due to self-selection is not a factor, since women who were already relatively empowered would have been enabled to participate in GNAEC or other NGO programs, presumably on an equal basis.

Information from the FGDs confirms the perception of currently higher level of women's involvement in HH decision-making processes for participants than for non-participants. In particular, with regards to health and education matters, women were reported to be much more involved. For Mymensingh this impression was stronger than for Noakhali, with men's perception higher than women.

The FGDs also revealed that, in the majority of cases, women's roles seemed to be limited to input and consultation in the decision-making process and that final decisions were generally taken by men. Women's decision-making authority appeared to be confined to purchasing food and some HH items. In general, women seem to have very limited or no control over finances. Some women managed to save a small amount of "secret" money from selling eggs, which they then typically spent on their children (buying clothes, education, food etc.). MAEC participants reported more involvement of women in financial decision-making processes than GNAEC participants. In both areas the participants reported more involvement of women than did non-participants.

#### **New Freedom**

Atula and her sister got involved in aquaculture through a loan that an MAEC NGO was offering to women. Atula and her sister share two ponds. Atula also grows vegetables and has cattle. Although Atula seems a bit uneasy about the "new freedom" in her life, aquaculture has improved their family income. They have been able to lease more agricultural land and have a house.

## **6.2 Changes in the Mobility of Women**

Spatial mobility is an important factor in women's social, economic, and political empowerment. Several studies have revealed that promotion of women's freedom of movement is necessary to make them capable of making their own choices, to change their attitudes, to improve their social networks, and reduce their level of poverty. Mobility and freedom of movement are commonly used dimensions and indicators of empowerment. Research on traditional societies, especially in South Asia, uses mobility as an indicator or as an important factor when it comes to women's education, access to services, early marriage, and migration. The Canadian International Development Agency's Guide to Gender-Sensitive Indicators (August 1997) uses "the mobility of women within and outside their residential locality, as compared to men" as an indicator of social empowerment, and Demographic and Health Survey questionnaires have "freedom of movement" as an indicator in the Women's Status and Empowerment module.

The Mymensingh survey data, based on a comparison of 1997 information with the same respondents' answers to recall questions, does not show a statistically significant MAEC treatment effect in any of the analyses. The most significant difference between female participants and non-participants was with regard to permission to participate in NGO training outside the house. However, this may have been because women participating in MAEC were in most cases required to leave the house to participate in MAEC training activities.

The analysis of the average treatment effect of GNAEC on the mobility of female participants is shown in Figure 22. GNAEC had a statistically significant positive impact; an increase of 1.5 to 1.9 on a 7-point scale measuring freedom of movement. A significantly larger proportion of women participating in GNAEC had permission to go both to the local market/bazaar and somewhat larger proportion to the health centre/hospital. The most significant difference between participants and non-participants was participation in NGO training.

**Figure 22 Proportions of Respondents with Female Mobility**

Type of Decision	Participants % "Yes"		Non-Participants % "Yes"	
Type of Mobility	GNAEC	GNAEC + other NGO	NGO	No NGO
Allowed to go to NGO Training	63	70	7	4
Allowed to go to local Market/Bazaar	57	63	49	47
Allowed to go to Health Centre/Hospital	79	87	78	69
Number of Observations	107	248	91	574

Increased mobility of women was reported by the majority of FGDs in both Mymensingh and Noakhali. There was a tendency for non-participating women's groups to report less mobility than participating groups, although mobility was still increased compared to before their participation. Permission for the women to leave the house seem to be required in most cases, but more for non-participating than for participating women. Increased mobility for women included visits to NGO offices, banks, health centres/clinics, schools, and markets. Again, selection bias due to self-selection was not a factor, since women who were already relatively empowered would have been equally enabled to participate in GNAEC or other NGO programs.

#### **Empowerment**

Mafia's family has been in fish farming for 20 years. Knowledge acquired through Danida's training has helped turn their traditional activity into a commercial one. Mafia has also trained her husband, who is in agriculture. They plan to shift to aquaculture only. Aquaculture has provided them with food and fast cash when needed. Mafia participated in the last election of the Union authorities. She is free to visit her son in Dhaka or to go to traditional festivals for shopping.

### 6.3 Changes in Women's Control over Credit

The use of credit was driven by gender roles in both Mymensingh and Noakhali. There was no survey data from Mymensingh on changes in women's control over credit.

The treatment analysis of the Noakhali survey data showed a significant difference between GNAEC participants and non-participants with regards to the involvement of women in credit decisions. However, this result is biased by the fact that participating women were granted credit as part of their participation in GNAEC.

**Figure 23 Proportions of Respondents with Female Participation in Credit Decisions**

Type of Decision	Participants % "Yes"		Non-Participants % "Yes"	
Type of Mobility	GNAEC	GNAEC + other NGO	NGO	No NGO
Females involved in the Credit Decisions	87	95	36	32
Number of Observations	107	248	91	574

Participant FGDs in both Mymensingh and Noakhali reported limited involvement of women in credit decision-making. Many FGDs reported that women obtained loans through their participation in GNAEC but that afterwards men controlled the loans. Most women who received credit did not use it themselves, unless they were heads of HH.

Only a minority of non-participant FGD members in Mymensingh and Noakhali received credit for aquaculture, although many received credit from NGOs for other productive activities such as poultry or cattle raising. There were low levels of women's involvement in either aquaculture or non-aquaculture credit related decisions.

### 6.4 Participation of Women in Aquaculture

The findings presented in this section are based on qualitative information obtained from the FGDs as well as from case studies and site observations. It has not been possible for the Evaluation to carry out a treatment analysis on changes in women's role within aquaculture since survey data for non-participating HHs on this subject were not available.

Overall, MAEC and GNAEC participants see the role of women in HH aquaculture production as limited and mainly as support to their husbands. Their main involvement is to feed the fish. Men, when they are present, are responsible for and undertake, the majority of the tasks related to HH aquaculture production. The exceptions were HHs that were female headed or where the male head of the HH was absent frequently or for an extended period. Approximately 10% of Bangladeshi HHs are female headed, no data exists on beneficiary HHs that are female headed.

### **Survival**

Rekha was widowed when young and brought up her children alone. Despite many difficulties she has managed to feed them and put them through school. In 2003 she joined a group of women who were trained in aquaculture. Rekha now practices aquaculture commercially and has been able to pay off her loans with the profits. She is also involved in other income generating activities and is finally happy with her life.

Some of the women participating in MAEC and GNAEC reported that they occasionally undertook other aquaculture activities, such as pond preparation and maintenance, composting of fertilizer, and preparation of fish food, in addition to feeding the fish. In Noakhali, women emphasised the importance of their ability to do the whole spectrum of aquaculture activities and replace their husbands when they were absent.

It was recognized by HHs participating in MAEC and GNAEC that women possessed stronger and broader potential to support their husbands in aquaculture activities than they did before the interventions. This message came more clearly from the female groups than from the males. There was no clear difference in the information provided on changes in women's role between MAEC and GNAEC participants.

No major changes with regards to women's actual or potential roles in aquaculture were reported by those HHs that had not participated in MAEC or GNAEC. In Mymensingh and Noakhali, both male and female non-participants reported that women's role in aquaculture was at most to feed the fish, while many women had no role in aquaculture.

### **6.5 Other Changes in the Empowerment of Women**

The FGDs reported that domestic violence, although still an issue in many HHs, had decreased notably. Women saw this tendency to reduced violence within the HH as a direct result of economic development.

### **6.6 Determinants of Change**

The Evaluation's examination of gender equality results requires consideration of the two causal factors that have led to the observed changes:

1. Participation of women in MAEC and GNAEC and integration of gender equality into programming.
2. Broader regional and societal changes in Bangladesh influencing changes at the HH or community level.

#### *Women's Participation in MAEC and GNAEC*

Women participated in the interventions as beneficiaries but also as staff.

*Women's Participation as Beneficiaries*

In both Mymensingh and Noakhali the initial targets set for the participation of women as beneficiaries were exceeded. For the implementation of MAEC, it was emphasized that 30% of the beneficiaries should be women. In practice 45% of the primary beneficiaries in Mymensingh were women. In Noakhali, the NGOs were expected to achieve an equal balance between men and women in the training. In total 52% of the beneficiaries in Noakhali were women.

As mentioned in Chapter 3, an important difference between the design of MAEC and GNAEC was in the farmer approach. While MAEC used an individual approach, GNAEC made use of a HH approach, inviting both the men and women from participating HHs for training. When comparing these two different approaches, it should be noted that they were implemented within two different settings. It cannot therefore be concluded that what worked in one area would also work in the other. Given the different settings, it has not been possible to determine from the data and information obtained whether one of the approaches was better than the other. Also, the differences in approach might have been less apparent in practice than in theory. For example, ex-Extension Trainers (ETs) and ex-advisors in Mymensingh reported that when women participated in demonstration sessions their husbands often observed from a distance.

