

# **Environmental Impacts of Trade Liberalization and Policies for the Sustainable Management of Natural Resources**

A Case Study on Bangladesh's Shrimp Farming Industry



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**A Case Study on Bangladesh's Shrimp Farming Industry**

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## PREFACE

With the recent acceleration of global trade, countries throughout the world have benefited from more investment, industrial development, employment and income growth. Recognising that the benefits of trade can strongly contribute to the improvement of basic living standards, many of the world's developing countries and countries with economies in transition, have sought to actively participate in the global trading regime. For most of these countries, efficient and effective participation in the global economy has required substantial economic restructuring at home. Thus, in recent years, national governments have implemented structural adjustment programmes to stabilise and reorient their economies in order to face the challenges of development. This included in the first instance the restructuring of economies to increase foreign exchange earnings through enhanced trade and trade liberalisation as embodied in the set of agreements of the World Trade Organisation (WTO).

National experiences with structural adjustment programmes have been mixed. Nevertheless, trade liberalisation elements of restructuring programmes have facilitated the rapid growth of targeted export markets, and succeeded in attracting much needed foreign investment to fuel continued economic growth. Recently, however, many undesirable effects of rapid increases in trade have emerged. Affected countries find that inadequately managed economic activities, supporting, or supported by, growing trade, often result in serious environmental degradation. Air, water and soil pollution, and unrestrained natural resource exploitation, grow to levels that jeopardise the viability of the economic activities they support. Trade thereby becomes unsustainable.

The United Nations Environment Programme (UNEP) believes that the potential for negative impacts of trade on the environment can be minimised, if not avoided entirely, by integrating environmental considerations – that complement rather than inhibit trade— into development planning. Over the past two years, UNEP has worked closely with six countries – Bangladesh, Chile, India, Philippines, Romania and Uganda—on comprehensive projects to identify the impacts of trade liberalisation on national environmental resources and the use of economic instruments to sustainably manage these impacts.

These projects have encompassed new action-oriented research on unique trade-related environmental problems and their social and economic implications in diverse sectors and varied country settings. Importantly, projects have involved multi-stakeholder participation in numerous consultations to accurately identify the dynamics of environmental degradation, and to develop innovative and widely acceptable national response strategies. Each study concludes by recommending a set of practical measures—comprising ready-to-apply command and control measures and economic instruments designed to meet national conditions— that promise to effectively halt trade-related environmental degradation, and in turn, ensure that the country's trade remains robust yet sustainable over the long-term. But the projects do not end with published studies, the final component of each country project involves a pilot implementation of proposed measures undertaken by national authorities in collaboration with each project's national team and UNEP.

This report on the shrimp farming industry in Bangladesh, is one in a series of UNEP publications presenting country studies implemented under a first phase of “Capacity Building for Integrating Environmental Considerations into Development Planning and Decision-making” projects funded by the Ministry of Foreign Affairs of the Government of the Netherlands. Other projects in the first round examine the Chilean mining sector, the automotive industry in India, the Philippines' forestry sector, the Romanian water sector and the Ugandan fisheries sector.

As we approach the WTO's Third Ministerial Meeting in Seattle, which may mark the launch of the next round of trade negotiations, this report provides a valuable source of information and knowledge on Bangladesh's experience with the environmental impacts of trade liberalisation and the development of measures to address these impacts and promote sustainable trade and environmental policies.

The complex trade-environment dynamics and innovative strategies to manage emerging environmental problems of the shrimp farming industry in Bangladesh are presented and discussed in detail in this report. The insights that this, and other reports in the series provide, make the series an extremely valuable resource for policy-makers and sectoral practitioners aiming to effectively address the emerging environmental impacts of trade in their own countries.

## ACKNOWLEDGEMENTS

The preparation of this country report on Bangladesh's shrimp farming industry has been made possible by the cooperation and commitment of many individuals and organisations.

The Bangladesh national team—the author of this report—is to be commended for taking the lead in project execution. Led by Debapriya Bhattacharya of the Centre for Policy Dialogue in Dhaka, the team—with members coming from an array of research institutions, non-governmental organisations and national agencies—worked tirelessly to organise national workshops, gather field data, analyse economic and environmental trends, develop policy recommendations, and report on their activities and research results. Additionally, a National Steering Committee was established to ensure the project remained relevant and on-track, and local citizens' groups helped identify emerging environmental problems, elucidate their causes, and elaborate policy responses.

The work of a varied set of national team members, supplemented with inputs from a wide group of national constituents that participated in consultations, was essential in ensuring that diverse cultural and social perspectives were integrated into the project. Indeed, all of these national actors are to be thanked for their genuine interest and commitment in the project, and for the valuable contributions they made to the project's success. In addition, national authorities are to be thanked for their steadfast support of the project's objectives.

The Economics and Trade Unit (ETU), Division of Technology, Industry and Economics (DTIE) of the United Nations Environment Programme (UNEP), was responsible for the overall coordination and management of all six country projects. Through a joint UNEP-UNCTAD (United Nations Conference on Trade and Development) collaboration, René Vossenaar and Veena Jha provided technical guidance and assistance to the national teams on various aspects of their research. International expert meetings further provided a forum for project implementation review by national teams and representatives of relevant international and United Nations organisations. Additionally, critical reviews of draft reports were provided by Theodore Panayotou of the Harvard Institute of International Development and Konrad von Moltke of the Institute of Environmental Studies of Vrije University.

Once the national team had completed their final report, Eugenia Nuñez, Desiree Leon and Rahila Mughal of UNEP worked closely with an external editor, Robert Hamwey, to process the report for publication.

Finally, it must be recognised that like so many international environmental research projects, funding from interested sponsor governments is the key to their existence. UNEP is indebted to the Ministry of Foreign Affairs of the Government of the Netherlands who generously provided the financing that made this project possible.



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# EXECUTIVE SUMMARY

## Chapter I: Environmental Dimensions of Structural Adjustment

### Policies in Bangladesh: The Frame of Reference

The “structural adjustment programmes” (SAPs), promoted by the Bretton Woods institutions, have been instrumental in defining the development strategies of developing countries during last decade and a half. Thus, an appraisal of SAP policy packages in the context of particular countries may constitute an appropriate point of departure for assessing the environmental impacts of countries' revealed development efforts. The outcome of such inquiries may serve as an input for future policymaking with a view to integrating economic and environmental concerns into development strategies.

### Design of SAPs in Bangladesh

During the period 1979-1996, the World Bank's adjustment lending to Bangladesh amounted to US\$ 1.76 billion (i.e., 30 per cent of total ODA commitment to the country). This amount was channelled through fifteen structural and sectoral adjustment credits (SALs and SECALs). Bangladesh was one of the very first countries which took recourse to the Structural Adjustment Facilities (SAF) and Extended Structural Adjustment Facilities (ESAF) of IMF in 1986 and 1989 respectively.

The principal policy instruments of the structural adjustment programmes in Bangladesh included, inter alia, cutbacks in public sector expenditures, reduction of an anti-export bias in the tax structure, tariff rationalisation and overall trade liberalisation, incorporation of flexibility in the exchange and interest rates, privatisation, price decontrol and desubsidisation. Besides macro-economic management, almost all the major areas of the economy including agriculture and manufacturing, energy and communication, finance and trade were targeted for policy shocks under the adjustment package. Thus, the overarching goal of the reform measures under SAPs in Bangladesh was to stimulate the country's growth performance through the creation of a market-based economic management structure reflecting the comparative advantages of the country.

### Outcome of SAPs in Bangladesh

In terms of implementation, a large part of the contemplated policy measures under SAPs has been realised on the ground. However, according to a number of evaluation exercises, the outcome of SAPs in Bangladesh had been, at best, mixed. At the aggregate level, the current accounts deficit and domestic resource balance improved and inflation remained under control. Growth in exports accelerated in the post-reform period, although the commodity base remained narrow. However, a declining trend of the investment rate could not be halted and the savings rate could not be increased. Consequently, restored macro-economic stability in the economy did not translate to micro-level dynamism. At the same time, the social impacts of SAPs in Bangladesh have been judged in a number of studies to be, largely, negative.

## **Environment Issues and SAP in Bangladesh**

With Bangladesh being increasingly exposed to the global economy due to implementation of the adjustment policies, there is a growing apprehension that adjustment policy induced changes taking place in the economy are precipitating adverse environmental impacts. Moreover, as resources switch from non-tradable to tradable sectors of the economy and as major shifts occur in production and cropping patterns in response to the adjustment policies, resource degradation has been manifesting itself as a by-product of this particular pattern of growth.

## **The Trade-Environmental Linkages**

A review of literature on the trade-environment nexus in the context of SAPs suggests that (a) there is a strong substitution effect of adjustment policies favouring the export sector, (b) export-led growth induces structural changes and the concomitant shifts in allocative efficiency and relative prices may result in environmental degradation, and (c) future access of least developed countries (LDCs) to the markets of developed countries will critically hinge on the nature of entwining of trade and environmental factors.

## **Trade-Environmental Nexus: The Bangladesh Case**

Protection of the environment as a policy objective in the context of Bangladesh was first incorporated in the SAP Policy Framework Paper (PFP) for 1990/91-1992/93. Incidentally, the shrimp culture industry in Bangladesh received crucial support from the World Bank when it extended a credit amounting to SDR 20.6 million to Bangladesh for its “Shrimp Culture Project” in 1985. In the project document, it was mentioned that the project could not have any detrimental effect on the environment. But the coastal shrimp farming areas in the south have suffered environmental degradation; increased salinity of soil, canals and the ponds within the polders; reduction in grazing land and a consequent reduction of livestock; destruction of mangrove forests; adverse affects on the potential crop-mix, cropping intensity, crop calendar and the overall cropping pattern in the areas concerned; and a reduction in soil quality. In addition, the shrimp cultivating areas experienced an increase in unemployment and an aggravation of social and economic conflicts and tensions.

## **Framework of the Study**

The objective of the present study is to examine the environmental impacts of trade-related SAP policies, particularly in the shrimp culture industry. It seeks to: (a) analyse the trend and structure of the export-oriented shrimp culture industry in Bangladesh against the backdrop of trade policy reform in the country, (b) undertake a simple cost-benefit analysis to assess the environmental impact of shrimp cultivation, and (c) set forth a policy package for sustainable shrimp culture, integrating environmental concerns and trade expansion objectives. The research methods deployed include literature review; discussion of policy evolution, consequences and intervening factors; interpretation of empirical evidence based on statistical techniques and integration of site/industry specific information. Thus, the study is largely based on secondary data, selectively supplemented by primary evidence.

The graduation of subsistence shrimp culture to an export-oriented activity can be traced back to the period when Bangladesh initiated important policy changes under its structural adjustment programme in the mid-1980s. As is commonly recognised, both productive forces and production relations undergo crucial changes when an economic activity is transformed from one that is subsistence-oriented to one that is market-driven. The emergence of commercial shrimp culture in Bangladesh may be viewed from three vantage points; viz. (a) transition of traditional shrimp

farming into an export oriented activity, (b) the interface between this transition and changes in the policy regime, and (c) environmental implications and consequences stemming from the transformation of shrimp culture activity. The last aspect is critical in view of the fact that open capture fisheries are deemed to be self-producing and self-sustaining, while closed culture fisheries, as commercial shrimp culture tends to be, generates a wide range of externalities which make sustainability an important issue of concern.

## **Chapter II: An Environmental Perspective on Policy Choice**

### **Emergence of Commercial Shrimp Culture in Bangladesh**

Bangladesh is world's fourth largest producer of fish sourced from inland water bodies. Although subsistence shrimp culture had been a constituent of the country's fisheries sector for hundreds of years, shrimp culture as an export-oriented activity is a phenomenon of recent origin. Exports of shrimp from Bangladesh were worth only US\$ 2.9 million in 1972-73, accounting for 1 per cent of the country's total exports. Exports of shrimp increased to US\$ 33 million in 1980 and to US\$ 90.0 million in 1985. However, until the mid-1980s shrimp culture was principally dependent on open-water catches of shrimp. Thus, the culture of shrimp through commercial farming is predominantly a development of the period beginning from the mid-1980s.

The policy initiatives and the incentives, many of which were implemented under the SAP in mid and late 1980s, set the context in which shrimp culture in Bangladesh started to attain the characteristics of a major, export-oriented economic activity. Exports of shrimp registered an increase from US\$ 90.8 million in 1986 to US\$ 197.6 million in 1994 and to US\$ 260.4 million in 1998. A visible shift is discernible in the trend line for shrimp exports during the post-SAP period, reflecting structural changes induced by reform policies.

### **Evolution of the Trade Policy Framework**

The above mentioned structural shift in the export of shrimp from Bangladesh may be explained by a number of factors—policy induced as well as market driven. A closer look at the policy changes under the SAP and the growth of commercial shrimp farming would indicate that there was a strong linkage between the reforms which were implemented under the SAP in Bangladesh and emerging incentives for shrimp culture activity in the country. Fiscal and financial incentives and institutional support provided under the reforms, undertaken in connection with the stabilisation and structural adjustment programmes, played an important role in terms of putting in place a conducive export-friendly environment which stimulated commercial shrimp farming in Bangladesh. Under the reform package the average tariff rates for imported inputs was brought down from 88 per cent to 21 per cent, anti-export bias in the trade and investment regime was substantially removed, and the private sector was encouraged to invest in export-oriented activities.

### **Taking Advantage of the Policy Reforms and Global Opportunities**

Along with the readymade garments (RMG) industry, the shrimp industry in Bangladesh was able to take advantage of the policy changes encouraged by the SAP. Within the overall policy framework of export-led growth, provisions such as zero-tariff access to imports, fiscal incentives for direct and deemed exports, income tax rebates, subsidised credit, leasing of land—both private and khas (government)—on favourable terms, and various institutional supports for setting up downstream factories, together created a policy environment which stimulated private investments in shrimp culture, shrimp processing, and shrimp exports. The provisions of duty drawback, cash

compensation schemes, concessional interest rates etc. stimulated investment in export-oriented activities such as shrimp culture and contributed to their better performance compared to the rest of the manufacturing sector, particularly with respect to labour productivity, capital productivity, capacity utilisation and returns on capital. Increasing returns in the fish processing enterprises promoted upstream activities in the shrimp culture industry of the economy.

The conducive domestic policy environment in this period was also reinforced by emerging global market opportunities. The growing demand for shrimp in high income countries came at a time when (a) there was a significant fall in shrimp production in some of the major exporting countries, and (b) capture of wild ocean shrimp was becoming more expensive and erratic.

## **Profile of Shrimp Farming in Bangladesh**

Bangladesh accounted for 4.1 per cent of global production of commercial shrimp in the mid-1990s (global production at the time was 721 thousand tonnes). The total area of shrimp culture (a major component of coastal aquaculture) in Bangladesh covers about 130 thousand hectares, which is 12.7 per cent of total global area under shrimp culture. The area under shrimp culture registered a three-fold increase over the last decade. The 750 km coastline provides an ideal natural environment for commercial shrimp culture in Bangladesh. Two areas in the south, the Chittagong-Cox's Bazar belt and Khulna, Shatkhira-Bagerhat belt accounts for 95 per cent of total acreage of shrimp culture in the country. Production of shrimp by coastal aquaculture accounted for about 30 per cent of annual shrimp production, while the relative shares of marine capture and fresh water capture were 23 per cent and 47 per cent respectively. The production of shrimp by aquaculture method is a 100 per cent export-oriented activity, taking place in about 9000 farms. While shrimp from fresh water is destined predominantly for the domestic market, a part of the marine capture is also processed in the shrimp processing units operating presently, in the southern regions of the country. The major part of the shrimp exported from Bangladesh is destined for USA (31.8 per cent), Japan (18.3 per cent), Belgium (16.2 per cent) and UK (11 per cent). Shrimp culture in Bangladesh is predominantly carried out by non-local entrepreneurs on leased-in lands. A semi-intensive method of shrimp culture is mainly practised in the country, with an average yield rate greater than 130-250 kg/hectare/annum.

## **Evolving Scenario and Policy Debate**

In recent years, the cultivation of shrimp as an export-oriented commercial activity has come under scrutiny. It is often mentioned that negative externalities generated by commercial shrimp culture, e.g., destruction of the irreplaceable mangrove resources in the south, increasing salinity, declining productivity of land, increasing deforestation, growing landlessness and increasing shrimp industry related violence far outweigh the tangible incremental economic gains. Consequently, some have maintained that shrimp culture runs contrary to the very concept of sustainable development and have, thus, argued that this "global casino" industry based on "blue death" ought to be closed altogether. Those who question the desirability of commercial shrimp farming in Bangladesh have highlighted that the industry has developed without any sensitivity to local knowledge, practices, preferences and resource use. Control over local resources has shifted from communities to external entities. Some have questioned production relations in the fisheries sector, arguing that private property regimes are not the most suitable ones for sustainable management of aquatic resources, including coastal aquaculture.

Conversely, those advocating support for export-oriented commercial shrimp farming are of the view that the industry should be provided with additional incentives in order to induce entre-

preneurs to factor-in environmental concerns and also to enhance their competitive strength in the global market.

However, recognising the negative externalities generated by shrimp culture, in Bangladesh, there is position which maintains that a set of environmental policy instruments may be designed and implemented to ensure that free trade does not lead to externalities that reduce overall welfare. In the absence of appropriate environmental policies and proper enforcement of such policies, conventional estimates of incremental gains accrued from export-oriented activities may overstate the gains to society, which in turn puts a short-term perspective on a phenomenon which inherently has long-term implications and consequences.