However, it should be noted that most of the female beneficiaries were unable to utilise anything more than the elements of training as they pertained to feeding, due to the constraints of gender roles.

*Women's Participation as Staff*

The need for gender balance among the ETs was emphasised in both Mymensingh and Noakhali in order to facilitate contact with the female farmers. The target was that 30% of the ETs should be female. This female staff target was reached in Mymensingh and exceeded in Noakhali, where 35% of the ETs employed by the contracted NGOs were women.

The selection of female ETs appears to have been an important vehicle for attracting the large number of women participants to the training sessions; thereby contributing to their empowerment. In the FGDs with female participants this aspect was strongly emphasized. Ex-Advisors and ex-ETs from Mymensingh reported that female ETs became role models within their communities. At the start of the interventions they faced many barriers and challenges due to discrimination. However, gradually they won more respect and gained higher status within their communities.

**Changes in Norms and Gender Equality in Bangladesh**

There have been far-reaching changes in gender norms in Bangladesh over the past two decades that have pervaded both outcomes and attitudes. (WB, 2008) Girls' secondary school enrolment now exceeds that of boys. The gender gap in primary and secondary level education has also been eliminated (MDG 3). Progress towards gender parity in tertiary education is also improving (UNDP, 2007) and the gender gap in infant mortality has been closed. The micro-credit revolution continues to boost women's solidarity groups and earning potential, and vast numbers of young women are leaving their villages to work in garment factories. In earlier generations young women were rarely seen outside their homes. These changes are a result of constructive policies and programs that spurred much of the progress in gender equality. (WB, 2008)

Despite impressive gains in women's status and gender equality, women still face barriers in access to reproductive health services, participation in labour markets, physical security and equal roles in decision-making (WB, 2008, WB, 2007, Hausman et al., 2007, Hossain, 2004, Kabeer, 2003). The social status of rural women in particular remains very low (Parveen and Leonhauser, 2004, Parveen, 2007). Problems of quality and pockets of exclusion persist in the education system (Hossain, 2004). Despite increasing education and declining fertility, women's labour force participation rates are very low although they have doubled in the last 10 years (4% of women of prime working age work for a cash wage in Bangladesh (WB, 2008). Women are concentrated in domestic services and home-based work which tend to be socially and statistically invisible. Women are also less likely to be self-employed in non-farm activities, women's participation in rural non-agricultural work has declined, and unpaid work seems to have increased. Also women's role in decision-making is still small and restricted to the domestic sphere. In terms of physical security, according to a recent WB study less than half of the women surveyed felt safe going out alone in their village or neighbourhood at all times (WB, 2008).

### **Analysis of Determinants**

Although men appeared to be in control of both pond activities and financial decisions within the HHs, analysis of the data shows that MAEC and GNAEC have led to increased intra-HH interaction and mobility among those women who participated in the interventions compared to the group of non-participating women. The main impact of participation in MAEC and GNAEC on women's empowerment seemed to result from an increase in consciousness and self-confidence, rather than from the application of technical skills and knowledge gained from training, or from increased credit control within the HH. Most of the FGDs with MAEC and GNAEC female participants reported that participation in MAEC and GNAEC activities had increased women's self-confidence. The women themselves viewed this as an important change.

One important point to take into consideration when comparing the survey data on women's mobility is the time dimension. While the Mymensingh data was collected in 1997 the Noakhali data was collected during 2006/07, ten years later. During this ten year span many external factors have influenced the position of women in Bangladesh.

With respect to the determinants of the changes in empowerment, especially mobility, FGD members also stated that there were a number of external factors that had contributed, beyond MAEC and GNAEC. These included the absence of their husbands due to working abroad, changes in society due to education and awareness, media campaigns, activities of other NGOs, urbanization, and increased personal security. In addition, there were important differences between women depending on class, religion, age, and marital status. Women heading HHs for example, had very different experiences and freedom as compared to young, newly married women.

## **6.7 Conclusions**

MAEC and GNAEC had substantial impacts on women's empowerment for participants as compared to non-participants. These results were due mostly to intervention related increases in consciousness and self-confidence and practical changes from participation, such as attending meetings and receiving credit. The Evaluation concluded that these changes were not due to the actual application of technical training, as despite equal par-



ticipation levels as beneficiaries, the Evaluation found that restrictive gender roles prevented most of the women from using their training.

The Evaluation also concluded that increasing the empowerment of women is a long-term process. It may start with training/education of women together with some specific kind of economic empowerment, like access to credit. However, real changes in intra-HH power and responsibilities cannot be expected to take place in the short term. This experience shows that gradual increases in the mobility of women and their involvement in decision-making processes are necessary first steps in this process.

All of these changes have taken place in the context of a general societal change that for the most part is more supportive of an increased role for women in the HH and the community (although there are large variations depending on location and social context). While these changes have supported the intervention impacts on empowerment, there is no reason to believe that they would not have been equally supportive to other women, not involved in the interventions. Due to the fact that women participating in other NGOs (but not GNAEC) had largely the same (lack of) empowerment results as women who did not participate in any NGO programs, it is possible to conclude that the interventions were a much more important causal factor.

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## 7 Design and Delivery

The Evaluation was tasked to consider several issues relating to the design and delivery of MAEC and GNAEC. These included:

- What were the strengths and weaknesses of the training?
- Were the aquaculture protocols and methodologies appropriate for the context?
- Were they followed?
- What were the consequences of not following them?
- Were the hatchery and fry components of MAEC and GNAEC well managed?

### 7.1 Training

MAEC and GNAEC undertook substantial amounts of training. As discussed in Section 3.2 MAEC trained 107,500 beneficiaries (59,500 men and 48,000) women and GNAEC trained 46,850 HHs and an additional 2,000 service providers.

#### Aquaculture Methodologies and Protocols

MAEC and GNAEC used training to promote simple and appropriate protocols for carp polyculture and, in the case of Noakhali, both carp and prawn polyculture and integrated gher farming. The carp polyculture comprised five essential components:

- Pond Preparation – Dyke raising, bed preparation, liming, fertilizing, and weeding.
- Stocking – Feeding layers and stocking density.
- Feeding – Types of feed and frequency.
- Harvesting – Partial harvesting and restocking.
- Disease Control – Liming before winter and partial harvesting.

Prawn with carp polyculture added the following elements:

- Stocking – Shelters for prawn after stocking and differences in stocking behaviour.
- Feeding – Pelleted feed for prawns.
- Harvesting – No harvesting during moulting.

Integrated gher farming added another set of elements:

- Gher Preparation – Raising dykes, digging canals, liming, and application of manure.
- Stocking – Prawn larvae in canals.
- Planting – Planting rice on the upper portion and vegetables on the dykes, filling the rice portion with water, and adding prawns and fingerlings.
- Harvesting – Draining the water and harvesting prawns with nets.

#### Aquaculture Knowledge Acquisition and Practice Adoption

Data from the FGDs in both Mymensingh and Noakhali indicated that the training provided was effective in terms of the acquisition of knowledge and skills for advanced aquaculture. In comparison, non-participant men demonstrated basic aquaculture knowledge but lacked understanding and specific advanced knowledge on pond preparation, species

within polyculture, stocking densities, fertilization, and in the case of Noakhali, prawn integration. Non-participant women had much lower levels of knowledge compared to participating women, even in the traditional women's roles of feeding and fertilization.

According to the survey data most of the MAEC participants stated that they adopted the pond technology they had been trained in and, in 93% of the cases, the trained person managed the pond. GNAEC data also showed that most participants were using the skills and knowledge acquired through training.

#### **Most Valuable Asset**

Nurunnabi (46) has, with his training and knowledge in aquaculture, been able to feed his family and survive through hardships and natural disasters and yet start again. After losing his successful livelihood from a major flood in 2004, he has continued fish culture on a shared basis together with a relative. His knowledge and skills in aquaculture techniques have become his single most valuable asset, he says.

FGD data and site visits to Mymensingh showed that most MAEC participants and non-participants practised carp polyculture and were generally following the prescribed methodologies and protocols. The most common issue was overstocking, although this was only a concern from the technical standpoint and not a concern for the farmers, who saw it as a rational practice. Non-MAEC participants exhibited an increased concern with disease that was not found with MAEC-participants and more cases of monoculture.

GNAEC participants practiced carp polyculture with varying levels of prawn integration and generally followed the methodologies and protocols. The survey data showed that in 2006 68% of participants were integrating prawns. In contrast, while most non-participants were practicing carp polyculture and generally following the methodologies and protocols, there was a low incidence of prawn integration. There was also an issue of less pond preparation by non-participants and increased disease concern.