## **Policy Choices**

Policymakers are obviously faced with choices concerning the future of shrimp culture in Bangladesh. The choices lie in (a) continuing “business as usual” to the detriment of the environment, (b) closing down commercial shrimp culture at the cost of export deceleration, loss of employment and income as well as other negative socio-economic consequences, and (c) incorporating environmental policy measures in order to strike a balance between short- and long-term benefits as well as private and social welfare.

Obviously, if the third choice turns out to be the most desirable option, then the issue of governing the shrimp industry with environmental policies, incentive systems and a regulatory framework should be the focus of government attention and action. Admittedly, a consultation process, with multi-stakeholder participation, would be critical in better understanding the set related issues that taken alone do not point to feasible and practicable policy solutions. Problems encountered both at the stage of farming as well as at the stage of processing in the shrimp industry must be considered.

## **Chapter III: Export-Oriented Shrimp Culture in Bangladesh: A Review of Evidence on Environmental Implications**

### **Manifestations of Environmental Concerns in Bangladesh**

As the shrimp industry underwent rapid expansion in recent years, voices expressing concern over real and potential adverse impacts and negative externalities of shrimp culture for Bangladesh have been raised with increased frequency. Such concerns have been raised by the following four sources:

- “warning calls” from some of the local NGOs having close links with the international development community, who are actively involved in a global campaign for sustainable development and, more specifically, in the campaign against unregulated expansion of export-oriented shrimp cultivation in other countries (e.g., as Philippines and Thailand);
- “wake-up calls” from political activists, NGO workers and media people from coastal regions of Bangladesh, as negative externalities became increasingly evident following shrimp cultivation over relatively long periods of time (i.e., 4-5 years);
- research studies undertaken to assess and evaluate the socio-economic impact of shrimp culture in the coastal regions of Bangladesh; and
- scientific reports examining to the extent of environmental degradation in particular areas that gave rise to serious concern and alarm.



## **Diverging Views**

The following three strands of opinions can be identified by reviewing the relevant documented evidence:

The first line of argument underscores the environmentally unsustainable character of shrimp culture under the coastal-ecological conditions of Bangladesh. It purports that negative externalities are systemic, endemic and irreversible and, hence, there is a need to impose an outright ban on shrimp cultivation.

The second line of argument highlights the potential benefits of the industry, especially increased income, employment and foreign exchange earning capacity, and maintains that these benefits far outweigh the costs associated with possible negative impacts of shrimp culture;

The third line of argument, whilst not undermining the negative environmental externalities, stresses that the negative environmental impacts of shrimp culture may be satisfactorily addressed through an effective set of policies and instruments.

## **The Emerging Issues**

The concerns raised regarding export-oriented shrimp culture in Bangladesh encompasses political, socio-economic and environmental issues. Some of these are: (a) non-resident entrepreneurs having no motivation to practice sustainable shrimp farming; (b) increased salinity leading to drastic decreases in soil fertility; (c) irreparable damage to traditional economic activities such as cattle grazing, poultry keeping; (d) damage to household vegetation and communal forests; (e) loss of common property rights; (f) increased income erosion and growing income inequality; (g) irreversible damage to the (Sunderban) mangroves and coastal vegetation; (h) irreparable damage to flora and fauna and bio-diversity.

The opposing views generally tend to emphasise the major role of the industry in the economy, pointing out its growing importance as the country's second largest non-traditional export-earning activity. According to this view, the benefits in terms of foreign exchange earnings, incremental employment and income generation far outweigh any short-, medium- or long-term negative externalities. They further underscore that the benefits are not limited to entrepreneurs only; there are substantial multiplier effects that accrue to the local community as a whole.

The role of the Government of Bangladesh (GoB) has figured prominently in the discourse over shrimp cultivation in the country. As is known, the GoB's favourable disposition to shrimp cultivation played a critical role in stimulating entrepreneurial activities in the shrimp industry. At the initial period, the government provided crucial support to the industry in terms of acquisition of land, leasing of khas (government) land to shrimp farmers and providing fiscal and financial incentives in the production and processing of shrimp. When negative environmental impacts gradually emerged, and ecological-environmental concerns precipitated a debate as to the future of the industry, the government initiated a number of measures to contain these negative impacts. These included enactment of laws governing lease of land, designing guidelines for the setting up of shrimp farms, provisions for consent of local farmers in the setting up of shrimp farms, the formation of Shrimp Culture Steering Bodies at national, regional and local (thana) levels etc. However, government regulations have been criticised on the grounds that they are inadequate, weakly enforced and insensitive to environmental concerns.

Four major views with respect to role of the GoB are the following: (a) many of the negative environmental impacts originate because of the government's flawed policies; (b) existing provisions, regulations and laws do not adequately address environmental concerns; (c) weakness of

enforcement has led to the violation of rules enacted by the GoB; and (d) there is a need for a comprehensive shrimp farming policy in Bangladesh which should be designed, implemented and monitored in collaboration with major stakeholders.

## **Chapter IV: Export Oriented Shrimp Culture in Bangladesh: Economic Costs and Benefits of Environmental Consequences**

### **The Approach**

Given the debate regarding environmental impacts of export-oriented shrimp cultivation, a partial cost-benefit analysis has been made to compare the gains and losses from shrimp culture activity. The types of costs, which have been examined are: (a) land degradation due to salinity, (b) health impacts in terms of mortality and morbidity, and (c) mangrove destruction. The benefits are estimated based on the income of the industry received through the export of processed shrimp.

Assigning value to all environmental problems as well as quantification of all economic benefits arising from shrimp cultivation is clearly impossible, either because of lack of data or absence of usable methodology. The exercise done here is based on many critical assumptions and tentative information. These will be discussed in the section on cost and benefit estimation. The reference year used in this study is 1994.

### **Land Degradation: Production Loss**

The total area under shrimp cultivation is estimated to be 145 thousand hectares, which is about 1 per cent of total land area of Bangladesh. About 80 per cent of the total shrimp cultivating area is located in Khulna, Satkhira, Bagerhat, Barisal, Patuakhali, Jessore and Noakhali districts and cultivation of food and cash crops has totally or partially been eliminated in these areas. If agricultural production is to be carried out in these districts using the same level of inputs and similar methods of management, the land-output ratio will not be the same as before the switch to shrimp culture activity. The difference between the outputs during the two periods is the loss in production.

A moderate degree of land degradation, which results in a production loss of 45 per cent, is estimated to cause a loss of 146,160 Mt. of rice in physical terms and Tk 1237.6 million in monetary terms. This is 0.35 per cent of the agricultural GDP and 0.11 per cent of the total GDP of the country in 1994.

### **Land Degradation: Restoration or Reclamation Cost**

Salinisation and water logging can be reversed, and the productivity of land partly restored by reclamation. The main elements of the technology involved here are: (a) installation of deep drains to lower the water table; (b) leaching of salinised areas, requiring the application of non-saline water in amounts considerably in excess of the irrigation requirement; and (c) treatment of sodic soil with gypsum. In Pakistan, soil salinity was reduced from 28 to 40 per cent during 1969-85 using such technologies, and since then 80,000 hectares of lands are being restored to production each year. The cost of such reclamation has been estimated to be US\$ 500. Assuming that the cost would be similar for Bangladesh given the similar socio-economic situations of the two countries, the reclamation cost for degraded land in shrimp cultivating areas (except Chittagong) would be Tk 2331.6 million, which is about 0.22 per cent of the total GDP of the country and 0.66 per cent of the total GDP of the major shrimp cultivating districts.

## **Loss of Livestock**

It has been claimed elsewhere that there has been drastic reduction in the number of livestock owning households following introduction of commercial shrimp culture. Based on the “recall method” among 607 households, it was estimated elsewhere that the rate of reduction in cattle per household is (-) 8.9 per cent per year during this period. This rate has been used in this study to estimate the value of livestock loss. The number of cattle loss in the area under study was 22,792. Taking Tk 4000 as the average market value of the local cattle, the loss of income due to cattle reduction as a result of shrimp cultivation is found to be Tk 91.2 million. This is equivalent to 0.01 per cent of the total GDP of the country and 0.03 per cent of the total GDP of the seven districts in the reference year.

## **Health Impact**

Shrimp cultivation induced water pollution causes premature deaths (mortality) and increases the occurrence and incidence of diseases (morbidity). The economic value of mortality is estimated based on the value of statistical life (VOSL). The VOSL is the marginal willingness to pay (WTP) to reduce the risk of a fatal accident or willingness to accept (WTA) for increased risk aggregated over a large number of people. The cost of morbidity has been estimated in terms of treatment cost and wages lost.

As epidemiological data on water-borne diseases induced by shrimp culture are not available, it is assumed that half of the attacks and deaths due to diarrhoea and dysentery (only water-borne diseases estimated) are due to shrimp induced water pollution.

Adjusting the VOSL in the UK to Bangladesh in proportion to the average income difference between the two countries, the shrimp cultivation induced water pollution mortality cost is estimated to be Tk 925.6 million. This is 0.09 per cent of the total GDP of the Bangladesh and 0.26 per cent of the total GDP of the districts concerned.

The treatment cost is estimated by multiplying the number of morbidity cases with the treatment cost per person. Taka 97.05 per person is taken as the treatment cost following a survey finding. The total treatment cost in this study is estimated to be Tk 4.7 million. Losses because of the workers' absence at work due to illness are equivalent to Tk 3.9 million.

## **Mangrove**

The present study estimates only the direct use value of Chokoria mangrove area which has been totally lost due to salinity and human intervention. The area of this mangrove is 8750 hectares, which is 1.5 per cent of the total mangrove area in Bangladesh (577 thousand hectares) and 0.46 per cent of the country's total forest area (1,908,600 hectares). An annual income could have been earned from the products extracted from the area had it not been destroyed. The GDP contribution of forestry sector was Tk 42,626 million in 1994. Therefore, the amount of annual income lost from this mangrove is Tk 196.1 million. This is 0.02 per cent of the total GDP of Bangladesh in 1994.

Biodiversity benefit from the affected mangrove is valued here only in terms of the value of medicinal plants using estimates from an Indonesian study on the assumption that the same benefit would be derived from Chokoria mangrove area. Taking a net benefit of US\$ 15 per hectare for medicinal plants from mangrove, the total value for the Chokoria mangrove is estimated to be Tk 5.3 million.

## **Benefits of Shrimp Culture**

In 1994, the total value of shrimp export was Tk 13,210 million, which is 10 per cent of total export income and 1.22 per cent of the total GDP in the reference year. Since it is a local resource-based industry, 90 per cent of the income can be taken as the value added and the rest accounted to machinery and other production costs. Therefore, the export earning from shrimp cultivation is Tk 11,889 million, which is 1.1 per cent of the total GDP of the country and 3.39 per cent of the total GDP of the districts where shrimps are cultivated. Admittedly, there is a distributional issue involved with respect to these earnings.

## **Comparison of Costs and Benefits**

A comparison of the costs and benefits of shrimp culture activity is difficult to make at this stage since the estimates of this study are partial and based on a number of assumptions. Nonetheless, an approximation of the costs and benefits is worth estimating for policy-making purposes. The total cost of shrimp cultivation varies from 0.23 to 0.33 per cent of the total GDP in the reference year. This gives a Cost-Benefit Ratio of 0.21 (on a production loss basis) and 0.30 (on a restoration cost basis). In other words, the cost is 21 per cent (production loss) and 30 per cent (restoration cost) of the benefit derived through shrimp cultivation.

## **Social Costs**

Apart from economic costs, various social costs are associated with shrimp cultivation which cannot be measured in monetary terms. Most of the shrimp farms are cultivated by entrepreneurs who are not residents of the area and thus have no social obligations to the area. Area residents who protest against shrimp cultivation are often subject to torture and violence, and even killing. Small and marginal farmers are not allowed to work in the shrimp fields, as the entrepreneurs are afraid of theft of shrimp. Consequently, they have to look for employment somewhere else, often outside the village leaving the family and resulting in family dislocations.

As output from this industry is consumed primarily in export markets, the degradation of the Bangladesh environment in affected regions remains a local externality whose costs go unaccounted for in consumption markets.

As a vulnerable group of the society, women are the most affected victims of environmental degradation. Not only are they engaged in the collection of shrimp fries and the processing of shrimp, but they also have to perform household activities in a degraded environment which poses serious threats to their health. They are also harassed and tortured by the owners of the shrimp farms. Children, on the other hand, miss their classes during the season when shrimp fries are collected. It is maintained that even after accounting for such social costs, the benefits accrued from shrimp cultivation outweigh the costs incurred.

## **Concluding Observations**

As the estimates are not complete, they should be interpreted cautiously when used to make policy interventions. Notwithstanding the partial nature of the estimates, they give an indication of the environmental damage induced by shrimp cultivation and of the benefits deriving from this industry. Though economic gains outweigh the environmental costs, conclusions have to be made carefully because environmental costs are far-reaching, and the impact may be observed later over a long period of time. Moreover, some of the environmental impacts, such as biodiversity loss are irreversible. The value of environmental resources is far greater than any quantifiable amount

since they are essential for human existence. Keeping these limitations in mind one can argue that some of the damages, especially those estimated in this chapter, can be avoided and benefits can be increased with the right type of measures and interventions.

## **Chapter V: Promoting Environment-Friendly Export-Oriented Shrimp Cultivation: Policies and Instruments**

### **Policy Framework for Sustainable Shrimp Culture: The Underlying Premises**

Environmental problems precipitated by export-oriented shrimp cultivation in Bangladesh, as with other types of environmental problems, arise due to market failures, policy failures and institutional failures.

Overcoming the market, policy and institutional failures in shrimp cultivation calls for a judicious mix of market-based and non-market-based measures. Market-based instruments are easier to implement as they often provide fiscal and financial incentives. However, given the limited efficacy of the incentives in certain cases, command-and-control instruments also need to be deployed to effectively address the environmental problems associated with the industry. The policy instruments suggested below for promoting an environmentally sound export-oriented shrimp culture industry includes only price- and technology-related instruments, and exclude quantity-related instruments (e.g., tradable permits) as they do not seem to be appropriate in case of shrimp cultivation in Bangladesh. As the direction of changes in resource use will depend to a large extent on the nature of intervening institutional factors, the roles of the institutions in policy implementation are discussed separately.

### **Economic Instruments and Regulations for Sustainable Shrimp Cultivation**

Bangladesh has traditionally used restrictions and regulations to contain environmental damage resulting from an economic activity. This command-and-control approach gave rise to standards-driven environmental policies that espoused quantitative limitations on levels of pollutants and on levels of resource exploitation. However, the experience of developed countries suggests that mandated environmental standards and technologies may act as a drag on economic growth and costs may be excessive for a low-income economy like Bangladesh.

Thus, the challenge of integrating environmental and economic (sectoral) policies in the context of sustainable shrimp culture may be largely addressed by economic instruments for environmental management. Such instruments motivate behavioural change, inducing differential response by economic agents and allowing them to adjust flexibly to evolving circumstances. Use of economic instruments may also generate financial resources.

This is not say that command-and-control regulations have to be abandoned and replaced by economic instruments altogether, as this is neither desirable nor possible. Accordingly, what has been suggested below entails improving the efficiency and flexibility of existing regulations through selective introduction of economic instruments.

## Market-Based Instruments or Economic Instruments

### Economic Instruments Based on Price Related Measures and Fiscal Incentives

The first group of market-based instruments examined here is price related measures and fiscal incentives. If used properly, price related measures and fiscal incentives can be mutually beneficial to entrepreneurs, workers and the community at large. Three specific instruments, viz. a land use tax, an effluent charge on water pollutants and a Soil Conservation Fund are discussed below.

- *Land Use Tax.* Since there is no tax on agricultural land, it is considered as a free good and, therefore, tends to be misused. This can be reduced through a tax imposed on the users of land for shrimp cultivation. This would make certain land unprofitable for shrimp culture. This measure has relatively low monitoring and enforcement cost and may raise substantial revenue. The revenue earned can be used to finance technological improvements that would reduce shrimp cultivation induced natural resource degradation.
- *Effluent Charge on Pollutants of Water.* The shrimp farms should pay for polluting the water through effluent charges on pollutants containing BOD (biochemical oxygen demand) and COD (chemical oxygen demand) materials. This charge may vary according to the size of the farms in order to account for their varying pollution intensity. Apart from the positive revenue effect, this will provide the entrepreneurs with an incentive to employ more environmentally sound production practices. The revenue raised may be used to construct water treatment plants. The charge rate can be increased gradually over time until prices are corrected.
- *Soil Conservation Fund.* The shrimp farms can be encouraged to conserve lands by providing loans. Loans may be given on flexible terms to shrimp farms for employing environmentally sound technologies to reduce salinity and water logging. However, one needs to take into account that (subsidised) soil conservation loan to finance environmentally sound technologies is not a dynamically efficient instrument, since it might make shrimp culture activities more profitable and induce additional entrants in the industry, thereby giving rise to increased environmental damage.

### Economic Instruments that Promote Appropriate Technologies

The second group of market-based instruments is designed to promote environmentally sound technologies in shrimp cultivation. The technology requirements in shrimp cultivation are mostly indigenous by nature. Two specific, but complementary, means can be mentioned in this regard. These two means are rice-shrimp mix farming and semi-intensive shrimp farming.

- *Rice-Shrimp Mix Farming.* A pilot (model) project may be designed to closely examine the scheme which employs semi-intensive shrimp culture during the first half of the year, and then, during the second half of the year, employs marine/brackish water fin fish culture, sweet water fish culture or rice cultivation, depending on the land type. By encouraging this traditional practice, the long-term gains will be maximised in terms of both productivity and land quality. There may be shared leasing between the crop farmers and the shrimp farmers for the shrimp-rice cultivation cycle. In this practice, since the rice farmers have to maintain the quality of their land to produce rice, they will therefore have to take measures to stop land degradation. Furthermore, the shrimp farmers will have to allow the monsoon sweet water to wash away salinity in the shrimp cultivating lands. It may serve the dual

interests of land owning small farmers and landless poor people of the area. It would also support protection of environment.

- *Semi-Intensive Shrimp Farming.* As a principle, semi-intensive shrimp cultivation should be encouraged with necessary safeguards. A pilot project could seek to understand hydro-morphological land changes associated with this practice, and examine technologies to overcome related problems.

## **Regulatory or Command-and-Control Based Measures**

The command-and-control measures discussed below simply draw on the existing policies and regulations. These measures include land zoning, mandatory forest development, a ban on trawler shrimp catching, licensing, and strengthening of property rights and legal reforms.

*Land Zoning.* There is a tendency for the horizontal expansion of shrimp farming which is responsible for destruction of mangrove forests and agricultural lands. There should be definite guidelines for use of the resources of brackish water areas for the cultivation of marine and fresh-water shrimp, as well as other suitable species of shrimp and fish. Criteria for selection should be based on topography, tide fluctuations, salinity, soil quality, etc. The government, referring to an extensive survey of the geographical and environmental features of current shrimp culture locations, should decide which areas remain suitable for shrimp cultivation. Accordingly, there should be clear area demarcations and land zoning for shrimp cultivation with a view to minimising the conflict between shrimp culture and agriculture and ensuring protection of the environment.

*Licensing.* Licensing of shrimp farms should be reintroduced. This will help to control the indiscriminate and unplanned expansion of shrimp cultivation.

*Mandatory Forest.* It should be made mandatory for the shrimp cultivators to develop a green belt of mangrove forest to maintain the biodiversity of the area. It should be at least 30 per cent of the total cultivated area. It will maintain the aquatic and plant diversity of the coastal area. Tradable mangrove conservation obligations may be introduced and developed.

*Ban on Trawler Shrimp Catch.* Trawlers contribute to only 3.5 per cent of total shrimp production and they catch mainly mature and gravid shrimp. Shrimp catch of trawlers should be banned to increase the supply of broods for hatcheries and to enhance the productivity of the natural breeding cycle.

*Strengthening of Property Rights.* Land use rights favouring local people are one of the prerequisites for sustainable shrimp culture activity. At present khas government lands are leased out to the shrimp cultivators on flexible terms, leading to inefficient use of land. Expanded programmes in land registration and titling are needed to clarify property rights. Adequate compensation for those people losing lands to shrimp cultivation should be ensured. The government can introduce a minimum cost for per-unit leasing of agricultural land for shrimp farming.

Securitisation of property rights will reduce institutional constraints that prevent “buy-outs” or prevent the mixing of shrimp and rice farming activities. Strengthening of security rights may also be also attractive for equity reasons.

*Legal Reforms.* Apparently, there is no shortage of policies or regulations directly concerned with the environmental impacts of shrimp cultivation. These include, the Fish Act (1950), the Shrimp Mohal Management Policy (1992), the Tiger Shrimp Cultivation and Pond Regulation Policy for Bagerhat District (1993), the Shrimp Cultivation Tax Act (1992) and the National Fish Policy. Documents such as Bangladesh Environment Conservation Act (1995), the National Environ-

ment Management Action Plan (NEMAP), the National Conservation Strategy, etc., also have relevance for developing sustainable shrimp culture.

Most of these policies and regulations are never implemented properly. Often there is an absence of necessary supportive legislation. At the same time, relevant rules have not been formulated as provided for under these policies. Thus, there is a need to review all of these documents and come up with a comprehensive law (e.g., Sustainable Shrimp Culture Act) which encompasses all aspects of the activity.

## **Institutional Initiatives for Sustainable Shrimp Culture**

Currently, a plethora of public agencies are involved in one way or another in regulating shrimp culture in Bangladesh. These include the Ministry of Fisheries, the Ministry of Land, and the Ministry of Forests and Environment. While the Ministry of Industries is involved in the shrimp processing phase, the Ministry of Commerce deals with exports of shrimp. Scientific and technological support with respect to shrimp cultivation is supposed to be forthcoming from Fisheries Research Institute (FRI), Bangladesh Agricultural University (BAU), and Khulna University. Law enforcement agencies are quite often involved in mitigating shrimp cultivation related violence.

Besides public institutions, a host of private bodies and NGOs are actively engaged in the industry. The Bangladesh Frozen Food Exporters Association (BFFEA) is the most representative trade body of industry entrepreneurs. The NGOs (e.g., Nejera Kori) and the political parties are involved in mobilising the small and marginal cultivators, as well as landless labourers, to protect land rights, and limit growth of the shrimp cultivation industry.

Against the background of the overall problem of governance, the inter-dependence and complementarity of these institutions may be achieved through a tripartite initiative involving the government, the private sector and NGOs. For such an initiative to yield results, the Department of Environment has to emerge in a leading role, whereas the private sector has to commit itself to a socially responsible (environment sensitive) code of conduct. Last but not the least, the local community should be involved through a social mobilisation process which may be catalysed by the NGOs.

If undertaking a pilot scheme on sustainable shrimp culture under a tripartite initiative seems to be a difficult exercise, the proposed joint initiative may launch a voluntary eco-labelling project that may ensure quality standards at all levels of production and protect the country against possible loss of its overseas market due to a poor image of the Bangladesh shrimp industry.

Concurrently, building social institutions like schools, health care centres for the local people near the ghers and ensuring sanitary and safe drinking water facilities in the areas is an important task. Also, there should be some provisions to ensure that the shrimp farms employ the majority of their workers from the locality. It will decrease social tensions and rising unemployment caused by the loss of land to shrimp cultivators.



# Chapter I

## Environmental Dimensions of Structural Adjustment Policies in Bangladesh: The Frame of Reference

### 1.1 Bangladesh's Experience with Structural Adjustment Programmes

The current consensus view of a close interdependence between environment and economy has prompted national decision-makers to more closely examine the links and variables behind the country's sustainable development policies. Such a view has generated a demand for designing policy responses that can better ensure environment-economy dynamics are factored into mainstream development plans.

Against the background of attempts to restructure least developed country (LDC) economies through sets of wide ranging reforms, concerns relating to environment-development dynamics have also begun to command attention in LDCs (See for example UNCTAD 1998, Part two, Chapter 4). Therefore, the imperative to assess the environmental impact and implications of new economic policy regimes currently figures prominently in the developmental agenda and discourse of these low-income economies.

Notwithstanding the above, environmental dimensions of development issues are still in need of further articulation in LDCs, since little is known about the actual nature of the environment-growth linkages within the contextual realities of this group of countries. Until now, there had been little research on such issues in most of the LDCs, Bangladesh included, to identify the environmental impacts of development policy designs and to develop corrective interventions to be integrated into future development plans.

The "structural adjustment programmes" (SAPs), promoted by the Bretton Woods institutions, had been instrumental in defining the development strategies of developing countries during the last one and half decades. Thus, appraisal of SAP policy packages in the context of particular countries may constitute an appropriate point of departure for assessing the environmental impacts of revealed development efforts. The outcome of such inquiries can serve as an input for future policy making.

### Design of SAPs in Bangladesh

As is well known, since early 1980s, stabilisation and structural adjustment programmes were implemented in many LDCs with financial and technical assistance of the World Bank (WB) and the International Monetary Fund (IMF). It can be safely said that since the mid-1980s Bangladesh's development strategy was broadly defined by, and closely guided under, the economy-wide framework of *stabilisation and structural adjustment policies* advocated by the Bank and the Fund (see Bhattacharya 1995).

Bangladesh was one of the very first countries (among a total of 36) which undertook economic reform measures in March, 1986 under the aegis of the Structural Adjustment Facilities (SAF) of the IMF. Bangladesh was also among the forerunners (among 29 countries) in the use of Extended SAF (ESAF) which was launched by IMF in June 1989. Throughout the 1980s and early 1990s, Bangladesh also obtained policy conditionality based structural adjustment credits from the

WB in support of sectoral reform packages. During the period 1979/80-1995/96, the World Bank's adjustment lending to Bangladesh amounted to US\$ 1.76 billion, or about 30 per cent of total ODA commitments to the country. Fifteen structural and sectoral adjustment credits (SALs and SECALs) which were extended to Bangladesh by the Bank related to the industrial export, energy, financial and jute sector development, and public resource management (see Bhattacharya and Titumir 1998).

The principal policy instruments of the structural adjustment programmes in Bangladesh included, *inter alia*, cutbacks in public sector expenditures, reduction of an anti-export bias in the tax structure, tariff rationalisation and overall trade liberalisation, incorporation of flexibility in the exchange and interest rates, privatisation, price decontrol and desubsidisation. The policy package essentially comprised of *demand management, resource switching and institutional reform* measures. Besides macro-economic management, almost all the major areas of the economy including agriculture and manufacturing, energy and communication, finance and trade were targeted for policy shocks under the adjustment package. Thus, the overarching goal of the reform measures under SAPs in Bangladesh was to stimulate the country's growth performance through the creation of a market-based economic management structure reflecting the comparative advantages of the country. An infusion of enhanced competitiveness in the economy was supposed to advance this objective and succeed in increasing the efficiency of economic sectors.

### Outcome of SAPs in Bangladesh

According to a number of evaluative exercises (e.g., Rahman 1992; Mujeri *et al* 1993; Sobhan 1995), the outcome of SAPs in Bangladesh had been, at best, mixed. In terms of implementation, a large part of the contemplated policy measures under SAPs in Bangladesh has been realised on the ground. The economy is now notably more market driven: interest rates are largely market determined and the financial sector has been decontrolled; the exchange rate is fixed through a managed float and the national currency (*taka*) has been made partially convertible in the current account; the tariff rates had been significantly reduced and rationalised, most of the agricultural subsidies including those on fertiliser and other inputs had been either withdrawn or significantly diminished; a large number of state-owned enterprises have been earmarked for privatisation, while some have already been divested.

As a result of implementation of the SAPs in Bangladesh, at the aggregate level, the current accounts deficit and domestic resource balance improved and inflation remained under control. However, the declining trend of investment rate could not be halted and savings rate could not be increased; consequently, the growth rate continued to stagnate. In other words, the macro-economic stability achieved in the country could not transmit enough dynamism to the micro (firm) level. Nevertheless, one important redeeming feature of the outcomes of SAPs in Bangladesh relates to enhanced vibrancy in the country's exports (see Bhattacharya 1995).

The social impact of SAP in Bangladesh has been judged to be largely negative (see Rahman and Ali 1993; CIRDAP 1993, Bhattachaya and Titumir 1998). Such impacts have been attributed to, among others, changes brought about in the volume and composition of the public expenditures under SAPs. Certain "soft sectors", such as health and education have been adversely affected due to public expenditure reduction policies. Furthermore, provision for "safety net" programmes for vulnerable groups were inadequate for mitigating the social costs of SAP implementation. It has been also argued that the income distribution has become more skewed, while a limited member of people benefited from the export promotion.

While economic and social impacts of SAPs in Bangladesh have been examined in a number of studies, not a single study to date has ventured to explore the environmental dimensions of the structural adjustment programmes or related trade liberalisation.

## 1.2 Environmental Issues and SAPs in Bangladesh

With Bangladesh being increasingly exposed to the global economy due to implementation of the adjustment policies, there is a growing apprehension that adjustment policy induced changes taking place in the economy are precipitating adverse environmental impacts. Moreover, as resources switch from non-tradable to tradable sectors of the economy and as major shifts occur in production and cropping patterns in response to the adjustment policies, resource degradation has been manifesting itself as by-products of this particular pattern of growth.

### Trade-Environmental Linkages

The trade-environment linkages could be looked at from three vantage points. *First*, the environmental implications may first appear as fall-out of growth process, which if not tackled adequately may undermine the sustainability of the growth process itself. *Second*, environmental issues are increasingly being monitored by developed countries and can seriously jeopardise global market access of certain developing country export products, thereby seriously undermining the efficacy of export-led growth strategies. *Third*, there is an increasing realisation that future economic and structural reforms and growth strategies must be designed and implemented by integrating social and environmental concerns into them.

A review of literature on the trade-environment nexus in the context of SAPs suggests that (a) there is a strong substitution effect of adjustment policies favouring the export sector, (b) export-led growth induces structural changes and the concomitant shifts in allocative efficiency and relative prices may result in environmental degradation, and (c) future access of least developed countries (LDCs) to the markets of developed countries will critically hinge on the nature of entwining of trade and environmental factors (UNEP 1996).

Thus, putting in place a stable macroeconomic framework, the cornerstone of SAP philosophy, while being considered necessary, is no longer deemed sufficient from the perspective of *sustainable development*. There is a growing concern that these policies could lead to serious and diverse environmental impacts depending on the underlying incentives, market structures and conditionalities.

### Trade-Environmental Nexus: The Bangladesh Case

As mentioned earlier, several studies have been carried out in Bangladesh on the impact of SAPs on overall macroeconomic performance. Social and equity impacts of SAPs have also been dealt with in some detail in a number of research works. However, any rigorous study on the environmental impacts of SAPs is virtually absent in Bangladesh.

In fact, the issue of environmental concerns did not figure at all in the SAP initially designed for Bangladesh. Protection of environment as a policy objective in the context of Bangladesh was first incorporated in the SAP's Policy Framework Paper (PFP) for 1990/91-1992/93. The strategies and measures mentioned in this regard included preparation of environmental impact assessment for major new projects during the country's fourth Five Year Plan period (1992-1997), streamlining the capacity of Ministry of Environment and Forests to direct environmental policy, and review and modify pricing and administrative procedures affecting the use of natural resources to reflect sound economic principles.

Incidentally, shrimp culture in Bangladesh received crucial support from the World Bank when it extended a credit amounting to SDR 20.6 million (SDR: *special drawing right* is an international reserve asset created by the IMF; one SDR = 1.33 US\$ in 1998) to Bangladesh for "Shrimp Culture Project" in 1985. In the project document, it was mentioned that "*the project could not have any detrimental effect on the environment. Intensification of shrimp culture would*

*take place only in areas where it already exists. Neither the existing land-use pattern nor the present ecological balance would be changed. Positive effects would be achieved through the elimination of salt water seepage into adjacent agricultural land, by the construction of appropriate boundary embankments, and by efficient and timely water exchange to block out salt from soils for paddy cultivation. The further spread of extensive shrimp-farming operations into agricultural and forest lands would be counteracted by the revision of Government policies on salt-water intake, the leasing of public lands and by demonstrating the financial rewards of intensified shrimp culture. The project would not cause harm to other riparian States nor would it be harmed by the use of water by other riparian States” (World Bank 1985). As will be shown later, such an optimistic assessment of the project was not vindicated by the realities on the ground. However, the World Bank has subsequently, taking into cognisance the negative environmental impacts of shrimp culture, incorporated mitigating measures in its later projects, e.g., *Third Fisheries Project*.*

Subsequently, commercial culture of shrimp expanded at a rapid rate driven by a conducive policy environment within the country and emerging opportunities in the global market. With the expansion of shrimp culture in Bangladesh, concerns were articulated regarding possible negative externalities and impacts that such commercial activity may have on the natural environment in shrimp farming areas. Some of these concerns drew attention to the following:

- the coastal areas in the south (where commercial export-oriented shrimp culture has mainly expanded) have suffered environmental degradation;
- shrimp culture has increased the salinity of soil, canals and the ponds within the polders;
- higher salinity levels have reduced the land area available for grazing and, consequently, the scarcity of fodder has led to a reduction of livestock;
- there had been destruction of mangrove forests in land leased for shrimp culture in the coastal belt of Chittagong because of high salinity;
- shrimp culture has adversely affected the potential crop-mix, cropping intensity, crop calendar and the overall cropping pattern in the areas concerned;
- slower decomposition of rice roots in shrimp-cum-paddy fields has reduced soil quality and increased the prevalence of 'stem root' virus;
- greater water exchange for shrimp culture has increased the rate of salinisation in the fields which may, in the long run, reduce possibilities for the coexistence of flooded rice and shrimp culture and subsequently give rise to water management problems.

Some have argued that many of the negative impacts could have been avoided or at least contained had there been an articulated comprehensive policy by the Government of Bangladesh (GoB) incorporating environmental concerns, rather than leaving the development of the industry exclusively in the hands of private entrepreneurs.

### **1.3 Framework of the Study**

In the aforementioned context, the major objective of the present study is to examine the environmental impact of trade-related SAP policies, particularly on shrimp culture.

Concretely, the study seeks to do the following.

- (a) To review the relevant literature on export-oriented shrimp culture with particular reference to its impact, in the context of the SAP, on the economy, environment and social fabric of the local community;
- (b) To analyse the trend and structure of export-oriented shrimp culture in Bangladesh against the background of trade policy reforms in the country;

- (c) To undertake a simple cost-benefit estimate to assess the environmental impact of export-oriented shrimp culture in Bangladesh;
- (d) To evolve a policy package for sustainable shrimp culture, integrating environmental concerns and trade expansion objectives.

The research methods deployed in the study include the following:

- (a) historical account—discussion of policy evolution, consequences and intervening factors;
- (b) analytical approach—interpretation of empirical evidence based on statistical techniques;
- (c) case studies—integration of site/industry specific information.