A major issue in aquaculture practice was the use of training provided to women. While women were able to acquire the full range of aquaculture knowledge from the training, in the majority of cases their role was limited to feeding. Women only practised the totality of their knowledge of aquaculture when they were the head of a HH. Women also played a role by imparting knowledge to their husbands. Women probably expanded their roles when their husbands were temporarily absent and most of them were confident that they could manage the range of aquaculture activities if needed. However, in general, due to established gender roles the knowledge acquired by women was not being put into practice in Mymensingh or Noakhali.

#### **Deviations from Methodologies and Protocols**

The consequences of not following specific protocols differed depending on the type of protocol. Figure 24 lists of the protocols that were not followed, the scope of the problem, and the observed or reported consequences.

**Figure 24 Deviations, Scope, and Consequences**

Deviation from Protocol	Scope of Deviation	Consequence
Overstocking without proper feeding	Majority of Farmers	Low growth rate, increased disease
Not fully emptying the Ponds	Minority of Farmers	Low water quality, increased contamination
Harvesting and Selling before maturity	Minority of Farmers	Increased income due to higher price per kilo/piece
Not using a Feeding Ring	Majority of Farmers	Feed loss, decreased cost-efficiency
Tilapia Monoculture	Minority of Farmers	Faster returns but increased risk
Improper dyke Building/Maintenance (Gher)	Minority of Farmers	Increased susceptibility to flooding

### Appropriateness of Credit

The use of credit was driven by gender roles in both Mymensingh and Noakhali. Credit was reported as being provided to both males and females. The majority of male participants stated that credit was useful for supporting and extending aquaculture activities. Women reported that there was a tendency for their husbands to use the initial credit for aquaculture but then to divert some of the subsequent credit to other uses.

The perceived appropriateness of credit also depended on the terms of repayment. In some cases where weekly instalments were required, credit recipients found that this did not fit well with the time period required to get income from aquaculture activities. However, this issue was taken into account, and most credit providers were reported to have changed their credit terms to suit the cash flow from aquaculture, by allowing a three-month grace period.

Only a minority of non-participants FGD members in Mymensingh and Noakhali received credit for aquaculture, although many received credit from NGOs for other productive activities such as poultry or cattle raising. Those that did receive credit for aquaculture got loans from other NGOs or from fry traders for fry or aquaculture inputs.

## 7.2 Hatcheries and Fry

The considerable expansion of aquaculture activities in Bangladesh has been accompanied by a parallel expansion of hatcheries. At the start of MAEC in the late 1980s there were very few hatcheries in the greater Mymensingh area, in 2003 there were 69 hatcheries and 720 nurseries, and by 2004 there were more than 100 private hatcheries plus a number of government owned hatcheries. In the country as a whole there were 52 private carp hatcheries in 1995. There are now more than 60 private fresh water prawn hatcheries in Bangladesh in addition to the three hatcheries established by GNAEC.

The first GNAEC prawn hatchery was established in 2002 and produced 1.7 million prawn larvae (PL); this increased to 4.3 million in 2006. The number fell to 2.8 million in 2007 as result of disease. A second hatchery (UPAKUL) was established in 2003. Its production increased from 2.7 million PL in 2003 to 9.0 million in 2006 and declined to 7.0 million in 2007. The third GNAEC hatchery was established in 2006 with a production of 1.0 million PL increasing to 3.4 million in 2007.

The Evaluation conducted a site visit to the Reliance Farm Tilapia hatchery, owned and established by an MAEC trainee, near Mymensingh. As a result of his training the owner was able to design and operate the hatchery in a cost-effective and innovative manner. This included maximum use of gravity fed water systems, the use of fertilised water from the hatchery for rice production, minimization of predation and feed loss, a high degree of control over fish in the production cycle, innovative methods to induce spawning, proper packing of the fry to avoid mortality while transporting them for sale, use of bacteria for de-nitrification, and an innovative bio-filter design in the incubation system. The design of this bio-filter, knowledge of these operational processes, the deliberate use of bacteria reveals an extraordinary talent for aquaculture, which according to owner started with the training at MAEC.

#### **MAEC Inspired Innovation**

Ritish Pandit, a hatchery owner, gives credit for his success to the training he had with MAEC back in 1995. He subsequently studied aquaculture techniques in more detail and, in 2004, he finally opened his own business. Ritish's highly innovative hatchery techniques have allowed him to reduce fuel and electricity costs, use fertilized water for rice production, avoid feed loss and induce spawning. His most innovative creation is an incubation system that recycles water through a bio-filter.

A site visit to the UPAKUL hatchery found that it was very well designed and the production logistics were well planned. The overall impression of the hatchery and staff was very good and it was apparent that the owner was well educated in the hatchery business. He had improved many aspects of the hatchery such as the tank design, which made it possible to maintain the high level of hygiene that was key to his success.

#### **Successful Hatchery**

The UPAKUL fresh water prawn hatchery in Noakhali was established in 2002 with GNAEC support. The Hatchery has done well despite some occurrences of disease. The owner has improved many aspects of the hatchery including the tank design. The improvements to the tank design allow a high level of hygiene and are apparently the key to his success. In order to meet the demands of the new organic Noakhali Gold Brand the hatchery does not use any drugs during the nursery phase.

### Current Issues with Fry

There were two commonly reported problems encountered with the supplies of fry. Farmers often said that they had purchased poor quality fry, giving rise to lower growth rates, increased disease, increased mortality, and an inability to maintain stocking ratios. There were also issues with hatcheries mixing breeding species resulting in hybrids with lower growth rates and potential future problems for fry traders selling fingerlings.

#### Hybrid Problems

Muslem Odin (58) has been involved in aquaculture for quite a long time and is doing very well. Aquaculture constitutes an increasing proportion of his annual income. He has recently discovered a problem affecting his business and possibly many people. Some hatcheries are delivering hybrid fish which are far less valuable than 'genetically' pure fish. Unfortunately this cannot be detected until the fingerlings become adults.

### 7.3 Conclusions

With respect to implementation MAEC and GNAEC used methodologies and protocols for aquaculture production that were simple, appropriate for the context, and effective. The training undertaken in Mymensingh and Noakhali was found to be effective and participants were able to demonstrate more advanced knowledge of aquaculture than non-participants. The survey and the FGD found that most male participants utilised their training. In Noakhali the survey found that 68% of respondents were cultivating prawns in addition to carp polyculture. The most common area where the training was not followed was the tendency towards overstocking, leading in some cases to decreased growth rates and increased incidence of diseases. In addition, due to restrictive gender roles, women were only able to use a small portion of their new knowledge and skills, unless they happened to be a HH head or their husbands were largely absent.

The provision of credit was generally appropriate, once the terms had been adjusted to match the cash flow from aquaculture investment. However, most of the credit provided to women was used by men. The hatchery and fry components appeared to be well managed, although with the expansion of the aquaculture industry, quality issues are starting to appear. However, these issues are not attributable to MAEC or GNAEC.

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## 8 Sustainability

The Evaluation examined the extent to which the results of the interventions can be sustained over the long-term, in the absence of Danida assistance. A number of sustainability issues were reported from the FGDs, interviews, and site visits. Some issues were relevant to both Mymensingh and Noakhali; others were only relevant to one of the areas.

### 8.1 Sustainability Issues for Both Areas

The technical skills provided to male participants through training seem to be maintained to a large extent in both Mymensingh and Noakhali. The majority of those male participants who were involved in the discussions as part of the Evaluation are still applying the same techniques that were taught to them by MAEC and GNAEC, and they demonstrated an overall good understanding of various technical matters.

The Evaluation found that maintenance of technical skills was more problematic for female participants. The majority of women had a limited role in HH aquaculture and reduced opportunity to practice learned skills. It is likely that these skills will be lost if they are not maintained by refreshment training. The Evaluation found that female participants appeared to forget more of their training than did the men.

Fingerling quality is also an increasing concern. In many hatcheries the same stocks are used many times. The resulting hybridization will become a serious sustainability issue for the future if not addressed. (DoF told the Evaluation that this is a priority area and that action will be taken to ensure and control fingerling quality).

Natural disasters and flooding, which have become more frequent phenomena, are a serious future threat to the development of aquaculture. This concern is more serious for Noakhali than for Mymensingh.

#### **Flooding Issues**

Abdul Motaleb (48) has a long family history in fish culture. He started fish culture for consumption purposes without training, but was motivated by CODEC and received training in techniques and skills. Unfortunately, after taking out several loans and extending his fish projects, he got caught in a web of credit and hasn't been able to get out. His plight was worsened when the severe flood of 2004 washed away all his fish. Abdul blames greed, failure to follow his training, and acting on his own, for his current situation.