Thus, the study is largely based on secondary data, selectively supplemented by primary evidence. Various published sources (national and international) were consulted to give shape to the conceptual issues and leading hypotheses. Since country level data on the related issues are scarce in Bangladesh and available data lack consequential correlation with SAP policies, information has to be elicited from concerned government officials, NGO activists, farmers, entrepreneurs and other stakeholders through structured debriefing and focus group discussion. Cost-Benefit Analysis was carried out in order to identify and capture the major variables and their relationships. However, exercises done elsewhere have shown that it is quite difficult to provide quantitative expression for environmental impacts of SAPs, not to say components of them, e.g., trade policies.

The paper is divided into five chapters, Following the introductory chapter (Chapter I), Chapter II focuses on the evolving structural features of export-oriented shrimp cultivation from an environmental perspective. Chapter III reviews the available literature on shrimp culture in Bangladesh and highlights the environmental concerns voiced in these documents. An exercise involving estimation of costs and benefits from environmental perspective of shrimp cultivation has been presented in Chapter IV. In the final chapter (Chapter V), a set of policies has been identified keeping in mind the prospect of developing an environmentally sound export-oriented shrimp culture industry in Bangladesh.



## Chapter II

### Export-Oriented Shrimp Cultures in Bangladesh: An Environmental Perspective on Policy Choice

#### 2.1 Introduction

This section focuses on the interface between the trade policy and environmental issues as manifested in the export-oriented shrimp industry of Bangladesh. It is generally well recognised that both productive forces as well as production relations undergo important changes when trade is introduced, and commercialisation replaces erstwhile subsistence modes of production and traditional farm practices. The shrimp industry of Bangladesh is no exception in this respect. The graduation of subsistence shrimp culture in Bangladesh to an export-oriented industry can be traced back to the period when Bangladesh initiated and implemented important policy changes as part of its structural adjustment program (SAP). It has been observed in many countries that the process of adjustment and transition from regulated to market-driven economic management has often induced negative impacts, warranting intervention at macro/micro policy level as well as at implementation level.

In case of export-oriented shrimp industry of Bangladesh one such negative impact had been attendant environmental impacts as the industry evolved from one based on subsistence level of farming to commercial farming. The present section presents the perspective on the link between the SAP and environmental impacts as they relate to export oriented shrimp industry of Bangladesh at three levels of aggregation. These are as follows:

- (a) transformation leading to export-orientation;
- (b) trade policy in the SAP package inducing this graduation; and
- (c) environmental impacts stemming from this graduation.

#### 2.2 Emergence of Commercial Shrimp Culture in Bangladesh

Bangladesh is world's fourth largest producer of inland fish. The fisheries sector accounts for 3.5 per cent of GDP and contributes about 10.4 per cent of gross value in the agriculture sector. About 8 per cent of the total population in Bangladesh depends on the fisheries sector for livelihood and 73 per cent of households are involved in subsistence fishing in the flood plains (Asaduzzaman and Toufique 1998). Subsistence shrimp culture has been a constituent part of the country's fisheries sector for hundreds of years. In contrast to traditional fish culture, coastal aquaculture involving production of shrimp on commercial basis is a relatively new development in Bangladesh. One of the reasons why this particular type of farming has come under close scrutiny on a global scale is that whilst *open (capture)* fisheries are generally deemed to be self-producing and self-sustaining, *closed (culture)* fisheries need direct use of inputs and human care, involves property rights and, whilst being renewable, generates a wide range of externalities which makes sustainable development a critically important issue (Asaduzzaman and Toufique 1998).

Exports of shrimp from Bangladesh were worth only US\$ 2.9 million in 1972-73, which accounted for less than 1 per cent of total exports from the country in that year. In late 1970s and early 1980s, encouraged by global demand for shrimp coupled with an upward trend in the unit

price, led to the emergence of a shrimp export business. Thus, exports of shrimp from Bangladesh increased to US\$ 33 million by 1980 and to US\$ 90 million by 1985. This increase, however, was spurred mainly by open water catches of shrimp.

Culture of shrimp as an exclusively export-oriented activity based on commercial farming of shrimp is predominantly a development of the late 1980s. During this period Bangladesh, through a number of policy initiatives and incentives, made an active effort to shift from an inward looking development strategy characterised by a high degree of regulation and controls on international trade, to a strategy that favoured investment in export-oriented activities. This set the context whereby the private sector was encouraged to enter in a big way into commercial shrimp culture. Like the readymade garments (RMG) industry, the flagship export industry of Bangladesh, there was an opportunity to translate the comparative advantages of the country, natural resource and cheap labour in this case, into enhanced export earnings. Just as market quotas under the Multi Fibre Arrangement (MFA) generated the initial impetus in the development of the RMG industry in Bangladesh, here also production fluctuations in some of the traditional shrimp producing countries of the south-east Asia provided Bangladesh with initial market opportunities. An incipient private sector in Bangladesh, that was being gradually freed from a regime of control and regulation by the World Bank-IMF induced structural and sectoral adjustment programmes, successfully took advantage of the emerging situation. This historical confluence of external and domestic factors was critical to the take-off of export-oriented shrimp culture in Bangladesh.

### 2.3 Evolution of the Trade Policy Framework

Export-oriented shrimp has expanded from a US\$ 10 million business in 1975 to US\$ 77 million in 1985, and subsequently to a US\$ 260 million business in financial (FY) 1998. Over the last decade, the industry has registered a robust growth rate of about 9 per cent per annum (in dollar terms). Excepting the readymade garments industry, no other industry in Bangladesh has been able to match such performance. The high growth of export-oriented shrimp culture in the country may be explained by trade policy reform measures which had been carried out in Bangladesh during the corresponding period as a part of the SAP package. These policies, pursued by three successive governments, have indeed evolved through three phases in terms of their width, depth and intensity.

The *first phase*, covering the period between 1981 and 1986, witnessed a number of steps towards liberalisation of the import regime, including a shift from “positive” to “negative” lists of import control, an expansion of export performance benefits and the institution of duty drawback facilities to stimulate the export sector. In the *second phase*, during 1987 to 1991, trade policy reforms were able to remove a major part of the quantitative restrictions (QRs) on imports, significantly reduce anti-export bias through tariff rationalisation and offer export-oriented activities important concessions and incentives by way of zero tariffs for accessing imported inputs and making available subsidised credit. The *third phase* coincided with the comprehensive stabilisation and reform program which Bangladesh began implementing in 1992. The reforms under the SAP were different from the preceding attempts in a number of ways. While the reforms in the 1980s were limited in nature, the measures undertaken in connection with the SAP were more comprehensive. Fiscal, financial and institutional policies and incentives, which were a constituent part of the conditionalities under the stabilisation and the structural adjustment programme, contributed to putting in place an economic environment embodying an export conducive regime. Table 2.1 depicts some of the basic trade policy parameters in the pre-and post reform periods. The table shows for example, the average import-weighted tariff rates in Bangladesh were brought down from 88 per cent to 21 per cent, an anti-export bias was substantially removed and the private sector was encouraged to take up export-oriented activities.



TABLE 2.1

## Changes in Trade Related Policies: Pre- and Post-SAP Period

Trade Related Area	Pre-Reform (1990-91)	Post-Reform (1995-96)
Nominal Protection		
<i>Unweighted</i>	88.6 per cent	24.6 per cent
<i>Import weighted</i>	42.1 per cent	21.0 per cent
Highest Tariff Rate	350.0 per cent	50.0 per cent
Quantitative Restrictions (number of commodities at 4 digit level)	239	114
<i>for trade reasons</i>	179	23
<i>for non-trade reasons</i>	60	91
Provision for Import	Through "Positive List"	Through "Negative List"
Advance Income Tax Deduction on Export Earnings	0.50 per cent of Export Income	0.25 per cent of Export Income
Cash Compensation Scheme (per cent of local value addition)	15.0 per cent	25.0 per cent
Operative Tariff on Imports of Capital Machinery for Export Oriented Sectors	7.5 per cent	0.0 per cent
Duty Drawback Rate	Differentiated Rates of Rebate	Flat Rates of Rebates for a Large Numbers of Imported Inputs Direct as well as Deemed Exports
Eligibility for Duty Drawback	Direct Exports	Exports
Interest Rates on Bank Loan to Export Oriented Sectors	8.0-12.0 per cent	8.0-10.0 per cent

Source: Collated from World Bank (1996), Bangladesh Bank (1998), Rahman (1995), NBR (1998), GOB GoB (1996).

## 2.4 Taking Advantage of Policy Reforms and Global Opportunities

Besides the readymade garments industry, the other non-traditional activity in Bangladesh, which took advantage of the emerging export-friendly policies spurred by the SAP, was the shrimp industry. Within the overall policy framework of an export-led growth strategy, a number of fiscal, financial and institutional supports for setting up downstream factories in the industry created a policy environment that stimulated private investments in *shrimp culture, shrimp processing, and shrimp exports*. These measures included provisions for zero-tariff access of imports, fiscal incentives for direct and deemed exports, income tax rebates, speedy customs clearance, cheap credit and land lease of both private and *khas* (government) land in favourable terms. These changes in policy framework were instrumental in triggering a breakthrough in this non-traditional export-oriented industry. It was earlier mentioned that Bangladesh is the world's fourth largest producer of freshwater fish. However, production and marketing characteristics of aquaculture and the marine shrimp industry as commercial activities, are quite distinct from, and more demanding, than those of traditional pisciculture servicing domestic demand. The SAP related reforms provided the crucial initial policy support in bringing about this transition in the country's fisheries sector and subsequently, putting the sector on a trajectory of high growth.

Thus, under the SAP induced reforms, the anti-export bias in the economy, which had earlier inhibited investment in export-oriented activities, was to some extent reduced. Management of export-promotion schemes also underwent some improvement. For example, the duty drawback scheme was modified by introduction of standard schedule of *flat rates* for a number of imported inputs, which greatly facilitated import of inputs, by the export-oriented sectors. Duty drawback was extended to indirect exporters using inland letters of credit, and the facility was extended to direct as well as deemed exporters. The concessional interest rates for credit to the export sectors were in the range of 8 to 10 per cent per annum, compared to 10 to 14 per cent for other sectors. Such policies contributed to the better performance of the export-oriented sector compared to the rest of the manufacturing sector, particularly with respect to *labour productivity*, *capital productivity*, *capacity utilisation*, and *returns to capital* (World Bank 1996). The fish and seafood sector figured prominently in terms of all these indicators. Revealed profitability of the fish processing industry in Bangladesh, understandably, promoted upstream activities in the country's shrimp culture industry.

Commercial shrimp farming in Bangladesh also got a crucial break with the implementation of the World Bank/UNDP investment programme of Tk. 1000 million (US\$ 30.0 million) in the late 1980s and early 1990s which helped furnish Bangladesh's prawn industry with infrastructure, technology and foreign advice. The government also contributed with a number of incentives covering amendments to land-lease laws, subsidised credit and a nine-year tax holiday.

TABLE 2.2

## Trend in Exports of Shrimp from Bangladesh

Item	FY1981	FY1986	FY1991	FY1994	FY1997	FY1998
Export of Shrimp						
<i>Value</i> (mn. US\$)	33.6	90.8	127.9	197.6	279.2	260.4
<i>Quantity</i> (thousand tonnes)	7.5	17.2	24.1	25.2	25.8	18.9
Share of Shrimp in Country's Total Export (per cent)	4.7	11.1	7.8	7.8	6.3	5.1

*Source:* Computed from Export Promotion Bureau data.

The conducive domestic policy environment in this period was reinforced by the emerging global market opportunities with growing demand for shrimp in high-income countries. The growth in global demand came at a time when the capture of wild ocean shrimp was becoming more expensive and erratic, and there was a fall in production in some of the major producers in the neighbouring countries to the east of Bangladesh. Per unit price of shrimp exported from Bangladesh registered a rise from US\$ 2.4 per lb. to US\$ 4.5 per lb. between mid-1980s and mid-1990s, and, consequently, the unit price reached US\$ 6.3 per lb. in March 1998. The per unit price of shrimp exported by Bangladesh came down to US\$ 5.6 per lb. in early 1999. If the volatility in the value of U.S. dollar is accounted for, it would be evident that Bangladeshi exporters faced a high degree of fluctuation in shrimp prices in international markets.

Exports of shrimp from Bangladesh increased from US\$ 91 million in FY1986 to US\$ 280 million in FY1997 (see Table 2.2). During the corresponding period, the quantity of shrimp exports increased from 17.2 thousand tonnes to 25.2 thousand tonnes (however, its share in total export earnings decreased from 11.1 per cent to 7.8 per cent. Mostly because of the faster rate of increase in the RMG exports from Bangladesh over the same period. The exports of shrimp from Bangladesh registered some decrease in FY1998, from US\$ 279.2 million to US\$ 260.4 (the corresponding quantity of exports decreased from 25.8 thousand tonnes to 18.9 thousand tonnes) mainly because of the temporary ban on imports of shrimp from Bangladesh to the EU market in

1997. The ban was enforced on the ground of non-compliance with EU hygienic standards. Although the ban was subsequently withdrawn, Bangladesh has not yet been able to fully recover from this setback. Exports of shrimp during the first seven months (July-January) of FY 1999 was equivalent to US\$ 146.6 million (11.8 thousand tonnes) compared to US\$ 181.1 million (13.0 thousand tonnes) over the corresponding period of FY 1998.

## 2.5 Profile of Shrimp Culture in Bangladesh

As Table 2.3 shows, Bangladesh accounted for 4.1 per cent of global production of commercial shrimp in 1995 (30 thousand tonnes out of global production of 721 thousand tonnes). Culture of shrimp on commercial basis is carried out in 50 countries that cover an area of more than one million hectares. Moreover, 80 per cent of such shrimp aquaculture is carried out in Asian countries. Thailand, Indonesia, China and India are the major shrimp producing countries of Asia (see Table 2.3). In 1995, total shrimp area of Bangladesh under coastal aquaculture was about 130 thousand hectares, which was 12.7 per cent of total global area under commercial shrimp culture in the corresponding year.

The area under shrimp cultivation in Bangladesh has registered a three-fold increase over the last decade. Two southern regions of Bangladesh, Chittagong-Cox's Bazar and Khulan-Shatkhira-Bagerhat, covering about 103 thousand hectares, account for 95 per cent of the area under shrimp culture in the country (Table 2.4). The 750 kilometres of coastline in Bangladesh to which these two areas predominantly belong provide a favourable environment for shrimp aquaculture on commercial basis.

TABLE 2.3

### Bangladesh in Global Commercial Shrimp Production, 1995

Country	Production (bn tonnes)	Percent of Production	Area under Production (1000 hectares)	No. of Farms
Thailand	220.0	31.0	90.0	20,000
Ecuador	100.0	14.0	125.0	1,900
Indonesia	80.0	11.0	300.0	4,000
China	70.0	10.0	13.0	6,000
India	60.0	8.0	80.0	5,000
Vietnam	50.0	7.0	225.0	2,000
Bangladesh	30.0	4.0	130.0	9,000
Mexico	12.0	2.0	14.0	250
Columbia	11.0	2.0	3.0	30
Others	88.0	12.0	42.0	2,188
<b>Total</b>	<b>721.0</b>	<b>100.0</b>	<b>1022.0</b>	<b>50,368</b>

Source: Aftabuzzaman (1998).

Production of shrimp in Bangladesh is carried out by various methods. As can be seen from Table 2.5, production of shrimp by coastal aquaculture accounted for about 30 per cent of annual shrimp production in Bangladesh in recent years. By comparison, the relative shares of marine capture and fresh water capture were 23 per cent and 47 per cent respectively. Shrimp produced by aquaculture method is a 100 per cent export-oriented activity in Bangladesh. A part of the marine capture is also processed for exports. Shrimp from fresh water capture is predominantly destined for the domestic market.

It is to be noted here that global consumption of farm raised shrimp increased from 3 per cent in the mid-1980s to 30 per cent in the mid-1990s. The expansion of global production and hence exports of shrimp produced through aquaculture can be explained by this remarkable increase in global consumption. Consumption of shrimp in USA and Japan increased by 40 per cent and in Europe by 100 per cent over the corresponding period (Clay 1996). It is to be noted that Bangladeshi producers have demonstrated a remarkable capacity to access this enhanced market opportunity. Between 1990 and 1995, shrimp produced through coastal aquaculture in Bangladesh registered a growth of about 60 per cent (Department of Fisheries 1995). As evidenced by Table 2.6, most of this export was destined for US and EU markets—accounting for 32 per cent and 47 per cent of the total exports respectively.

TABLE 2.4  
Shrimp Area Statistics of Bangladesh  
(hectares)

Districts	1983-84	1987-88	1994-95
Chittagong & Cox's Bazar	19,531	24,755	29,717
Khulna, Satkhira & Bagerhat	31,817	68,363	103,998
Jessore	422	690	626
Patuakhali	42	64	246
Noakhali	-	26	75
Barisal	-	112	3,095
Dhaka Division	-	-	239
<b>Total</b>	<b>51,812</b>	<b>94,010</b>	<b>137,996</b>

Source: Department of Fisheries (1995).

TABLE 2.5  
Shrimp Production from Different Sources in Bangladesh  
(Metric tonnes)

Year	Marine Capture			Coastal Aquaculture	Fresh Water Capture	Grand Total	Percentage among Total Fish Production
	Trawler	Artisanal	Total				
1989-90	3117	12751	15868	18624	36184	70776	8.27
1991-92	2902	17140	20042	20335	46500	86877	10.65
1994-95	4220	19225	23445	30503	47830	101778	8.48

Source: Fisheries Resource Survey, Department of Fisheries (1995).

There are four types of aquaculture shrimp farms: (a) single control, using self labour; (b) single control using hired labour; (c) control by landowners who cultivate shrimp on their own land, primarily with family labour; and (d) shrimp culture controlled by several people and carried out with hired labour. In Bangladesh, the most prominent form of management is the last one (ATDP 1997).