### 8.2 Specific Sustainability Issues for Mymensingh

The Danida-funded aquaculture interventions in Mymensingh were completed five years ago, in 2003, and the Danida Programme Office in Mymensingh was closed down at

that time. This has been a challenge for sustainability of the implemented activities, particularly for extension (See Section 8.4).

In general, the Evaluation found that the established linkages from service providers to the farmers showed a high degree of sustainability: The required inputs seemed to be available to the farmers, opportunities for credit were available, a supply chain was established, and there was good access to markets. A few farmers reported that there was a shortage of fertilizer.

Price development was reported to be of particular concern in Mymensingh. While fish prices trended downwards, input prices have risen. The profitability of aquaculture production has therefore been under pressure, threatening the sustainability of aquaculture activities for many of the farmers.

### 8.3 Specific Sustainability Issues for Noakhali

In Noakhali the issue of sustainability has been linked to the Community Based Organizations (CBOs), which were promoted in many areas during the last part of the interventions. At first the CBOs were supported directly by GNAEC, but this modality was later modified so that funding is now channelled through the Union Councils to strengthen their capacities and to develop more formalized cooperation between the Councils and the CBOs.

#### **Important Community Resource**

In 2004 GNAEC assisted in the formation of a Community Based Advisory Service Centre (CBASC) designed to provide a one stop service centre for local people. The centre provides a range of services and has become an extremely important community resource. Since local needs are frequently assessed in community meetings, CBASC operates monthly service centres in regions of the unions. Advice on medical concerns and problems with fisheries is available. CBASC has since become a CBO with official government registration. CBASC provides a list of experts with technical assistance in livestock, fisheries, birth attendants, etc. It also demonstration vegetable plots for farmers, has established fish nurseries, and has good links to feed suppliers and hatcheries.

The CBOs are very young organisations that still need external support with respect to technical, managerial, and financial matters, to carry out their functions. A key factor with regards to future sustainability of the CBOs will be the extent to which they manage to develop and maintain sufficient income-generating activities to become financially sustainable. The latter is directly related to their ability to maintain and develop linkages to the private sector. This backward and forward linking to private sector actors has been a cornerstone in GNAEC's approach and will be fundamental to sustaining aquaculture activities in Noakhali.

Currently the aquaculture sector in Noakhali appears to be on a positive track with a strong demand trend (markets) and fixed agreements between CBOs and private sector actors concerning inputs and prices. This set-up is securing sufficient input to the farmers



at cheaper prices (through the CBOs). The only missing link is a processing plant for fish and prawns. A plant was constructed during the intervention period but is not currently operational; measures to reactivate the plant are ongoing.

#### **Noakhali Gold**

Noakhali Gold Agro Feeds Ltd is an integrated part of the GNAEC and an important component in the overall move toward sustainability and developing an organic feed brand. The privately owned plant and the local fish and prawn farmers have found a way to gain mutual benefits. They have managed to secure a stable market for the owner of the mill and low prices of feed for the farmers. Their goal is to establish and protect their organic feed brand and to access the international seafood market. This arrangement will enhance the aquaculture production of the area and promote the use of sustainable practices such as manufacturing feed without preservatives.

One concern for sustainability is what will happen when the ex-GNAEC Office is no longer there to provide a “safety net” to the CBOs and to facilitate the agreements on fixed supplies and prices between the CBOs and the private sector actors. The hope is that by that time, the CBOs will be self-sustaining and that the market actors will be sufficiently established to ensure a high degree of market stability.

The sustainability of prawn cultivation is a concern in Noakhali. The initial choice of Golda as opposed to salt water prawns was made to allow for other uses of the ponds. However, prawn culture requires more resources and involves more risks than carp polyculture. There are higher feeding requirements, the prawns take longer to grow to market size, there is more risk of disease, and more dependence on international processing facilities and markets. It should also be noted that Noakhali has been flooded several times in recent years.

### **8.4 Sustainability of Extension**

The Evaluation found that aquaculture extension activities have decreased significantly in both Mymensingh and Noakhali since completion of the Danida-funded interventions. Participants and non-participants in Mymensingh and Noakhali both reported that there was a general lack of extension services, support, and post project follow-up from most NGOs and Government Officials. The exceptions were some of the extension services provided by CBOs and some NGOs (mainly CODEC in Noakhali).

These findings are supported by the data in Figure 25. Very few of the extension trainers who were employed by NGOs during implementation are still employed by them. Discussions and meetings with DoF District Offices and NGOs confirm that resources, particularly for transport, were limited after completion of interventions and that this has affected the provision of follow-up support.

**Figure 25 Number of GNAEC and MAEC Extension Trainers (Female/Male) employed and still working with NGOs**

Name of NGO	Total Number of Female ETs employed through MAEC/GNAEC	Total Number. of Male ETs employed through MAEC/GNAEC	Total	Number of Females in 2008	Number of Males in 2008	Total
CODEC (Noakhali)	49	101	150	3	7	10
NRDS	17	40	57	7	5	12
SSS (Mymensingh)	20	73	93	2	14	16
Total	86	214	300	12	26	38

The content and quality of aquaculture extension services currently provided by NGOs and Government Officials were also issues for both participants and non-participants. Hatcheries and fingerling sellers provide some advice to the farmers but they considered it to be of low quality.

## 8.5 Institutional Sustainability at the Governmental Policy Level

The Danida aquaculture interventions, together with the Fourth Fisheries Project (funded by the United Kingdom Department for International Development (DfID) and implemented from 1998-2004), have been the main drivers in the development of an improved institutional framework for the fisheries sector in Bangladesh.

Bangladesh's first National Fisheries Policy was approved, and endorsed by the Government of Bangladesh, in 1998. Prior to this time, the fisheries sector in Bangladesh had no clear objectives and was not governed by coherent policies. The National Fisheries Policy set out, for the first time in Bangladesh history, a framework for directing the management of the fisheries sub-sector, including the aquaculture sub-sector. Since then other Ministries and Departments, recognizing the need for fisheries to be considered during the development of water and land resources, have either developed new policies or revised existing ones.

A National Fisheries Strategy was formulated in 2006 to propose more specific procedures and to provide guidance for the implementation of the National Fisheries Policy. The Strategy represents the compilation of eight Sub-strategies, each formulated to give direction to a specific area. These were all prepared using a participatory approach, with input from DoF and other key stakeholders, including the private sector, researchers, other governmental agencies, NGOs, fish farmers and fishers. The Strategy and related Sub-strategies are governed by related Action Plans.

Two of the Sub-strategies are specifically related to aquaculture: the Aquaculture Sub-strategy and the Aquaculture Extension Sub-strategy. The Aquaculture Sub-strategy focuses mainly on the need to develop adequate regulations to ensure provision of future quality input. The Aquaculture Extension Sub-strategy, while recognising the resource constraints within governmental institutions, suggests fostering the development of private and need-based decentralised extension systems, in addition to collaboration with other extension providers. This would ensure broad and integrated extension coverage.

It is important to note that the policy and strategy documents for the Bangladesh fisheries sector in general, and for the aquaculture sub-sector in particular, *to a large extent build further on the Danida-funded aquaculture interventions implemented during the past two decades*. Quality input, enhanced private sector involvement and private/public sector interaction, together with improved and more integrated extension services, have all been key features within the Danida-funded interventions. This obviously strengthens the sustainability of the interventions.

DoF management and staff interviewed during this Evaluation, point to areas such as process planning, management, and multi-disciplinary cooperation, including with private sector actors, as examples of how the Danida-funded interventions have had a clear impact on their skills. This impression was shared by Danida advisors and other external partners. However, one concern was that a strong internal hierarchical structure within DoF compromised the ability of staff to apply the knowledge and experience gained from working with Danida.

One particular challenge faces DoF in relation to its role in sustaining and further developing the fisheries sector in Bangladesh: few of the staff have a professional background related to fisheries planning. The majority have training as aquaculture/fish farming specialists, obviously a result of the extensive DfID/Danida interventions related to the aquaculture sector. It may be necessary to assess the qualifications required of DoF management and staff in relation to successful implementation of the National Fisheries Strategy, and to ensure that individuals with the required qualifications will be available in the future.

## **8.6 Conclusions**

There are many elements of the aquaculture production system that have to be present for the results of MAEC and GNAEC to be sustainable. At the pond level the skills and knowledge from training are still very much in evidence for men, and much of the methodologies and protocols are being practiced. The exception is with women who are mainly constrained to a feeding role. The ongoing supports for aquaculture production to the farmers are less sustainable. Extension from GoB and NGOs has decreased since 2004 in Mymensingh and 2007 in Noakhali. While Danida supports remain in the case of Noakhali, there are likely to be ongoing shortfalls in extension and support to farmers. The inputs that are required for aquaculture production are largely in place and are being maintained on a sustainable basis. Feed, PL, fingerlings, fertilizer, and labour are all available, with possible issues identified by participants about fertilizer availability.

Markets for aquaculture production are more difficult to predict. In Mymensingh the proximity to Dhaka provides a strong ongoing source of demand. In Noakhali, Danida and DoF are still working on improving access to markets, especially for prawns. Reported price decreases over the past few years may also play a negative role with respect to sustainability. There are also significant risks to sustainability for both areas. Flooding and disease are critical risks, more important for prawns, but also of concern for carp polyculture. However, in the short- to medium term it appears that the large numbers of people now engaged in aquaculture have factored these risks into their involvement in the sector.

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## 9 Lessons Learned and Basis of Learning

The lessons that follow constitute learning opportunities derived from generalizations based on the Evaluation's conclusions. They have been selected, in particular, for their potential value in attaining extended benefits through other development cooperation interventions. As such they are focused on design and delivery issues.

1. **In the right context, with relatively small amounts of training and credit, poor people with pond access can make significant improvements in fish production.**

MAEC and GNAEC more than demonstrated that with the right set of circumstances a simple and relatively small intervention (small in terms of what each HH receives) can lead to significant improvements in fish production. These circumstances included pre-existing involvement in aquaculture, availability of ponds or land to make ponds, relatively low barriers to entry, internal (HH) and external markets, access to markets, relatively simple methodologies and protocols, mechanisms for appropriate credit provision, and relatively low risks. Encouraging poor people to enter into aquaculture without these circumstances would entail much more risk to the sustainability of their livelihoods.

2. **If the scale of the intervention is large enough, a development intervention can successfully catalyse a significant change in an economic sub-sector and the lives of the people active in that area.**

The scale of MAEC and GNAEC was significant in terms of time, geographic scope, and primary and secondary beneficiary coverage. The time dimension was important to enable sufficient cycles of implementation, examination of results, learning, innovation, and revised implementation. This process transcended locations as the learning (positive and negative) from MAEC was used to inform and improve GNAEC and PBAEC. The geographic scope was important as the saturation of Unions, Upazilas, and Districts facilitated replication and spill-over effects. Rather than assume that programming successes would be adopted over geographic distances, this saturation aided replication within the HH (women to men) and from participating HHs to non-participating HHs, through farmer-to-farmer transmission, government, NGOs, and private sector actors. This also underscores the importance of working with a wide range of primary and secondary beneficiaries. While the exact vectors of replication are not easy to establish, the evidence is clearly demonstrated by growth in the aquaculture sub-sector.

3. **There is a need to be clear about the causal results chain and to understand how much aquaculture production is necessary to significantly increase income and well-being.**

The common impact of "improved socio-economic position and physical well-being" needs to be realistically linked to increased aquaculture production. Important factors such as the generation of financial resources for investment in other livelihood practices need to be recognized. In addition, the episodic nature of the cash flow from aquaculture needs to be taken into consideration. These are both positive factors that help to assure

impact. However, the relative proportion of aquaculture as one of many contributions to HH income needs to temper the expectation of impact.

- 4. There is a need to better understand and articulate the macro-economic effects of a widespread and long-term micro level intervention, and factor these effects into planning.**

The short-run results from Mymensingh and the FGDs on MAEC and GNAEC conclusively demonstrate that the relatively simple aquaculture techniques and methodologies promoted, lead to significant increases in the quantity of fish production. At the HH level the logic of the causal chain is clear and realistic – that increased production will lead to increased income. However, with a long-term and intensive intervention such as MAEC, the micro-level production increases aggregate to have macro-level consequences on the price of fish. In this respect the intervention may have been the “victim of its own success”, as massive aggregate increases in production led to steady decreases in prices. These price decreases, when coupled with input price increases, have combined to constrain the increases in HH income due to aquaculture. These macro-economic circumstances need to be better understood, expressed in project documents particularly the results chain, risk, and assumptions, and factored into planning.

- 5. There is a need to minimise and address the apparent contradiction between the intervention’s reach, the desired level of results, and the profile of the beneficiaries.**

With any development intervention there is always a need to maximise reach and results, to cover the largest number of beneficiaries possible, and to achieve the highest level of results possible with them; whether that is by increasing HH income or by immunization against disease. However, when the easiest way to expand reach and results is to work with relatively better off beneficiaries (socio-economically), there is a risk that the impact will be jeopardized. Both MAEC and GNAEC compromised the profile of the beneficiaries (i.e. poor versus marginal/wealthy) in order to extend the reach in terms of numbers of beneficiaries. In doing so they reduced the level of impact by achieving good results, but with fewer of the desired target group.

- 6. Examining the context and means of the poor can lead to innovative programming that addresses those needs in a real way and involves them in the sector being targeted.**

It seems clear that for interventions of this type, eligibility criteria are insufficient to ensure targeting of the poor. Rather, an in-depth analysis of the context of the poor is required: the barriers and challenges they face and the strengths that they can bring to bear to improve their circumstances. The experience with GNAEC since 2004 has shown that, with commitment, resources, and innovation, the barriers and challenges can be addressed, and that even the poorest of the poor can be substantially involved in, and benefit from, growth in the aquaculture sub-sector. This enabled GNAEC to widen the target group to the hard core poor for participation in rice-fish culture, community based aquaculture, fish drying for prawn feed, and nursing of prawn juveniles.

- 7. Practical changes in women's lives, such as receiving credit, going to meetings, and learning about aquaculture, can influence strategic improvements in mobility and HH decision-making.**

For women, the practical aspects of being a participant in a development intervention can include travelling outside of their HH to attend a meeting at a NGO office, opening up a bank account and receiving credit, and receiving training. These activities are not necessarily intended to empower women per se. However, in some contexts, the experience of leaving the HH or receiving credit, even if the funds are simply turned over to their husbands, can influence changes in the mobility of these women and their relative power inside the HH. Consequently it is worthwhile to involve and train women from a women's empowerment standpoint, even if the training is underutilised due to restrictive gender roles. The female participants in MAEC and GNAEC appear for the most part, to not be using the full extent of their training. However, despite this, there have been empowerment gains in consciousness, self-confidence, mobility, and decision-making, from participation in the interventions.

- 8. Sustainability is enhanced when private sector forces and actors are brought into the implementation process without necessarily making them beneficiaries.**

Both MAEC and GNAEC demonstrated the value of having private sector actors as both beneficiaries and partners of a development intervention. Indeed, rather than always trying to establish a needed component, such as a hatchery, as part of a program, the value of working with existing private sector actors or catalyzing the involvement of nascent actors has been demonstrated. The benefits have been the application of stricter criteria for economic success and sustainability. However, it should be noted that these have worked within the context of a very successful intervention. There is an associated risk that, if the component faces declining economic viability, it may be a risk to sustainability.

- 9. The risks associated with bringing other actors into the implementation process need to be analysed and mitigated. In the case of the interventions, the use of NGO's for credit provision brought an agenda of ensuring creditworthiness for loan repayment, not necessarily poverty eradication.**

NGOs were used by both MAEC and GNAEC to provide credit to intervention beneficiaries. Since the NGOs interests were served by loan repayment this introduced an implicit selection criteria of creditworthiness. This became another force driving the beneficiary selection process towards the upper end of the income criteria. This agenda should have been mitigated to ensure that the intervention selection criteria were adhered to in practice and in spirit.

- 10. There is a need to rethink the model of support to and capacity development of government (and NGO) extension used in the interventions and in other Danida programs.**

Extension services provided by government and NGOs have decreased substantially following the completion of the Danida interventions. DoF does not have the financial resources to provide similar coverage and most extension workers are not employed by

the NGOs anymore. Both have lost many of their female extension workers. This is a serious challenge to the sustainability of the interventions and the continued growth of the sub-sector. Consideration should be given to increased use private sector actors and to make extension more the part of a commercially oriented “package”.

- 11. A strong focus on production amounts (tons of fish produced) can lead to a lack of attention on product and supply chain quality issues.**

While increases in the amount of fish production are well documented there are emerging issues of quality that are cause for concern, including fingerling quality. This has been recognised by GNAEC which has taken up this issue with respect to prawn production.

- 12. A negative set of circumstances for the direct beneficiaries of an intervention can be a positive factor for a larger set of indirect beneficiaries – the example of decreasing fish prices.**

Danida’s interventions were clearly instrumental in catalyzing and supporting substantial increases in fish production from aquaculture. However, associated with those increases in production were decreases in the prices of fish. From the FGD data this was seen as a negative occurrence that concerned many participants. However, the lower prices for fish have made them more available for the poor with benefits for their nutrition and health. Consequently, the aims of Danida for poverty reduction indirectly benefit, on a large scale, from a negative economic phenomenon for the direct beneficiaries of interventions.