Excepting some farms in the region of Cox's Bazar, most aquaculture shrimp farming in Bangladesh is carried out through "extensive" method. There are about 9000 shrimp farms in Bangladesh which constitute about 18 per cent of the total shrimp farms in the world. That Bangladesh produces only 4 per cent of global production from 18 per cent of global farms and 12 per cent of global area

TABLE 2.6

**Market Structure of Shrimp Exports from Bangladesh: 1997**

Country	Exports	
	(Mn. US\$)	Percentage
USA	88.7	31.8
Japan	50.9	18.3
Belgium	45.3	16.2
UK	31.5	11.3
Netherlands	23.9	8.6
Germany (European Union)	19.2 (131.3)	6.9 (47.0)
<b>Total</b>	<b>279.2</b>	<b>100.0</b>

Source: Export Promotion Bureau, 1997.

under shrimp cultivation is indicative of the extensive nature of shrimp farming in Bangladesh (see Table 2.3). Consequently, productivity in the industry is very low in Bangladesh. The average size of a firm in Bangladesh is 14.5 hectares in comparison to 75.0 hectares in Indonesia and 112.5 hectares in Vietnam. In Thailand and China, where shrimp is cultivated through intensive and semi-intensive methods, the average farm sizes are 4.5 hectares and 2.2 hectares respectively.

Evidence on the industry's contribution to *incremental employment creation* is inconclusive. However, it suggests that employment has indeed been created (including female income generating opportunities) in shrimp farming as in upstream and downstream activities, (e.g., services, transport, catching of shrimp fries, shrimp processing etc. (Toufique and Hasan 1998; Manju 1996). At the same time shrimp culture has also led to the displacement of labour from agriculture related activities. Information about the *net impact* in terms of employment creation and loss is nonetheless scant.

The special features of production relations in shrimp culture in Bangladesh also need to be assessed. Unlike many other countries where owner-cultivators principally carry out aquaculture, most of the shrimp culture in Bangladesh is carried out by outside entrepreneurs in leased-in lands. Both of these factors—low productivity and the ambiguous property rights—have important bearings on further development of the industry. Moreover, both these factors underpin the concern relating to environmental implications as well as distributive justice in this industry, which is elaborated in the subsequent section of this report.

Productivity in the shrimp aquaculture of Bangladesh varies from 130 and 250 kg per hectare per annum, which is very low compared to other countries where shrimp is farmed through semi-intensive and intensive methods. The reasons for the recourse to extensive methods of shrimp culture in Bangladesh include: (a) lower variable production cost per weight of shrimp; (b) lower initial capital requirements; and (c) limited availability of fry (ATDP 1997).

Under semi-intensive and intensive farming, productivity is twenty to thirty times higher (see Table 2.7) than is the case with extensive farming. Although significant natural resources and abundant workforce give Bangladesh a comparative advantage in shrimp production, poor management, a lack of infrastructure, the unavailability of suitable land, quality food and fertiliser and variable weather conditions constitute factors which combine to keep the productivity low. Shrimp farming in Bangladesh is mainly carried out in paddy fields during the dry season, when the salinity of soil and water in the coastal region makes rice culture difficult and relatively less productive and hence less lucrative. In the Khulna region rice is grown during shrimp off-season, whilst in the Chittagong area shrimp-salt rotation is practised whereby shrimp is cultured in a particular area for a certain amount of time to be followed subsequently by production of salt.

About 50 per cent of Bangladesh's post larvae shrimp (PL) is captured wild, the remainder being either produced in local hatcheries or imported. Some of the hatcheries are relatively *high-tech*; nevertheless the virus which afflicted the industry in 1995 was traced to hatchery raised PL. The virus did serious damage to the semi-intensive hatcheries, mostly in the Cox's Bazar region, where a number of semi-intensive firms had to be subsequently abandoned. Such developments have forced some of the investors to reconsider their farming strategies. In comparison, the traditional extensive system faced no such problem (Clay 1996).

TABLE 2.7

**Characteristics of Three Major Asian Shrimp Culture Systems**

Item	Extensive	Semi-Intensive	Intensive
Pond size	5 hectares or larger	1-5 hectares	1 hectares or smaller
Stocking density	3,000-20,000/hectares	25,000-80,000/hectares	over 80,000/hectares
Water management	Mostly tidal	Pumping, some aeration	Pumping, aeration and treatment
Fry sources	Wild or hatchery	Wild or hatchery	Hatchery
Feeding	Natural through fertilisation	Fertilisation with supplementary feed	Formulated diet
Crops per year	1—3	2	2—2.5
Production	300—800 kg/hectare/hr	1-3 mt/hectares/yr	8-12 mt/hectares/yr
Production cost/b	US\$ 2.20-3.85/kg	US\$ 3.30-6.60/kg	US\$ 6.60-10.00/kg

Source: ATDP (1997).

The ATDP study (1997) provides a sketch of the marketing channels in the shrimp industry. Shrimp is sorted and cleaned at the farms after it is caught in the harvested area. Small producers either contract trucking firms and arrange transport of the harvest to the shrimp factories, or they sell their products to local traders who carry or send it to markets. Big farmers usually arrange transportation of the shrimp to the processing factories themselves. The shrimp is subsequently sold to the packing companies, who usually also own the processing factories. At the processing factories, shrimp is cleaned, washed, frozen and packaged. There are about 70 processing firms in the country, most of which (80 per cent) are located in the Khulna, Chittagong and Cox's Bazar regions. Shrimp culture farms having their own processing units are usually also engaged in exports. Export takes place mostly using the Mongla port in the Khulna region, although during the peak season export is also carried out using the Chittagong port.

In recent years the quality of processed shrimp exported from Bangladesh has come under scrutiny because of poor hygienic quality and non-compliance with *Hazard Analysis Critical Control Point* (HACCP) regulations. In 1997, the EU banned imports of shrimp from Bangladesh because of non-compliance with EU industrial and quality standards. The EU identified four factors in favour of its decision: (a) unskilled and unhygienic labourers; (b) unhygienic methods of shrimp transportation and preservation; (c) irregular and unhealthy methods for acquiring shrimp, and (d) corrupt practices used to make excess profit at the expense of hygiene control (Toufique and Hasan 1998). Subsequently, a number of firms, in phases, were allowed to resume exports to the EU following receipt of the requisite certificates, although the issue of technological upgrading to improve phytosanitary standards remains on the agenda. Recently, the government has

opened special credit lines to facilitate the process of quality control and technological upgrading by the shrimp processing units.

## 2.6 Evolving Scenario and the Policy Debate

Following the “Green Revolution” in agriculture of the 1960s, commercial shrimp culture was termed the “Pink Revolution” of the 1980s. High hopes were raised that just as “Green Revolution” was supposed to free poor nations from hunger, the “Pink Revolution” would enable them to be free from the dearth of acutely needed foreign exchange. Global production increased exponentially from 200 thousand MT in 1985 to 780 thousand MT in 1995 and the global market reached US\$ 10 billion. In one sense, such expanding markets provided exciting opportunities for developing countries, such as Bangladesh, where a long coastline makes them natural candidates to avail opportunities in coastal aquaculture shrimp farming.

On the other hand, the industry is also increasingly being called the “Blue Death”. Apprehensions have been expressed that, as has happened to many countries in the past, Bangladesh is being haunted by the prospect of turning itself into “a desert in the delta”. Some are of the opinion that this “global casino” based on 'corporate gains at public expense' should be closed down altogether (Ahmed 1997). In Bangladesh, many argue that, negative externalities of shrimp culture such as destruction of the irreplaceable resource of the mangrove forests in the south, increasing salinity, declining productivity of land, increasing deforestation, growing landlessness and increasing shrimp related violence far outweigh the potential gains. According to some, shrimp culture itself runs contrary to the concept of sustainable development (Nijera Kori 1996).

Those who have questioned the desirability of commercial shrimp farming have argued that the industry has developed without any sensitivity to local knowledge, practices, preferences and resource use. Control over local resources has shifted from communities to external entities. Some have questioned the production relations in the industry, arguing that private property regimes are not the most suitable ones for sustainable management of aquatic resources, including coastal aquaculture.

On the other hand, those advocating an expansion of shrimp farming are of the view that the industry should be provided with additional incentives so that entrepreneurs have additional investment capital to address environmental concerns and enhance competitiveness in the global market. For example, in this regard, the Bangladesh Frozen Food Exporters' Association (FFEA), in their memorandum presented at pre-budget consultations in 1998, has demanded further incentives from the government in the form of duty exemption on imports of machinery, cash incentives under a cash compensation scheme, withdrawal of higher electricity rates for frozen fish processing industry, income tax exemptions on export earnings, and the abolition of import fee and tax at source (BFFEA 1997).

It is also to be noted that, against the background of its prominent involvement in the development of the shrimp industry in south-east Asia over the last decade, the World Bank is currently reconsidering its policy approach. In India, for example, the Bank is financing construction of special prawn production zones on state lands in which most of the plots are to be assigned to small farmers. The Bank is also encouraging countries to develop coastal management plans rather than relying on Klondike-Gold Rush style development pursued in many countries with dire consequences. Many are arguing for a shift from an extensive to a semi-intensive form of shrimp culture but such practices have also come under intense criticism following negative Thai and the Filipino experiences.

## 2.7 Ban on Import of Shrimp from Bangladesh

As is known, links between trade rights and environmental measures came under scrutiny in the Uruguay Round and have gained attention since then. Concurrently, the debate pertaining to the absence of measures to internalise the environmental costs in developing countries has increas-

ingly induced a protectionist stance in the developed countries. This will, in all probability, have serious implications for export prospects of the developing countries. The export-oriented shrimp industry figures prominently in this debate.

Unfortunately, for Bangladesh this issue is not an academic one. In recent years, Bangladesh's export-oriented shrimp industry has experienced serious setbacks due to sanctions imposed by some developed countries. As was pointed out earlier in September, 1997, the European Union (EU) imposed a ban on Bangladesh's frozen food imports based on a report by the EU inspection team noting that the shrimp processing plants in Khulna and Chittagong were not complying with EU standards pertaining to quality control. The US Food and Drug Administration has issued similar threats regarding imposition of restrictions on shrimp imports from Bangladesh.

In recent times adherence to FAO's Hazard Analysis Critical Control Point (HACCP) manual, which has as many as 265 points in its *check-list*, has been made mandatory for accessing developed country markets. So far, only a dozen out of the more than 200 shrimp processing factories comply with such high standards. Bangladesh has also been asked to ensure that turtle extrude machines are used in shrimp catching, on the grounds that catching shrimp in open water leads to unnecessary destruction of turtles. The USA has been the most vocal on this issue. Although India and Pakistan have successfully fought with the USA over this issue in the dispute and settlement body (DSB) of the WTO, these types of trade-restricting measures will in all probability, be on the increase in the near future. WTO rulings on environment and the entwining of trade and environment issues can be expected to pose a serious challenge to continued growth of the shrimp industry of developing countries such as Bangladesh in the coming years.

Trade liberalisation expands global production and consumption and if the problem of adverse environmental externalities associated with enhanced trade activities are not adequately addressed, greater environmental degradation may be the consequence. The so-called greening of world trade issues in recent years highlights this concern. Whilst a set of environmental policy instruments may be available to ensure that freer trade *need* not reduce overall welfare, there is a legitimate concern when such instruments are not put in place (Anderson and Blackhurst 1992). The essential issue here appears to be putting in place adequate mechanisms to internalise such concerns in policy design, and ensure they are effectively implemented.

In absence of appropriate environmental policies and proper enforcement of such policies, conventional estimates of incremental gains accrued from export-oriented activities may overstate the gains to society, implanting a rather short-term perspective on a phenomenon having long-term implications. However, the answer does not necessarily lie in restricting such export-oriented practices through trade-related or other policy measures. Trade is not the only area in which inappropriate environmental policies can be costly for a country, which means that manipulating country's trade policies cannot be a meaningful substitute for a direct attack on sources of the problems. It has been pointed out (Anderson and Blackhurst 1992) and there are reasons to support the view, that if environmental policies are inappropriate, it is much better to begin working to improve them than to try working around them.

As can be seen from the discussion above, the interface between trade and environment is mutually reinforcing. On the one hand, production of shrimp as a globally traded economic activity has induced activities which have important environmental externalities. On the other hand, addressing environmental concerns may require interventions lowering market access. If an export-oriented growth strategy is accepted as the dominant paradigm, as is the case in Bangladesh, then the policy choice for Bangladesh is two-fold: (a) to find modalities to tackle environmental concerns in a manner which is *essentially* not trade restrictive and (b) to design and use policy instruments which are sensitive to environmental concerns of either domestic or global origin.



## 2.8 Policy Choice

The policymakers of Bangladesh face many choices with respect to development of the shrimp industry. The choices lie in (a) continuing “business as usual” to the detriment of the environment, (b) closing down commercial shrimp culture at the cost of export growth, or (c) seeking to incorporate some environmental measures into the policy regime to strike a balance between short- and long-term gains as well as private and social benefits.

If the third choice turns out to be the most desirable option, then the issue of developing the shrimp industry while addressing environmental concerns in the policy package demands urgent attention. Admittedly, a consultation process participated in by all stakeholders in the industry will contribute towards a better understanding of the issues and will be able to generate feasible and practicable recommendations both at the stage of farming as well as at the stage of processing in the shrimp industry. This would possibly help exploit the potential of the industry in a manner that ensures environmental protection as well as growth with distributive justice.

## Chapter III

### Export-Oriented Shrimp Culture in Bangladesh: A Review of Evidence on Environmental Implication

#### 3.1 The Sources of Information

Within a little over a decade, the export-oriented shrimp industry of Bangladesh was transformed from a US\$ 16 million foreign exchange earning activity to a US\$ 280 million venture in 1997 (GoB 1998). Articulated exposition of environmental concerns with respect to shrimp cultivation in Bangladesh began to surface in the literature in the early 1990s when the negative externalities of this sectoral activity, particularly environmental degradation, became manifest. Thus, during the 1990s the industry has been under close scrutiny following the decline in the initial euphoria over this second most important export breakthrough of the country.

The literature that emerged includes perception analysis case studies on the socio-economic and politico-economic impacts of shrimp culture with some attention given to its environmental impacts. There were also several studies to document and capture environmental impacts using rigorous scientific methods (including physical observation). The present review does not cover environmental impacts of shrimp culture *per se*, for the obvious reason that such issues are well documented and there is quite an extensive literature on related aspects (Philips *et al* 1993; CAP 1995; Clay 1996; Sernbo and Kloth 1996). What the present review seeks to do is to document the existing state of knowledge as regards the consequences of shrimp culture (including the environmental ones) as they have emerged within the specific conditions of Bangladesh. In the process, the review also attempts to identify the important issues which need to be addressed, in Bangladesh context, in order to ensure environmental sustainability of the shrimp industry.

A review of the relevant literature reveals four possible sources where such environmental concerns have been recorded. They are the following four sources:

- (a) *warning calls* from some of the Bangladeshi NGOs often having close links with international development community which is actively involved in global campaign for sustainable development and, more specifically, in the campaign against unregulated expansion of export-oriented shrimp cultivation in countries like the Philippines and Thailand;
- (b) *wake up calls* from shrimp cultivation areas of coastal regions of Bangladesh (from political activists, NGO workers, local media people) as negative externalities began to be felt and manifested subsequent to cultivation over relatively long periods of time (4-5 years);
- (c) *research studies* undertaken to assess and evaluate the socio-economic impact of shrimp culture in the coastal regions of Bangladesh; and
- (d) *scientific examination reports* pertaining to the extent of environmental degradation in particular areas which gave rise to some cause for alarm.

Methods used by the various studies for assessing the environmental impacts are: (a) *Case Study Method* (Rahman A. *et al* 1995); (b) *Purposive Sample Survey Method* (Manju 1996); (c) *Participatory Appraisal Method* (including physical observations and soil tests in sample and control areas) (Nijera Kori 1996).

## Diverging Views

A scrutiny of the above mentioned documents further allows us to identify three major strands of views regarding the desirability of export-oriented shrimp cultivation in Bangladesh. The following three strands of opinions can be identified by reviewing the relevant documented evidence:

- (a) The first line of argument underscores the environmentally unsustainable character of shrimp culture under the coastal-ecological conditions of Bangladesh. It purports that negative externalities are systemic, endemic and irreversible and, hence, there is a need to impose an outright ban on shrimp cultivation.
- (b) The second line of argument highlights the potential benefits of the industry, especially increased income, employment and foreign exchange earning capacity, and maintains that these benefits far outweigh the costs associated with possible negative impacts of shrimp culture;
- (c) The third line of argument, whilst not undermining the negative environmental externalities, stresses that the negative environmental impacts of shrimp culture may be satisfactorily addressed through an effective set of policies and instruments.

## 3.2 The Emerging Issues

Most of the literature pertaining to shrimp cultivation in Bangladesh focuses on the negative impacts of the activity. Such negative impacts have been identified in politico-socio-economic terms as well as environmental (Nijera Kori 1996; Rahman A. *et al* 1995; Manju T.H. 1996; Adnan S. 1991; Tahmina 1996; Ahmed 1996; Green Peace 1996; Gain 1997; SEHD 1998). The identified impacts are well articulated, if not always well evidenced.