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## 10 Recommendations

Given that this impact evaluation was undertaken after the completion of MAEC and GNAEC, and that Danida-supported activities are continuing in some areas, the recommendations are: 1) general in nature but related to current and future programming, 2) targeted to the audiences of this report, and 3) actionable for future programming. The following recommendations are advanced on this basis.

### 10.1 Overall Recommendations

The Evaluation's findings and conclusions generally support the premise that important results can be achieved that improve the lives of beneficiaries in the context of catalyzing widespread economic growth. On this basis many elements of the intervention's success are recommended to be considered and examined for inclusion in current and future programming. These include:

- A. **Scope** – strengthen or collaborate with all the components of the production process from inputs, to capacity, and marketing to catalyze development of a whole sub-sector of the economy on a regional basis. This would require broad development thinking at the conceptual level and the development of relevant institutional, financial, and sub-sector economic frameworks to ensure the sustainability.
- B. **Size** – ensure that interventions are large enough to bring about economic development on a meaningful geographic scale to catalyse regional economic development and establish backward and forward sub-sector linkages within a region.
- C. **Length of time** – ensure that commitment to an intervention is long-term, facilitating implementation, learning, innovation, and improvement.
- D. **Appropriate Partnerships** – involve all relevant stakeholders from Government, NGOs, and the private sector, as partners, beneficiaries, and implementers to build the foundations for success and help to ensure sustainability. This could be done in a way that involves actors, such as hatcheries, without making them direct beneficiaries. However, partnerships should be formed in an appropriate way that ensures that the agenda of partners does not run counter to the aims and objectives of the intervention.
- E. **Technical Approach** – implement using simple but effective techniques and methodologies for aquaculture production, which are readily adopted and demonstrate results, aiding sustainability and replication. These approaches should be implemented with due assessment of the context, ensuring that the requisite circumstances outlined in Lesson Learned 1 are present and the intervention does not require participants to take on undue risk.

### 10.2 Specific Recommendations

Current and future programming could also be improved through consideration of the following recommendations:

- A. Support the type of learning and innovation displayed in GNAEC that improves targeting of the poor. This includes working with the poor, especially poor women, taking into account their context, and adapting the intervention to their needs and situation, rather than trying to fit them into a pre-designed intervention. Targets may be a useful benchmark to compare how the intervention is actually reaching the poor versus plans, but in and of themselves, benchmarks and criteria will not produce programming that is pro-poor.
- B. Ensure the causal chain of results is informed by experience and analysis and reflects reality in the linkages between results levels. (For example, how desired socio-economic changes are related to fish production and employment). The causal chain should be informed by socio-economic analysis.
- C. Analyse the macro-economic effects of wide-spread micro level interventions and integrate these into project planning. This includes the results chain, matrices of risks and assumptions, and monitoring and evaluation. This analysis could include the scenario encountered by these interventions, where a negative set of circumstances for direct beneficiaries (decreasing fish prices) is an indirect benefit to the wider target group of poor women and men.
- D. Support the type of learning and innovation displayed in GNAEC that puts in place a long-term strategy for sustainability. This includes being realistic about sustainability and the support that beneficiaries will require in the future. While facilitating the development CBOs raises its own set of capacity and sustainability issues, it represents a sustainable model for future support.
- E. Develop a model of support to government and NGO extension that is sustainable and does not feature dramatic increases in activity and results during implementation that drop off with the cessation of external support.
- F. Increase the use of private sector actors as extension agents. Since private sector actors are often playing somewhat of an extension role, consideration should be given to strengthening this to allow them to provide high-quality advice, in line with the training that is already being given in this regard, and the informal role that MAEC and GNAEC trained service providers have already been playing.
- G. Be clear and realistic about the expected role of women and the benefits that they will derive from the program. Examine and analyse how traditional gender roles in the HH and communities will influence women's roles and participation and the benefits they receive. Move beyond setting quantitative targets for "participation" to setting targets at the outcome level.

- H. Work with women, regardless of the restrictions they may face with respect to the use of credit and application of training, for the empowerment benefits it brings them. Do not rely on a pure efficiency view of training only on the existing roles of women (such as fish feeding), but rather recognise that important empowerment results of increased self-confidence, mobility and HH decision-making, can be gained by participation and learning.

### **10.3 Impact Evaluation Recommendations**

To improve the success and utility of future impact evaluations it is recommended that:

- A. All quantitative information should be analysed before starting the qualitative component of supporting fieldwork. Fieldwork should not even be scheduled until all the quantitative data required or expected is in the possession of the Evaluation.
- B. Impact assessment criteria and methodologies should be built in from the start of interventions. For example, if the intervention is approved with an impact that deals with HH income, part of the inception phase or implementation plan should be a performance measurement strategy that states how HH income will be measured over time.
- C. The data required for monitoring and evaluation should be retained by Danida and stored centrally to ensure its availability for performance measurement and accountability purposes.

# Annex 1 Terms of Reference

## Impact Evaluation of Aquaculture Interventions in Bangladesh

*Copenhagen, 16 August 2006*  
*EVAL File No. 104.A.1.e.56*

### 1. Introduction

Danida has supported aquaculture in Bangladesh since the 1970s with the long-term development goal to strengthen the socio-economic position and physical well being of poor farmers. This was to be achieved through increased production of fish and prawn for consumption and marketing, in turn generating employment, raising incomes, and improving general nutritional status. Over the years the support has shifted gradually from a merely technical intervention towards a broader development scheme emphasising women's empowerment and sustainability.

From 1989 to today Danida's support for the three main aquaculture extension interventions in Bangladesh amounts to nearly DKK 145 million and has reached approximately 200,000 households through the Mymensingh Aquaculture Extension Project/Component (MAEP/C)<sup>1)</sup>, the Greater Noakhali Aquaculture Extension Project (GNAEP/C), and the Patuakhali & Barguna Aquaculture Extension Project (PBAEP/C).

The longest of the interventions was MAEP/C, which began in 1989 and consisted of three phases: Phase I 1989-1993, Phase II 1993-2000, and a consolidation phase 2000-03. The first Phase was designed as a pilot project to develop an extension system, which would spread the results of Danida supported aquaculture research to pond owners and people with access to ponds, and increase the production of fish protein in selected upazilas of Mymensingh District. Phase II saw the pilot extension system disseminated through a "crash" programme in selected upazilas of seven districts, including Mymensingh. The consolidation Phase covered upazilas from Phase II as well as some with no previous intervention. For the former category the aim was to further the integrated socio-economic approach of partner NGOs and Department of Fisheries (DoF) to ensure self-sustaining capacity of aquaculture extension at upazila and farmer levels. For new upazilas the aim was to complete the MAEP Adoptive Research Programme (Training Programme without Credit).

Following the initial success of MAEP similar programmes were designed for Patuakhali, Barguna & Greater Noakhali districts starting in 1997-98. As an additional feature these include a central prawn cultivation component and an expansion of activities to non-pond culture including paddy field rice-fish culture, prawn juvenile nursing, and cage culture. In addition, PBAEC includes a component for community based fishery management in closed and semi-closed public water bodies (jalmohals) thus expanding the

1) *The interventions were originally 'projects' and are still referred to as such by the Government of Bangladesh. Officially however, they became 'components' of the Agricultural Sector Programme Support in 2000.*

target group to non-pond owners including landless and poor fishermen. These interventions are due to terminate in 2006, however it is expected that a second phase will be included in Danida's Agriculture Sector Programme Support, Phase II to be approved in the second half of 2006.

The *primary target group* throughout the intervention period in all areas has been men and women with access to ponds with special attention to landless, marginal farmers, and people with access to fish and prawn cultivation through leased or own ponds or ghers (modified rice fields with a combined production of vegetables, rice, fish and prawns). Following the Joint Annual Sector Reviews of 2002 and 2003 GNAEC widened the target group to the hard core poor for participation in rice-fish culture or community based aquaculture. *Secondary target groups* include fishermen and traders, entrepreneurs involved in hatchery development, and landless labourers who would become engaged in related services, e.g. net-making, nursery, harvesting, etc.

## **2. Objective of the Evaluation**

The purpose of the Evaluation is to measure the impact of the interventions on people's socio-economic position and physical well being: Has there been a change in people's income, living standards and women's empowerment amongst beneficiaries of the three components – and crucially, *can any such changes be attributed to the interventions?*

More specifically, the Evaluation should examine:

- What has been the impact on incomes?
- What has been the impact on living standards in general?
- What has been the impact on health, e.g. malnutrition?
- What has been the impact on women's empowerment?

The Evaluation should also identify channels through which these impacts have occurred, and establish the determinants of change along with reasons for little or unintended impacts. This can be done by examining the causal chain from inputs – outputs – outcome – impact as discussed in section three below. Issues for consideration during the analysis are listed in Appendix 1.

## **3. Approach and methodology**

The Evaluation should take a theory-based approach to impact evaluation. Theory-based evaluation (TBE) analyses the causal chain from inputs to impact and critically examines each link in the chain. Doing so requires mapping out the channels through which the inputs provided by the intervention are expected to affect the intended intervention outcomes. This approach ensures that, whilst the focus is on impact, causes of the obtained results are similarly explored.

Within the framework of TBE the Evaluation should apply a mixed methods approach combining rigorous quantitative analysis and qualitative methods.

A rigorous quantitative analysis of the intervention should take a quasi-experimental approach to establish the counterfactual – that is what would have happened had the

intervention not taken place. To do so the design can, for instance, take form of a ‘double difference’ approach, propensity score matching or use a pipeline approach for constructing a comparison group. The latter approach selects as comparison group those groups selected for participation in the project, who have not yet started participating. The possibilities for adopting such an approach in Noakhali and Patuakhali should be explored.

The consultant should propose the optimal quantitative methods based on the availability of data. A variety of data exist, including large monitoring datasets, some baseline data, and a number of national survey data such as census data and the Demographic and Health Survey (DHS). The availability of data from other sources in the three areas should similarly be examined. There is generally a large amount of data in Bangladesh including data from national and international NGOs, and the possibilities for conducting the analysis based fully or partially on existing data should be explored.

Qualitative analysis should be undertaken in order to comprehend the intricacies of the causal chain and to inform the quantitative analysis. Methods could include PRA techniques, key informant interviews, etc.

It is suggested that the Evaluation comprises of three phases as follows:

*Phase I* consisting of a study of relevant documents; an examination of available data; mapping of the causal chain; and detailed development of methodology including, if necessary, design of field surveys. A field visit may be deemed necessary at this stage.

*Phase II* consisting of carefully planned fieldwork, qualitative and quantitative, as stated in the methodology.

*Phase III* should focus on analysis of data and qualitative findings, as well as writing of the draft report, which will conclude on the impacts of Danida funded aquaculture interventions, draw lessons learned and make recommendations for similar interventions in the future and, if appropriate, for development interventions in general.

Based on the draft report, a workshop for relevant stakeholders will be organised in Bangladesh. The workshop will discuss main conclusions and recommendations with a bearing on development policy and strategy issues. Based on the outcome of this workshop and on written comments on the draft report, the final Evaluation Report will be prepared.

#### **4. Evaluation outputs**

The outputs of the Evaluation correspond to the main tasks described above and consist of the following:

1. Draft Inception Report, max. 20 pages excluding annexes, to be delivered in word and pdf-files; a final Inception Report will be produced after receiving comments from the Evaluation Department. The Inception Report is to be presented at the end of Phase I and approved by the Evaluation Department before any major fieldwork is initiated.

2. Debriefing Note, containing preliminary findings to be presented to the relevant stakeholders at the Embassy of Denmark at the termination of the fieldwork, and to the Evaluation Department in Copenhagen;
3. Draft Evaluation Report, max 80 pages, excluding annexes, to be delivered in word and pdf-files, with cover (digital) photo proposals; the draft report will be adjusted<sup>2)</sup> by the Evaluation Team after receiving comments from the Evaluation Department. The draft Evaluation Report will be delivered three months after the termination of the fieldwork;
4. Workshop: A presentation to be prepared of the draft Evaluation Report and presented at a stakeholder workshop in Bangladesh. This workshop shall be arranged three weeks after the circulation of the draft Evaluation Report;
5. Final Evaluation Report, max. 80 pages, excluding annexes, with attached CD-ROM (containing all major evaluation documents), to be delivered in word and pdf-files. The annexes should contain a Field Report, including the reports from the fieldwork, as well as compiled statistics, questionnaires etc., as relevant. Based on the discussion at the workshop, and on written comments on the draft from stakeholders and the Peer Review Group, the final Evaluation Report will be prepared not later than six weeks after the workshop;
6. Draft Evaluation Summary, three to four pages, for production of a pamphlet aimed at public audiences;
7. Presentation of the Evaluation Report at a workshop in Copenhagen;
8. A brief 'post-mortem' report (max five pages) of the evaluation process as experienced by the Evaluation Team.

All reports shall be written in English.

## **5. Composition and profile of the Evaluation Team**

An Evaluation Team, selected through international global tendering, will carry out the Evaluation. The organisation of the Team's work is the responsibility of the consultant and should be specified and explained clearly in the proposal.

The Evaluation Team should consist of international and national consultants. International consultants are defined as persons with an international background, e.g. a degree from an internationally recognised university and with a major part of the professional experience from assignments within developing countries.

Neither the company or organisation undertaking the Evaluation nor any individual team members may have been involved (through preparation, appraisal, implementation or review) with Danida funded aquaculture interventions in Bangladesh and the company must provide a written statement confirming that no such involvement has taken place.

2) *See Danida's Evaluation Guidelines (1999) Section 7.1 Preparing the report.*

The Evaluation Team should possess the following qualifications and experience:

General qualifications for all team members:

- Higher relevant academic degree;
- At least five years of experience with international development assistance;
- Experience with evaluation of development interventions preferred;
- Fluency in English.

Specific qualifications for the Team Leader:

- At least ten years of experience with international development assistance;
- At least three references as Team Leader for multidisciplinary teams;
- At least three references of experience in evaluation of development assistance and design;
- At least one reference of experience with rigorous impact evaluation;
- Extensive experience with both quantitative and qualitative surveys and analysis;
- Knowledge of rural development and livelihoods, and poverty reduction strategies;
- The team leader must be permanent staff of the Tenderer;
- The team leader must be an international consultant (as defined above).

Specific qualifications to be covered by two or more team members:

- Experience with evaluation of development assistance (at least one reference for each team member);
- Experience with impact evaluation of development assistance;
- Experience with quantitative surveys and econometrics for impact evaluation;
- Experience with qualitative surveys and PRA techniques;
- Experience with rural development and poverty reduction;
- Experience with technical assistance at country, sector and programme levels;
- Knowledge of aquaculture techniques and fisheries management;
- Knowledge of gender issues, specifically in South Asia;
- Knowledge of development policies, strategies and management.

The Team should cover experience from Bangladesh/South Asia:

- Long standing experience from Bangladesh for some team members;
- Experience from South Asia for all team members;
- Experience from Bangladesh for team leader is preferable.

It should be stated which of the proposed team members cover which of the above qualifications and experiences.

Team composition:

- Core team should be composed of both sexes;
- Survey team should consist of Bangladeshi females to the extent possible;
- Smaller teams are preferable.



## 6. Input

It is estimated that the Evaluation will cost a total of DKK 2.5 million including reimbursable costs.

## 7. Evaluation principles, management and support

The Evaluation must be carried out in accordance with the Danida “Evaluation Guidelines” (February 1999) as well as the DAC Evaluation Quality Standards 2006. Responsibility for the content and presentation of the findings and recommendations of the Evaluation rests with the Evaluation Team. The views and opinions expressed in the report will not necessarily correspond to the views of the Danish Government, the Bangladeshi Government, or the implementing organisations. The Evaluation Report will be available to all relevant stakeholders and will be published online at [www.evaluation.dk](http://www.evaluation.dk). Three sets of roles are contained in the evaluation process: the Evaluation Management, the Peer Review Panel, and the Evaluation Team (Consultant). A designated evaluation officer from the Implementation, Monitoring and Evaluation Department (IMED) of the Ministry of Planning in Bangladesh will follow the evaluation process.

### 7.1 Role of the Evaluation Department

Danida’s Evaluation Department (EVAL) will manage the Evaluation as regards funding, contracting and implementation management.

The Evaluation Department will:

- Ensure quality throughout the Evaluation process;
- Comment on and approve the draft and final versions of Inception and Evaluation Reports;
- Coordinate internal contributions;
- Provide feed-back to the Evaluation Team and the Peer Review Panel;
- Organise, facilitate and participate in Evaluation workshops, as per need;
- Organise the presentation of the evaluation results, and assist with necessary follow-up of the Evaluation.

### 7.2 Role of the Peer Review Panel

A Peer Review Panel composed of individual resource persons and researchers will be established.

Tasks of Peer Reviewers:

- Comment on the Inception Report, including methodology and work plan;
- Comment on the draft Evaluation Report;
- Participate in workshop(s) in Bangladesh and Denmark;
- Possibly provide input and contributions for workshop(s).

### 7.3 Role of the Evaluation Team (Consultants)

The Evaluation is carried out through a contract with a consulting company/ research institution by a team composed of international and Bangladeshi consultants lead by an Evaluation Team leader.