All of the studies point out that shrimp farming leads to changes in land-use patterns, thus affecting traditional agricultural activities and practices (Nijera Kori 1996). The situation gets aggravated as major beneficiaries of shrimp farming are non-local entrepreneurs who do not have a long-term stake in the development of the local community. As a result, share-croppers whose livelihood traditionally depend on the leasing and renting of cultivable land are deprived of access to the major productive resource and become unemployed (Manju 1996). Furthermore, traditional economic activities like cattle grazing, poultry-keeping, household vegetation and social forestry are no longer possible in many areas which have been under shrimp cultivation for relatively long periods of time.

Case studies, using a “before-after” approach, carried out in villages of southern Bangladesh show important changes in local occupation structure subsequent to introduction of shrimp cultivation in the region. For example, in the village of *Chalburnia*, the percentage of the population belonging to the category of rice-cultivators decreased from 33 per cent to 13 per cent, whilst the corresponding percentage for those involved in shrimp-cultivation increased from 20 per cent to 32 per cent (Manju 1996). Manju (1996) also provides estimates on financial loss to peasant households subsequent to the introduction of shrimp cultivation in the area. Losses are incurred as a result of (a) decline in rice productivity, (b) loss of poultry and livestock, and (c) erosion of homestead vegetation and social forestry. It was estimated that post-shrimp income level of local peasant households was only 62 per cent of the pre-shrimp level (Manju 1996).

Adnan (1991) also comes up with similar conclusion deploying “with-without” approach. Comparing “non-shrimp” Polder No. 22 of the Bangladesh Water Development Board (BWDB) with “shrimp” Polder Nos. 20 and 21, it was found that, during the period 1987-90, half of jackfruit and mango trees were destroyed and one-third of cattle heads had disappeared in the latter. It was suggested that these polders might eventually become saline deserts (Adnan 1991).

Loss of common property rights subsequent to introduction of shrimp culture is perceived by some as one of the principal reasons behind unsustainable shrimp culture in the coastal areas of Bangladesh (Farhad Majhar, an environmentalist quoted in SEHD 1998).

It needs to be noted that all the studies point to net increase in income from land when shrimp culture is compared to traditional practices. The question, however, is who benefits from the incremental income and to what extent. The gross yield per hectare from shrimp culture (Taka 32,000/hectare) is substantially higher than rice cultivation (Taka 12,000/hectare). Studies further show that most of the incremental income is accrued to the shrimp entrepreneurs (usually non-locals), and local peasants can hardly claim any share in this. These findings are also corroborated by Rahman *et al* (1995). The resultant distributive injustice has aggravated income erosion and income inequality, which in turn has accentuated social as well as economic disempowerment of the local people, particularly local peasants. Thus, it is the poorest segments of the local people are the hardest hit by changes brought about by the introduction of shrimp culture (Manju 1996; Nijera Kori 1996).

The negative impacts have not gone unchallenged and have often led to violent confrontations between the henchmen of shrimp cultivators and the local people, resulting in adverse law and order situation, terrorism, serious human rights violation and deaths (Manju 1996; Nijera Kori 1996). The local administration, police and other law enforcing agencies have in almost all cases sided with the shrimp cultivators vis-à-vis the dispossessed local people (Manju 1996).

Documents prepared by the shrimp-entrepreneurs and owners of shrimp farms usually emphasise the potential role of the industry in the economy, pointing out its growing importance as the country's second largest non-traditional export-earning activity. According to these documents, the benefits in terms of foreign exchange earnings, incremental employment and income generation far outweigh any short-, medium- or long-term negative externalities. It is further underscored that the benefits are not limited to entrepreneurs, a substantial multiplier effect is accrued to the whole of the local community (Aftabuzzaman 1996; CPD 1998a).

However, most of the researchers tend to disagree with the above view, pointing out to the need to take into cognisance the short- and long-term externalities in carrying out the cost-benefit analysis of shrimp culture in Bangladesh. Adnan (1991), for example, argues that the notion of justifying shrimp cultivation on grounds of high foreign exchange earnings needs to be treated with caution. According to him, such estimates fail to account of the opportunity cost of the same investment in human capital formation in terms of education and health care of the people in the shrimp farming areas, and of discounted present value of current foreign exchange earnings. He further argues that the superiority of shrimp culture over paddy production in terms of employment creation and local peoples' earnings is not proven (Adnan 1991).

Some of the literature, reflecting mainly the concerns of NGOs and political activists, has called for outright banning of shrimp cultivation in Bangladesh. According to them, at the very least, restrictions should be imposed on shrimp culture in areas where there is clear proof of overwhelming negative impacts (Nijera Kori 1996).

The role of the government has figured prominently in this whole discourse on shrimp cultivation in Bangladesh. The Government of Bangladesh's favourable disposition to shrimp cultivation played a critical role in stimulating entrepreneurial activities in the shrimp industry. During this initial period, the government provided crucial support to the industry in terms of acquisition of land, leasing of *khas* (state-owned) land to shrimp farmers and providing fiscal-financial incentives in the production and processing of shrimp. When the negative impacts and implications gradually started to emerge and ecological-environmental concerns precipitated a debate, the government took up a number of initiatives to contain the negative impacts. These included enacting laws governing the leasing of land, designing guidelines for setting up shrimp farms, requiring the consent of local farmers before setting up shrimp farms, and the formation of *Shrimp Culture Steering Bodies* at national, regional and local (*thana*) levels (Sobhan 1997; Aftabuzzaman 1996).

However, government regulations have been criticised on the grounds of their inadequacy, weak enforcement and non-sensitivity to environmental concerns (Nijera Kori 1996; Manju 1996; Habib 1998).

It has been maintained in most of the studies that exclusion of local people in shrimp cultivation often undermines its sustainability. For example, the law stipulates that 85 per cent of the landowners have to agree before an area is to be brought under shrimp culture. Permission is also to be sought from the Bangladesh Water Development Board for construction of water management infrastructure (Sobhan 1995). A license is also to be obtained from the *Upazila Shrimp Control Committee*. However, the Upazila Shrimp Control Committee is not a representative body, and the interests of local farmers remain un-addressed in the decision-making structure at all levels. Furthermore, weakness in enforcement often leads to violations of rules enacted by the government (Nijera Kori 1996; Manju 1996).

### 3.3 Environmental Concerns

A number of studies point out the serious damage caused to the local environment as a consequence of shrimp cultivation. Increased salinity, land degradation, deforestation and destruction of mangroves in southern coastal region have led to serious damage to biodiversity and ecosystem which is, for most part, irreversible (Rahman A *et al* 1995; SEHD 1998). Indiscriminate conversion of the country's mangrove forests into shrimp farms has resulted in the destruction of marine breeding grounds and the erosion of shorelines. The destruction of the mangroves has far-reaching ecological implications for the whole of the region. A large number of local varieties of fish have disappeared and nutrient content of the soil has diminished, resulting in drastic reductions of land productivity. The spillover of negative impacts to areas adjacent to those under shrimp cultivation is also substantial (Nijera Kori 1996). Viral contamination in shrimp farms has also brought about tremendous losses not only to the shrimp, but also to the biodiversity in areas under cultivation by semi-intensive methods. Even the *Grameen Shrimp Farm Project*, set up in Cox's Bazar region by the Grameen Bank in early 1990s, had succumbed to such damages (SEHD 1998).

Rigorous scientific evidence of the negative impacts of saline water intrusion is scant. It appears that only Nijera Kori (1996) has carried out a systematic study on this subject. The Soil Science Department of the Dhaka University executed the study. The study sample covered three types of areas: (a) newly cultured areas, (b) areas where shrimp has been cultured for a number of years, and (c) areas adjacent to non-shrimp farming areas. In a section of the report, captioned "Observations of Environmental Conditions", the study concludes that *the contrast between non-shrimp polders and shrimp farming polders is striking and needs to be physically seen. The findings are inadequate to express the degradation that has already taken place.* The study points to (a) increasing salinity and soil degradation, (b) deforestation and destruction of homestead vegetation, (c) destruction of coastal vegetation, and (d) water logging leading to irreversible changes in micro-flora and fauna. All such externalities have led to income erosion of local households. Such damaging impacts were not limited to the area under shrimp farming, but extended to the adjacent areas as well (Nijera Kori 1996).

In recent years, the government has indeed enacted a number of laws and regulations to control damage to the environment which should have, *theoretically speaking*, reduced some of the practices prevalent in shrimp cultivation areas such as unplanned embankment breaching. However, enforcement of these laws has been minimal. Resource availability for monitoring implementation and enforcing compliance has also often been inadequate (Habib 1998). This prompted the Bangladesh Environmental Lawyers Association (BELA) to initiate a number of public interest litigations. There is also an absence of coordination amongst various public agencies involved in management of fisheries, water and land. Weak interfacing of these agencies in regulating shrimp farming has undermined environmental objectives (SEHD 1998). Attempts to test out "good practices" on a pilot basis and then promote their replication as part of an on-going exercise to ensure

sustainable shrimp culture within the unique aqua-climatic conditions of Bangladesh have also been missing (CPD 1998b).

Evidence on the extent of the environmental damage from the industry appears to be inconclusive. For example, the Project Completion Report (PCR) of the World Bank supported Shrimp Culture Project observes that *there are no environmental effects caused by the project. The land use pattern and the ecological balance have not changed as a result of project interventions. On the contrary, some of the diverse effects which existed under pre-project conditions, such as water logging and uncontrolled cuts in embankments for the constellation of sub-standard inlet structures, have been minimised or eliminated by the project interventions. No mangrove forest has been destroyed as a result of the project* (World Bank 1994). However, as negative environmental consequences of shrimp cultivation became more pronounced World Bank policies started to manifest more sensitivity to the emerging environmental issues in the sector. Thus, the Fourth Fisheries Project which is being implemented in Bangladesh with the support of the World Bank to develop the fisheries sector of Bangladesh devotes substantial attention to issues related to sustainability of shrimp culture in the Bangladesh context (World Bank, 1999).

It has been argued that brackish water shrimp cultivation in the south-east region of Bangladesh is *per se* not the main cause of environmental degradation; rather it is the unplanned nature of such processes in shrimp cultivation that are at the root of resource degradation. Provided shrimp cultivation can proceed in a planned manner much of the resultant environmental damage may be averted (Asaduzzaman and Toufique 1998).

Rahman *et al* (1995), for example, make the following policy recommendations to inhibit unplanned industry expansion: (i) construction of hatcheries for *bagda* and *galda* shrimp; (ii) categorisation of coastal land resources by the degree of salinity (low, medium, and high); (iii) conservation of areas such as the *Sunderbans* forest and areas most suitable for crop production; (iv) zoning of the potential land area for shrimp culture. Regarding zoning, land available for shrimp cultivation may be categorised as follows: (a) areas suitable for semi-intensive culture have to be exclusively earmarked for year-round shrimp culture; (b) improved extensive culture needs to be converted into semi-intensive culture areas; and (c) the remaining area should be allocated for traditional culture. However, it should be ensured that shrimp land is released to paddy cultivation in due time to permit timely sowing of rice crops.

Table 3.1 presents, in summary form, the major environmental concerns as extracted from existing literature. The table also shows some of the possible actions recommended in the literature in response to such concerns. As can be discerned from the table, the recommendations put forward are indicative of the demand for a more proactive role of the government in terms of (i) enactment of environmentally sound laws, (ii) ensuring stricter implementation of regulations where they already exist, and (iii) removal of ambiguities and non-transparency in the existing regulations and their enforcement.

### 3.4 Filling the Research Gap: A Question of Methodology

As evidenced by Table 3.1, environmental issues arise in all the stages of shrimp cultivation: (a) the selection of area for shrimp cultivation; (b) the land leasing system; (c) the intensity with which shrimp is farmed; and (d) the relative position of shrimp culture within overall farming practices of the locality. However, in terms of policy recommendations, most of the studies fall short in two critical areas, viz. (a) they lack the *macro-perspective* which would situate the shrimp industry in the context of the national economy and in relation to the macro-reforms within which it operates; and (b) they lack the *policy perspective* that would endogenise the environmental concerns in the policy matrix.

Overall, three important insights emerge from the review of literature on shrimp culture in Bangladesh. *First*, although environmental implications of shrimp cultivation in Bangladesh have

been more or less documented, these have not been examined in relation to trade policy reforms in Bangladesh where externalities originate; this would require establishing relationships between trade policy and environmental concerns, and environmental problems and global market access issues. *Second*, the important issue pertaining to internalisation of the various dimensions of environmental costs in a manner which ensures both competitiveness of the shrimp industry as well as sustainability remains un-addressed. *Third*, there is a lack of critical evaluation of the institutional mechanism needed to ensure (i) the design of appropriate laws, (ii) enforcement of compliance, and (iii) monitoring, evaluation and revision of the related regulations on an ongoing basis.

The above concerns need to be addressed in earnest if a policy towards sustainable shrimp culture is to evolve in Bangladesh. For this to happen, one would need to address, inter alia, the following four issues:

- (a) *Precaution* (in the sense of limiting the extent of areas under shrimp culture);
- (b) Diversification (in the sense of ensuring bio-diversity in shrimp culture areas);
- (c) Integration (whereby shrimp culture is integrated with other agro-practices in the locality); and,
- (d) Localisation (whereby local communities are incorporated into planning and implementation of policies).

TABLE 3.1

**Literature on Shrimp Culture in Bangladesh: A Summary of Environmental Concerns**

<b>Action</b>	<b>Consequence for Environment</b>	<b>Environment Impact on</b>	<b>Intervention Recommended</b>
Land lease by outside entrepreneurs	Use of land only to maximise short-term profit-without concern for long-term sustainability	Deforestation, destruction of mangrove ecosystems and mangrove species of flora and fauna and resulting in destruction of alternative sources of livelihood	<i>a.</i> Ensure participation of the stakeholders in the management of shrimp farming and stricter implementation of existing laws. <i>b.</i> Go for zoning including declaring certain parts of the country to be non shrimp-farm areas.
Lease of government ( <i>Khas</i> ) land for shrimp culture	Traditional rice culture replaced by shrimp culture	Dis-entitlement of land less, and intensification of poverty in the area leading to prevalence of environmentally unfriendly practices	Enactment of laws ensuring participation of landless people in any use of <i>khas</i> land
Salt water penetration within embankment for substantial period	Increased salinity in the polder area	Gradual degradation in the quality of land, and soil-nutrient resulting in accumulation of sodium chloride affecting rice production	<i>a.</i> Develop land use policy and environmental guideline for shrimp culture; <i>b.</i> Develop optimal practices for rice-shrimp mixed culture.
Use of extensive methods of shrimp cultivation causing inundation of large tracts of land	Large area remaining under water for substantial periods of time	Destruction of homestead cultivation, fruit orchards and borders; rupture in the subsistence cycle	<i>a.</i> Encourage semi-intensive methods of cultivation. <i>b.</i> Go for zoning and area mapping
Indiscriminate fish fry collection	Destruction of fish-biodiversity, increased exploitation of preferred species	Over fishing; reduction in fish population and fish species	Develop shrimp hatcheries; if required provide adequate fiscal-financial incentives

*Source:* Compiled from Rahman A. et al (1995) Nijera Kori (1996) Manju (1996).



## Chapter IV

### Export-Oriented Shrimp Culture in Bangladesh: Environmental Consequences and Economic Benefits and Costs

#### 4.1 The Analytical Framework

The preceding chapters have discussed the contribution of shrimp culture in Bangladesh's economy as well as its negative externalities, particularly those manifested through various environmental impacts. The broad categories of the observed negative environmental impacts may be identified as: (i) salinisation of the soil, which in turn leads to decline in soil fertility; (ii) reduction in agricultural production due to reduction in agricultural land and soil fertility; (iii) decrease in cattle production as a result of decline in grazing land; (iv) human health hazards, such as skin diseases and high incidence of water-borne diseases; and (v) destruction of mangrove eco-systems and their biodiversity.

All these damages are not immediate, and may be observed over a long period of time. Costs of these damages, as they are direct in nature, can be included in economic analysis. There are also indirect costs of shrimp culture, which are not always obvious, and cannot be measured in monetary terms, as these are not marketed. For example, the loss of environmental services such as, the ecological contribution of mangrove forests, medicinal uses of mangrove, viewing wildlife, etc. imposes a cost on society. These services can be measured only through various indirect methods<sup>1</sup>.

Environmental impacts lead to economic loss through increased poverty, landlessness and forced changes in affected peoples' sources of livelihood (Rahman *et al* 1995; Manju 1996). The negative impact of shrimp cultivation has social implications as well. These non-quantifiable costs are being experienced in many forms, such as increased violence, absence of children from schools, and harassment of small farmers and women.

There is no environmental benefit of shrimp culture. Only economic and social (indirect) benefits are derived. It is the source of employment and income for many. It also brings substantial foreign exchange for the country. There are some indirect benefits of this industry. *First*, it has positive impacts on linked activities, such as trucking, banking, clearing and forwarding, shipment, and packaging services. *Second*, it has given the opportunity to a large number of women to employment in the shrimp processing enterprises, and to improve their role and position in the family. *Third*, it has contributed to human capital development by creating many new entrepreneurs. The direct and indirect costs and benefits of shrimp cultivation are shown in Figure 4.1.

A decision as to whether shrimp culture should be stopped or be continued depends on the extent of the losses and gains derived from shrimp cultivation. One of the ways to evaluate this industry's economic performance is to compare the costs and benefits observed. A Cost Benefit Approach (CBA) provides a practical mechanism to assess whether investment maximises social welfare. Social welfare is maximised when it is possible to make someone better off without making someone else worse off. The CBA technique developed in this chapter is simple and does not go into the calculation of the net present value using a discount rate because of lack of adequate data.

In this context, *costs* which have been examined are: (a) opportunity costs of land degradation due to salinity, (b) health costs in terms of mortality and morbidity, and (c) the costs of mangrove destruction. The *benefits* are estimated based on the income of the industry received through

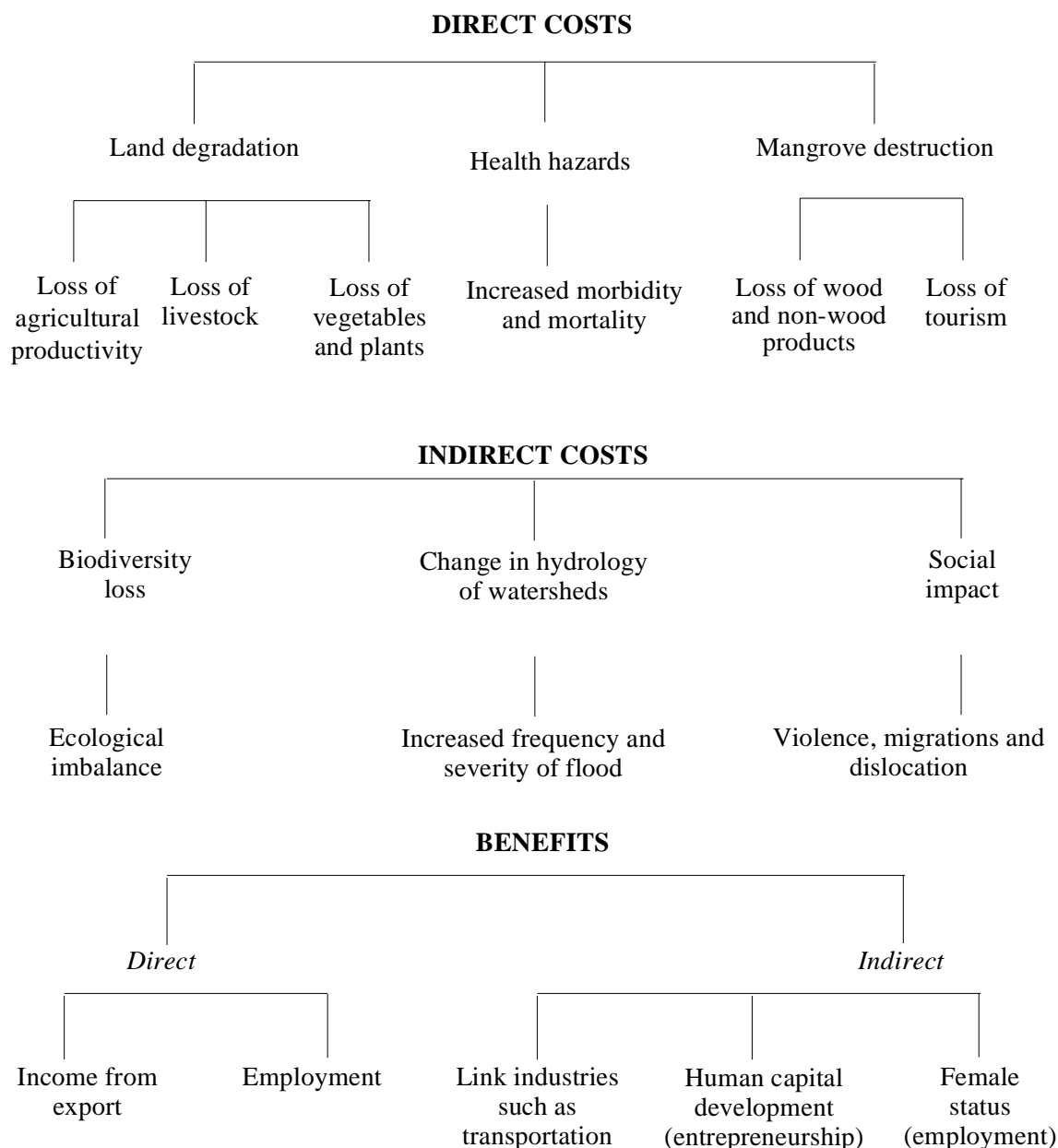
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<sup>1</sup> Discussion on these methods is beyond the scope of the present study. Detail discussions are found in much of the literature including Pearce *et al* (1994), and Markandya

the export of processed shrimp. The costs of environmental degradation are sometimes called the benefits in the environmental cost-benefit literature, since degradation costs reduced or saved through various abatement measures become the benefits when investments are made to mitigate environmental damages. In this study, this approach is not adopted, and the benefits of shrimp cultivation are seen only from an income earning aspect. Tables 4.1 and 4.2 illustrate the negative and positive impacts of shrimp cultivation, and indicate the valuation methods used to estimate those impacts.

FIGURE 4.1

### Costs and Benefits of Shrimp Cultivation in Bangladesh



Cost-benefit analysis of *all* environmental problems and economic benefits arising from shrimp cultivation is clearly impossible, because of a lack of data or comprehensive methodology. The effort made here is based on many critical assumptions on tentative data. These will be discussed during the process of cost and benefit estimation. The results are therefore, provisional, and refer to the order of magnitude of the macroeconomic effects. The reference year in this study is 1994.

TABLE 4.1

**Environmental and Social Consequences of Shrimp Culture: Cost Components**

<b>Problem</b>	<b>Impacts</b>	<b>Methods of estimation</b>	<b>Estimated in this study</b>
Land degradation	Impact on agriculture (due to loss of crop land)	Production loss basis Restoration cost	Yes Yes
Land degradation	Impact on livestock (due to loss of grazing land)	Number of livestock reduction × price of livestock	Yes
Human health	Water-borne diseases	Incidence of death × Statistical value of life + Incidence of sickness × (cost of treatment + lost wages)	Yes
Destruction of mangrove	Damage of wood and non-woods products	Value of forest product × area of mangrove lost	Yes
Loss of biodiversity	Loss of flora and fauna; medicinal plant	Contingent valuation method (CVM); Survey; Benefit Transfer	Partial estimate
Decline in tourism	Loss in revenue earning due to loss in mangrove forests	Existing information and survey	No
Social costs	Family dislocation, violence, school drop-out, migration, harassment	Difficult to quantify	No

Table 4.2

**Economic and Social Consequences of Shrimp Culture: Benefit Components**

<b>Areas</b>	<b>Benefits Observed</b>	<b>Method of Estimation</b>	<b>Estimated in this study</b>
Employment	Through increased employment	Survey	No
Income	Through foreign exchange earnings	National estimates	Yes
Link industries	Transport	National estimates	No
Human capital development	Entrepreneurship	Survey	No
Social	Improvement in female status	Qualitative survey	No

**4.2 Costs of Shrimp Culture****(a) Land Degradation: Impact on Agricultural Production and Livestock****Agricultural Production**

Land degradation has both on-site and off-site impacts. The negative impact of shrimp culture on the land is manifested through salinisation and water logging. Salinisation is a situation wherein soil degradation occurs due to an increase of salts in the soil, and water logging is the low-

ered land productivity caused by a rise in groundwater close to the soil surface. The net effect of salinity in water and water logging is land degradation through a loss of soil fertility, which leads to reduction in production. At the farm level (on-site), declines in crop yields lead to falling profits as a result of lower output. Farmers may have to change the mix of crops and the level of input use, and even withdraw land from cultivation leading to marginalisation and increase of migration to urban areas. Off-site costs include siltation of drainage canals, irrigation canals, changes in the hydrology of watersheds, which might increase the frequency or severity of floods, or reduce the availability of water during the dry season. Addressing these effects require increased government expenditure for infrastructure and conservation.

This study does not estimate the off-site costs of land degradation due to lack of data on the magnitude of impacts. Even the relation between land degradation and production is difficult to quantify because of lack of information on the link between degradation, production and economic returns. Therefore, the impact of shrimp culture on agricultural production has been estimated in this study by using an indirect method.

The estimates of agricultural production loss are based on the measurement of two variables: *production loss* and *restoration cost*. Production loss results from the reduced productivity of the soil due to land degradation, expressed as a percentage of production from the un-degraded soil. Restoration or reclamation cost is the cost of restoring the soil to its former productive state. In the case of salinisation and water logging, practical means such as drainage, leaching and gypsum application can be valued to estimate restoration costs. Production loss and restoration cost calculations are presented below.

#### (i) Production Loss Basis

The total area under shrimp cultivation is estimated to be 145, 000 hectares, which is about one per cent of total land area of Bangladesh. The largest areas under shrimp cultivation are in Khulna, Satkhira and Bagerhat; the south-western districts of the country. Around 61 per cent of Bangladesh's total shrimp cultivated land are in these three districts. In this study the impact of land degradation is estimated for seven districts, viz. Khulna, Satkhira, Bagerhat and Barisal, Patuakhali, Jessore and Noakhali, districts where 80 per cent of the total shrimp cultivating area are located (i.e., 116,000 hectares). This is because, though Chittagong is the second highest shrimp producing region (20 per cent of total shrimp cultivated area), lands used for shrimp cultivation in this area are mostly in the coastal area which would not have been used for agricultural production in any case, and an estimation of the area's agricultural production losses and restoration costs would be inappropriate.

The land in the seven districts (mentioned above), where the cultivation of crops has totally or partially been eliminated could be used for agricultural production. If agricultural production is carried out in these lands using the same level of inputs and similar methods of management, the land-output ratio will not be the same as before the shrimp culture activity took place. The difference between outputs during the two periods is the loss in production. Based on this idea, the production loss in this study has been estimated in the following way (UNDP, UNEP, FAO 1994):

Production loss = (production from non-degraded land) *minus* (production from degraded land with same inputs and management)

Relative production loss is the production loss as a percentage of production from non-degraded land. The relative production loss varies according to the degree of degradation, and it has been assumed that relative production loss due to light degradation arising from salinity is 20 per cent and due to moderate degradation is 45 per cent (Brandon 1995). It is assumed herein that land degradation due to shrimp culture in Bangladesh is of moderate degree. The production loss is estimated for the main cash crop (i.e., rice). The average yields of rice of all varieties in the districts under consideration were 1.4 metric tonne (Mt) per hectare in 1994. It is assumed that two crops would have been produced and harvested in a year and the productivity would have been the same for the

both. Therefore, the loss of production is:  $(116,000 \times 1.4 \times 0.45 \times 2) \text{ Mt} = 146,160 \text{ Mt}$ . Taking the net price of medium quality rice (gross price minus cost of production) which is Tk 8.47/kg (BBS 1996, 1997) the monetary loss is estimated to be  $(\text{Tk } 8467 \times 146,160) = \text{Tk } 1237.6 \text{ million}$  which is 0.35 per cent of the agricultural GDP and 0.11 per cent of the total GDP of the country at current prices in 1994<sup>2</sup>.

#### (ii) Restoration or Reclamation Cost Basis

Salinisation and water logging can be reversed, and the productivity of land partly restored, by reclamation. The main elements of the technology involved here are: (a) installation of deep drains to lower the water table, (b) leaching of salinised areas requiring the application of non-saline water in amounts considerably in excess of the irrigation requirement, and (c) treatment of sodic soil with gypsum. In Pakistan soil salinity was reduced from 40 to 28 per cent during 1969-85 using such technology, and 80,000 hectares of lands are being restored to production each year (ESCAP 1989; 1990). The cost of such reclamation is considerable at US\$ 500 per hectare (Ahmad and Kutcher 1992). Assuming that the cost would be similar for Bangladesh given similarities in socio-economic conditions of the two countries, the reclamation cost for degraded land in shrimp cultivating area (except Chittagong) would be  $\text{Tk } (20100 \times 116,000) = \text{Tk } 2331.6 \text{ million}$ <sup>3</sup>, which is about 0.22 per cent of the total GDP of the country and 0.66 per cent of the total GDP of the districts under this study.

### Livestock

Loss of livestock resulting from shrimp cultivation has also been done for the seven districts. The number of bovine animal per household in Bangladesh was estimated to be 1.6 in the Agriculture and Livestock Census, 1983-84 (BBS 1996). It is claimed that there has been drastic reduction in the number of livestock owning households (Rahman et al 1995; Manju 1996). Based on a "recall method" among 607 households, Manju (1996) found that the number of households having cattle has been reduced by 37.2 per cent in 1995 compared to 1990. Out of 607 households, in 1990 the number of households having cattle was 145, which has been reduced to 91 in 1995. This implies that the rate of reduction in cattle per household is—8.9 per cent per year during this period. This rate has been used in this study for estimating the value of livestock loss.

The total number of households in the districts under study is 3,387,497. The share of households having cattle in rural areas of Bangladesh is 7.56 per cent (BBS 1996). So the total number of households with cattle in the area =  $(3,387,494 \times 0.0756) = 256,094$ . Hence the number of cattle loss in the area under study is equal to =  $(256,094 \times 0.089) = 22,792$ . The average market value of the local variety cattle of different types is estimated to be Tk 4,000 (BBS 1996). Therefore, the loss of income due to cattle reduction because of shrimp cultivation is =  $(\text{Tk } 4000 \times 22,792) = \text{Tk } 91.2 \text{ million}$ . This is equivalent to 0.01 per cent of the total GDP of the country and 0.03 per cent of the total GDP of the seven districts in the reference year. In agriculture, the shares of livestock

<sup>2</sup> Total GDP of Bangladesh at current prices in 1994 = Tk 1,082,188 million

*The GDP contribution of the following sectors were:*

Agriculture = Tk 354,597 million

Forestry = Tk 42,626 million

Livestock and poultry = Tk 39,828 million.

*GDP of the seven districts at current prices in 1994 were:*

Total = Tk 350,774 million

Agriculture = Tk 103,176 million

Forestry = Tk 14,940 million

Livestock and poultry = Tk 10,619 million

<sup>3</sup> Exchange rate (1994) US\$ 1 = Tk 40.20 (Bangladesh Bank, 1998).

TABLE 4.3

## Costs of Land Degradation Due to Shrimp Cultivation

Type of loss and measure used	Physical Impact	Value (Tk Mn)	Percentage of			
			Total GDP	Agricultural GDP	Total GDP of the districts	Agricultural GDP of the districts
(1) Agriculture Production loss basis	146,160 Mt of rice	1237.6	0.11	0.35	0.35	1.20
(2) Agriculture Restoration cost basis	-	2331.6	0.22	0.66	0.66	2.26
(3) Livestock Loss of livestock	22,792	91.2	0.01	0.03	0.03	0.09
(4) Total (Agriculture + Livestock)	-	1328.8 2422.8	0.12 0.22	0.37 0.68	0.38 0.69	1.29 2.35

Note: (a) is the total of items 1 and 3 and (b) is the total of items 2 and 3.

loss are 0.03 per cent of the total agricultural GDP of the country and 0.09 per cent of the total agricultural GDP of the districts. The cost estimates are summarised in Table 4.3.

### (b) Health Impact

In Bangladesh 80 per cent of all illness is related to water-borne disease. The health impact of polluted water due to shrimp culture is revealed through skin diseases, diarrhoeal diseases, clinical malaria and intestinal worm infestation. Polluted water causes premature deaths (mortality) and increases the occurrence and incidence of disease (morbidity). As the value of human life is difficult to define, the economic value of mortality is often estimated based on the value of statistical life (VOSL). The VOSL is the marginal willingness to pay (WTP) to reduce the risk of a fatal accident, or the willingness to accept (WTA) increased risk aggregated over a large number of people<sup>4</sup>. The cost of morbidity can be estimated by medical expenses, lost wages due to restricted activity days, and discomfort due to illness.

Epidemiological data on water-borne diseases are not available. BBS has gathered some estimates of a few diseases. In Khulna<sup>5</sup>, Barisal, Patuakhali, Noakhali, Jessore and Chittagong the number of attacks due to diarrhoea and dysentery in 1994 were 62,190 and 34,053 respectively (BBS 1996). The number of deaths due to the same diseases is 268 and 77 respectively. These people are affected by water pollution generated not only by shrimp farming but by other sources as well. As the number of people affected by shrimp induced water pollution and by non-shrimp induced pollution is unknown, estimates are made herein. It is assumed that half of the attacks and deaths are due to shrimp induced water pollution. This may be an over- or under-estimate of the real situation. Therefore, the total numbers of attacks and deaths from both diarrhoea and dysentery are 96,243 and 345, half of which are 48,122 and 173 respectively. The mortality and morbidity costs are calculated below.

<sup>4</sup> Suppose a pollution control policy can reduce the probability of risk from 0.003 to 0.002, i.e., by 1 in 1000 people. Assuming that the average WTP for this reduction in the risk of death is US\$ 1000 per person, the total WTP of the group is US\$ 1,000,000. The change in risk will result in one statistical person being saved each year ( $1000 \times 0.001$ ). The value of statistical life is US\$ 1,000,000 in this case.

<sup>5</sup> Khulna refers to greater Khulna consisting of Khulna, Satkhira and Bagerhat districts.

**Mortality Cost.** The estimation of VOSL for Bangladesh is difficult, as there is no valuation study for risk reduction. In the absence of any WTP study, estimates have been made using the results from the developed countries, where estimations are based mostly on WTP approach. Based on those studies, the VOSL for Bangladesh has been estimated to be Tk 5.35 million by adjusting the VOSL in the UK to capture the income gap between the two countries (for details see Khatun 1996). So total VOSL for 173 deaths due to water pollution induced by shrimp culture amounts to  $(173 \times \text{Tk } 5.35 \text{ million}) = \text{Tk } 925.6 \text{ million}$ . This is 0.09 per cent of the total GDP of the country and 0.26 per cent of the total GDP of the districts concerned.

**Morbidity Cost.** The value of morbidity cost can be estimated in terms of individuals' preferences (i.e., WTP for reducing the occurrence of morbidity or WTA for having faced with the risk of morbidity) or in terms of resource costs (i.e., the cost of illness). The cost of illness measures the total cost of illness that is imposed on the society. This study measures two components of morbidity costs: treatment cost and wages lost which are equivalent to the value of lost productivity due to illness.