The Evaluation Team will:

- Carry out the Evaluation as per ToR;
- Be responsible for the findings, conclusions and recommendations of the Evaluation;
- Report to the Evaluation Department, be in regular contact, coordinate mission timing and key events with the Department and seek its advice when needed;
- The Team Leader is responsible for the reports and for the organisation of the work of the Team;
- The Team Leader will participate in workshops, as required.

## 8. Tender process requirements

### 8.1 Requirements for the Consultant's Home Office Intervention

*The Consultant's home office shall provide the following, to be covered by the consultant's fees:*

- General home office administration and professional back up. The back-up activities shall be specified.
- Quality assurance (QA) of the consultancy services in accordance with the Consultant's quality management and quality assurance system, as described in the Consultant's application for qualification. Special emphasis will be given to quality assurance of draft reports prior to submission.
  - The Tenderer should select a QA Team, envisaged to consist of minimum two persons, to be responsible for Head Office QA. The members of the QA should not be directly involved in the implementation of the Evaluation but their CVs should be included in the Tender. The QA team should have the same level of competence and professional experience as the Evaluation Team.
  - All QA activities shall be properly documented.
  - The Tenders shall comprise a detailed description of the proposed QA, in order to document that the Tenderer has established how to implement the QA and in order to enable a subsequent verification that the QA has actually been carried out as agreed.
- Implementation of the business integrity management plan, as described in the Consultant's application for qualification, in relation to the present Evaluation. This implementation shall be specified.

### 8.2 Alternative Tenders

Alternative tenders will not be permitted.

### 8.3 Agreement of Exclusivity

The Consultant is not allowed to impose agreement of exclusivity on national sub-consultants.

## 9. Timing

The Evaluation is scheduled to take place during 2006-07. It is anticipated that the Evaluation will be completed by October 2007, as indicated below:

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Tendering and contracting of the Evaluation	June-October 2006
Mobilisation of Consultant	October/November 2006

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### Phase I

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Desk study, Draft Inception Report, etc	November 2006-15 January 2007
Approval of Inception Report	25 January 2007

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### Phase II

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Field studies	February-March 2007
Debriefing at the Embassy of Denmark and Danida Evaluation Department	End March

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### Phase III

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Evaluation Report, draft	June 2007
Workshop in Bangladesh	July 2007
Evaluation Report, final	September 2007
Presentation of the Evaluation in Copenhagen	October 2007

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## 10. Information and Data provided by the Client

Various papers including guidelines and project documents are provided on CD-rom. Other relevant references include:

- Baker, J. (2000) *Evaluating the Impact of Development Projects on Poverty: A Handbook for Practitioners*, The World Bank, Washington D.C.
- Bamberger, M. (2006) *Conducting Quality Impact Evaluations Under Budget, Time and Data Constraints*, The World Bank, Washington D.C.
- White, H. (2005) *Maintaining Momentum to 2015? An Impact Evaluation of Interventions to Improve Maternal and Child Health and Nutrition in Bangladesh*, Independent Evaluation Group, The World Bank, Washington D.C.

## Appendix 1: Evaluation questions

While the main evaluation questions are stated under objectives above, the following should be seen as examples of issues to be explored as part of the analysis. While any significant findings should necessarily be discussed and will constitute part of the analysis of impact, the report should not focus on answering all specific questions below.

### *Overall*

- What are the main determinants of changes in income, living standards, health, and women's empowerment?

### *Income, living standards, and employment*

- To what extent have incomes risen as a result of the interventions and how is this reflected in possessions, quality of dwelling, consumption levels, and health?
- To what extent have employment opportunities in intervention areas improved?
- To what extent have income sources diversified as a result?
- Does the effect differ amongst groups of primary and secondary target groups?
- To what extent have project effects and impacts spread to surrounding areas, i.e. has there been a spill-over or contamination effect?

### *Sustainability*

- To what degree are the above impacts likely to be sustainable?
- Mymensingh: To what extent have the interventions proved sustainable following termination of Danida support?

### *Gender*

- Have women been involved to the extent intended and have they had control over credits taken and decision-making in relation to aquaculture production and marketing?
- Have female project workers been employed as intended?
- Has training on socio-economic issues increased knowledge for male and female beneficiaries respectively?
- Have women's intra-household decision-making power and their mobility changed as a result?

### *Jalmohals*

- The use of jalmohals (publicly owned ponds) in Patuakhali have made it possible for landless people to become involved aquaculture: Does the impact on incomes and livelihoods of jalmohal users differ significantly from impact on beneficiaries with own pond?
- If so, how?
- To what extent does management style and method affect outcome?

### *Prawn vs. table fish production*

- Have there been any differences between impact of combined prawn and fish cultivation and pure table fish cultivation?
- Can any such differences be attributable to the nature of the intervention or to different characteristics of beneficiaries of the two types of aquaculture?
- To what extent is prawn farms taken over by richer farmers and what is the effect of this?

*Differences between intervention areas and phases*

- Has impact differed between the three intervention areas? What are the main reasons for any such differences?
- Are there any differences in impact for beneficiaries of Phases I, II and the consolidation phase, respectively, in Mymensingh?
- What are the reasons for any such difference?
- How, if at all, has impact differed between credit-receiving beneficiaries and non-credit beneficiaries?

*Training*

- Were some training methods more effective than others, e.g. participatory training processes vs. training based mainly on written materials?
- Were training materials generally distributed and used?
- Did extension workers understand training materials fully?
- Did beneficiaries understand fully?

*Aquaculture management and technology*

- Carp polyculture farming as practised in Mymensingh is based on an adopted ancient Chinese technology for fish farming. The technology can be characterised as a high yield system that demands a relatively low input due to the advantages of using different species of carps with different eating habits. By a well-balanced composition of the number of different species and the amount of individuals from each species, the feed and fertilizer offered will be utilized more than once in the system. The drawback of such system however, is that relatively complicated management procedures have to be followed very strictly to obtain profitable results: Were the required management procedures generally followed? Did whether or not this was the case affect intervention impact, either positively or negatively?
- To introduce the polyculture concept in the area fry and fingerlings of eight species of fish have to be available at the right time and in a sufficient amount: To what extent has this been achieved? And have impacts been less where this approach was not followed?
- Some components set out to assist hatcheries and nurseries to meet the demands for fry and fingerling: Was such support sufficient, effective and timely?
- There has in some places been a concern about the quality of fingerlings from hatcheries and nurseries: Can this be documented and what are the consequences?

*Corruption and social favours*

- Have diversions of project money for private use by government officials, project staff or NGOs, payments for the use of jalmohals, payments to middlemen, etc. had a decisive effect on the intervention?
- Have more prominent people in the villages been favoured in the selection of beneficiaries?
- Have people with income or land exceeding the eligibility criteria for entry into the project been allowed to participate anyway and if so has this been at the expense of poorer people?
- Have partner NGOs participated in an open and just tender?
- Did NGOs have to pay, provide money or goods to get their contract?

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## Annex 2 Team Structure

**BCAS**  
Atiq Rahman  
Management

**Lamans**  
George Triantaphyllidis  
Management

**Orbicon**  
Per Møller Jensen  
Management

**S.M. Alauddin**  
Coordination/Social

**Katia Frangoudes**  
Women in Aquaculture

**Bernard Woods**  
Team Leader

**Dwijen Mallick**  
Socio-Economist

**Michael Bech**  
Aquaculture Techniques  
and Fisheries  
Management

**Carsten Schwensen**  
Deputy Team Leader

**Rabeya Rowshan**  
Gender

**Finn Tarp/John Rand**  
Technical Support Team  
(Data and Econometrics)

**Shaymal Barman**  
Aquaculture and Fisheries

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### ***Quality Management & Monitoring***

**Morten Kvistgaard** (Orbicon)  
**George Triantaphyllidis** (LAMANS)

# Bangladesh



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## IMPACT EVALUATION OF AQUACULTURE INTERVENTIONS IN BANGLADESH

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This evaluation focuses on the impact of Danida-supported aquaculture interventions in Bangladesh from 1989 to 2006, with regard to income, living standards, health and women's empowerment. Further, the evaluation contains an analysis of the channels through which these impacts have occurred and of the determinants of change. The evaluation had to work with limited baseline data, and is based on data from available surveys and databases, as well as a number of site visits, workshops, interviews and focus groups discussion.

The overall conclusion of the evaluation is that the Danida-supported interventions successfully achieved their goal: an increase in the value of fish production from aquaculture, and to some extent increased sub-sector employment, resulting in an improvement of the socio-economic position and physical well-being of participating households. In addition, the interventions enabled and supported a period of unprecedented growth in aquaculture production in Bangladesh that affected participants and non-participants alike.

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