**Treatment Cost.** This cost is estimated by multiplying the number of morbidity cases with the treatment cost per person. It is difficult to get any estimate for treatment cost. This cost can also vary among people depending on where they go for treatment. One assumption can be made that since those people engaged as wage labourers in shrimp farms will go for the cheapest available facilities and rely on the government hospitals where only a nominal fee of Tk 5 is paid for clinical visits and out-patient medicine. In addition to this cost, there may be other related costs such as transportation costs. In any case, this cost does not reflect the true treatment cost since treatment in government hospitals is subsidised. To avoid this underestimation here this study has used the result of a survey that shows that treatment cost per patient in Bangladesh is Tk 97.05 on average (CPD 1998c). Thus the total treatment cost is Tk  $(\text{Tk } 97.05 \times 48,122) = \text{Tk } 4.7 \text{ million}$ .

**Wages Lost.** There may be cases when the workers cannot go to work due to illness and thus lose income. This is expressed in terms of restricted activity days. The annual number of days lost per worker due to water pollution induced illness in Bangladesh is reported to be between 5 to 6 days (Shibli 1996; DGHS 1993-94). Taking a lower bound estimate, 5 workdays lost, the total number of work days lost will be  $(48,122 \times 5) = 240,610 \text{ days}$ . Since all of these lost workdays cannot be attributed to shrimp related water pollution (there are other causes of water pollution) it is assumed that half of these days are lost due to shrimp related pollution. Therefore, the number of days lost is 120,304. Per capita annual income in 1994 was Tk 9760. Taking 300 days as total working days in a year the per capita daily income is Tk 32.53. So the total wage lost for 120,304 days will be  $(\text{Tk } 32.53 \times 120,304) = \text{Tk } 3.9 \text{ million}$ .

Cost estimation for discomfort, pain and relatives' worry is not attempted here since these cannot be estimated in monetary terms, though an attempt has been made to account for some of these types of costs, psychic costs being one of them<sup>6</sup>.

Adding mortality and morbidity costs together, the total health cost is estimated to be Tk  $(925.6 + 8.6 \text{ million}) = \text{Tk } 934.2 \text{ million}$ . This cost is 0.09 per cent of the total GDP and 2.27 per cent of the total GDP of the districts.

### (c) Mangrove Forests

The direct and indirect use values of mangroves contribute to national welfare, and are observed through the mangrove's multifunctional role implying that there does not exist a single price, which reflects its value. The most important use is that of wood extraction for timber and fuelwood. In addition to this, mangroves also support offshore fisheries. Mangroves are not only

<sup>6</sup> If the EPA (Environmental Protection Agency, USA) practice, of estimating the psychic cost by multiplying the treatment cost and forgone earnings together by a factor of 5, is followed the psychic cost is Tk 1.2 million.

TABLE 4.4

**Health Effects of Water Pollution Induced by Shrimp Culture**

Types of costs	Physical Impact	Value (Tk Mn)	Percentage of	
			Total GDP	GDP of the districts
Mortality	173 persons	925.6	0.09	0.26
Morbidity	48,122 persons	8.6	0.001	0.002
Treatment costs	-	4.7	Negligible	0.001
Wages lost	120,305 days	3.9	Negligible	0.001
<b>Total</b>		<b>934.2</b>	<b>0.09</b>	<b>0.27</b>

valuable for marketed products, but they also provide non-consumptive services. Marketed products provide direct use values derived from wood products and non-wood products. Non-consumptive services such as storm protection, shoreline stabilisation, erosion control, flood control, sedimentation, toxicant retention, nutrient retention represent indirect values. Valuation of non-consumptive services which maintain ecological balances and are important for biodiversity conservation is difficult and time consuming to estimate since it depends on extensive data to be collected from the field surveys and subsequently analysed.

This study estimates only the direct use value of the Chokoria mangrove area, which has been totally lost due to salinity and human intervention. The area of this mangrove is 8,750 hectares, which is 1.5 per cent of the total mangrove area in Bangladesh (577,000 hectares) and 0.46 per cent of the total forest area (1,908,600 hectares). An annual income could have been earned from the products extracted from the area had it not been destroyed. The contribution of forestry sector was Tk 42,626 million at current prices in 1994. So the amount of income lost from this mangrove is  $(\text{Tk } 42,626 \times 0.0046) = \text{Tk } 196.1$  million. This is 0.02 per cent of the total GDP of Bangladesh in 1994. This is the income forgone every year due to destruction of Chokoria mangrove area.

Biodiversity benefits can be exhibited through direct use values, option values and existence values for endangered species of flora and fauna. Here only the affected mangrove area, which could be used for collecting medicinal plants, is valued. This valuation is done on the benefit-transfer basis from an Indonesian study on the assumption that the same benefit would be derived from Chokoria mangrove area. Ruitenbeek (1992) estimated a net benefit of US\$ 15 per hectare for medicinal plants from mangroves. Multiplying US\$ 15 by the total area under the Chokoria mangrove, an amount of Tk 5.3 million worth of benefit is found. Table 4.5 shows the details.

TABLE 4.5

**Costs of Mangrove Destruction Due to Shrimp Cultivation**

Types of Damage	Physical Impact	Value (Tk Mn)	Total GDP	Percentage of		
				Forestry GDP	Total GDP of the districts	Forestry GDP of the districts
Deforestation	8750 ha lost	196.1	0.02	0.46	0.06	1.31
Pharmaceutical value	-	5.3	Negligible	0.01	0.002	0.04
<b>Total</b>	<b>-</b>	<b>201.4</b>	<b>0.02</b>	<b>0.47</b>	<b>0.06</b>	<b>1.35</b>



### 4.3 Benefits of Shrimp Culture

Benefits of shrimp cultivation are derived in many forms as indicated in Table 4.2. As in the case of cost estimation, not all types of benefits are easily estimated. Therefore, the increased income through foreign exchange earnings is considered. In 1994, total income from shrimp export was Tk 13,210 million, which is 10 per cent of total export income and 1.22 per cent of total GDP in the reference year. Since it is an export oriented industry, 90 per cent of the income can be taken as the value added, and the remainder used to cover machinery and production costs. Therefore, the export earning from shrimp cultivation is Tk 11,889 million, which is 1.1 per cent of total GDP of the country and 3.39 per cent of the total GDP of the districts in the reference year.

### 4.4 Comparison of Costs and Benefits

A comparison of the costs and benefits of shrimp culture activity is difficult to make at this stage since the estimates of this study are partial and based on a number of assumptions. Nonetheless, an approximation of the costs and benefits is worth estimating for policy-making purposes. The total cost of shrimp cultivation varies from 0.23 to 0.33 per cent GDP in the reference year.

The total cost of shrimp cultivation is estimated to be Tk 2464.4 million (when production loss is considered) to Tk 3558.4 million (when restoration cost is considered), while the benefit is Tk 11,889 million gained through export earnings indicating that the benefits are greater than the environmental costs of shrimp cultivation. Total cost of shrimp cultivation varies from 0.23 to 0.33 per cent of the total GDP of the country and from 0.70 to 1.01 per cent of the total GDP of the districts concerned in the reference year.

This gives a Cost-Benefit Ratio of 0.21 (on a production loss basis) and 0.30 (on a restoration cost basis). In other words, the cost is 21 per cent (production loss) and 30 per cent (restoration cost) of the benefit derived through shrimp cultivation.

TABLE 4.6  
Summary of Estimates of Costs and Benefit of Shrimp Culture

Components	Value (Tk Mn)	Percentage in total GDP	Percentage in GDP of the districts
<b>Costs</b>	(a) 2464.4	0.23	0.70
	(b) 3558.4	0.33	1.01
<b>Cost Components</b>			
Land Degradation			
(1) Loss of agricultural production	1237.6	0.11	0.35
(2) Restoration cost	2331.6	0.22	0.66
(3) Loss of livestock	91.2	0.01	0.03
(4) Health Impact	934.2	0.09	0.27
Mortality	925.6	0.09	0.26
Morbidity	8.6	0.001	0.002
(5) Mangrove Forests	201.4	0.02	0.06
Loss of forest products	196.1	0.02	0.06
Pharmaceutical value	5.3	Negligible	0.002
<b>Benefits</b>			
<i>Export Earnings</i>	11,889	1.1	3.39
<b>Cost-Benefit Ratio</b>	0.21		
	0.30		

Note: (a) is the total of items 1, 3, 4 and 5, while (b) is the total of items 2, 3, 4 and 5

Source: Tables 4.3, 4.4 and 4.5.

## 4.5 Social Costs

As mentioned earlier, apart from economic costs, various social costs are associated with shrimp cultivation that cannot be measured in monetary terms. These costs are manifested in the shrimp culture industry in many forms. Most of the shrimp farms are cultivated by entrepreneurs who are not residents of the area and thus have no social obligations to the area. They are connected with powerful people and political parties, and can get away with many offences. Those who resist shrimp cultivation are often subject to torture and violence, and even killing. False cases are filed against them. Small and marginal farmers are harassed in many ways. They are not allowed to work in the shrimp fields, as the entrepreneurs fear the theft of shrimp. Consequently, they have to look for employment elsewhere, often outside of their native villages resulting in family dislocations.

One way of looking at the social aspects of the shrimp culture industry is that as its benefits are captured primarily by urban owners and not distributed equally among all sections of the society involved in the industry, the degradation of the environment in the affected region is, in fact, contributing to the urban interest. As output from this industry is consumed primarily in export markets, the degradation of the Bangladesh environment in affected regions remains a local externality whose costs go unaccounted for in consumption markets.

As a vulnerable group of the society, women are the most affected victims of environmental degradation. Not only are they engaged in the collection of shrimp fries and the processing of shrimp, but they also have to perform household activities in a degraded environment which poses serious threats to their health. They are also harassed and tortured by the owners of the shrimp farms. Children, on the other hand, miss their classes during the season when shrimp fries are collected. Poor parents send their children, in the age group of 6 to 15 years, for shrimp fry collection mainly during the time of the tide. They earn about Tk 40 to 50 per day by spending 6 to 8 hours a day and contribute to their family's income in a major way (Murtaza 1994). It is maintained that even after accounting for such social costs, the benefits accrued from shrimp cultivation outweigh the costs incurred.

## 4.6 Concluding Observations

A number of caveats have to be made before analysing these results because making conclusions without qualifications may be misleading. Both damage and benefit costs are underestimated firstly because, only the on-site costs of shrimp culture are considered, and secondly, a number of assumptions have been made while in some cases data have been borrowed from other countries on the basis of benefit transfer approach.

As the estimates are not complete, they should be interpreted cautiously when used to make policy interventions. Notwithstanding the partial nature of the estimates, they give an indication of the environmental damage induced by shrimp cultivation and of the benefits deriving from this industry. Though economic gains outweigh the environmental costs, conclusions have to be made carefully because environmental costs are far-reaching, and the impact may be observed later over a long period of time. Moreover, some of the environmental impacts, such as biodiversity loss are irreversible. The value of environmental resources is far greater than any quantifiable amount since they are essential for human existence. Keeping these limitations in mind one can argue that some of the damages, especially those estimated in this chapter, can be avoided, and benefits can be increased with the right type of measures and interventions (discussed in Chapter V).

# Chapter V

## Promoting Environment-Friendly export-Oriented Shrimp Cultivation: Policies and Instruments

### 5.1 Policy Framework for Sustainable Shrimp Culture: The Underlying Premises

The analyses presented in the preceding chapters highlighted that export-oriented shrimp culture in Bangladesh has experienced a discernible growth in the post-adjustment period. It has been suggested that trade liberalisation measures implemented under the Bangladesh SAP has contributed to a large extent towards bringing about this growth. Review of evidence shows that this unleashed growth process has had some severe environmental implications. Nevertheless, a partial cost-benefit estimate reveals that benefits accruing from shrimp cultivation outweigh its costs. Remaining cognisant of the fact that many unaccounted environmental factors manifest in the long term, it must be emphasised that policies and instruments need to be designed and incorporated into the future policy regime in order to promote sustainable shrimp cultivation in Bangladesh. The present chapter seeks to address the last of the above mentioned aspects.

Environmental problems precipitated by export-oriented shrimp cultivation in Bangladesh, as in other types of environmental problems, arise due to market failures, *policy failures* and institutional failures. *Market failure*, in this case, is reflected through the underestimation of the costs incurred due to shrimp cultivation. This occurs because shrimp cultivators do not pay the economic prices of the resources they use. For example, the leasing system of government land induces cultivators to consider agricultural land as a free good and to exploit it as much as possible to maximise private gains despite deleterious environmental impacts.

Incidence of market failure is usually closely associated with policy failure. Policy failure results from an absence of policy, or inappropriate policy or a misapplication of policy. For instance, in order to undertake shrimp cultivation in a certain area, consenting agreement of 85 per cent of the people residing in that locality should be secured. However, due to the misinterpretation of the regulation, owners of 85 per cent of the lands can now exclusively decide on shrimp cultivation. Thus only a few take part in the decision-making, while the majority remain outside this process.

Even when markets are well developed and policies are well formulated, their functioning may still be inhibited by institutional weaknesses. Such *institutional failures* are quite common in countries like Bangladesh. Not only are institutions not backed-up by effective legal and administrative support, they further suffer from a lack of qualified workforce, leading to weak formulation and implementation of necessary measures. Thus, due to poor institutional capacity, existing policies, laws and regulations regarding shrimp cultivation are not enforced in most cases.

Overcoming market, policy and institutional failures in shrimp cultivation calls for a judicious mix of *market-based* and *non-market-based* measures. The *market-based* instruments are easier to implement as they usually entail provision of fiscal and financial incentives. However, in certain cases, given the limited efficacy of the incentives, *command-and-control* types of instruments need to be deployed to address the situation. The policy instruments suggested below for promoting an environmentally sound export-oriented shrimp culture industry include only price- and technology-related instruments, and exclude quantity-related instruments (e.g., tradable permits) as they do not seem to be appropriate for shrimp cultivation in Bangladesh. As the direction

of changes in resource use will depend to a large extent on the nature of intervening institutional factors, the role of the *institutions* in implementation of the policies is discussed separately,

## 5.2 Instruments and Regulations for Sustainable Shrimp Cultivation

Bangladesh has traditionally used restrictions and regulations to contain environmental damages from an economic activity. This command-and-control approach gave rise to standards-driven environmental policy that employs quantity constraints to control levels of pollutants and limit the depletion of resources. However, experience in developed countries suggests that mandated environmental standards and technologies may act as a drag on economic growth and costs may not be within the means of low-income economies like Bangladesh.

Thus, the challenge of integrating environmental and economic (sectoral) policies in the context of sustainable shrimp culture may be largely addressed by economic instruments for environmental management. Such instruments motivate behavioural change, inducing differential response by economic agents and allowing them to adjust flexibly to evolving circumstances. Use of economic instruments may also generate financial resources. In a sense, the search for environmental management instruments in developing countries (like Bangladesh) is a search for instruments for sustainable development (in industries such as commercial shrimp culture) (Panayotou 1998).

This is not say that command-and-control regulations have to be abandoned and replaced by economic instruments altogether, as this is neither desirable nor possible. Accordingly, what has been suggested below entails improving the efficiency and flexibility of existing regulations through selective introduction of economic instruments.

For the promotion of sustainable shrimp culture in Bangladesh, two sets of measures involving economic instruments and command-and-control regulations may be pursued. These measures have been presented in Table 5.1.

### Market-Based Instruments or Economic Instruments

#### *Economic Instruments Based On Price Related Measures And Fiscal Incentives*

The first group of market-based instruments is price related measures and fiscal incentives. If used properly, price related measures and fiscal incentives can be mutually beneficial for entrepreneurs, workers and the community at large. Three specific instruments, viz. land use tax, effluent charge on water pollutants and Soil Conservation Fund have been discussed below in this regard.

- *Land Use Tax.* Since there is no tax on agricultural land, it is considered as a free good and, therefore, tends to be misused. This can be reduced through a tax imposed on the users of land for shrimp cultivation. This would make certain land unprofitable for shrimp culture. This measure has relatively low monitoring and enforcement cost and may raise substantial revenue. The revenue earned can be used to finance technological improvements that would reduce shrimp cultivation induced natural resource degradation.
- *Effluent Charge on Pollutants of Water.* The shrimp farms should pay for polluting the water through effluent charges on pollutants containing BOD (biochemical oxygen demand) and COD (chemical oxygen demand) materials. This charge may vary according to the size of the farms in order to account for their varying pollution intensity. Apart from the positive revenue effect, this will provide the entrepreneurs with an incentive to employ more environmentally sound production practices. The revenue raised may be used to construct water treatment plants. The charge rate can be increased gradually over time so that prices are correct.

- *Soil Conservation Fund.* The shrimp farms can be encouraged to conserve lands by providing loans. Loans may be given on flexible terms to shrimp farms for employing environmentally sound technologies to reduce salinity and water logging. However, one needs to take into account that (subsidised) soil conservation loan to finance environmentally sound technologies is not a dynamically efficient instrument, since it might make shrimp culture activities more profitable and induce additional entrants in the industry, thereby giving rise to increased environmental damage.

#### *Economic Instruments That Promote Appropriate Technologies*

The second group of market-based instruments are designed to promote environmentally sound technologies in shrimp cultivation. The technology requirements in shrimp cultivation are mostly indigenous by nature. Two specific, but complementary, means can be mentioned in this regard. These two means are rice-shrimp mix farming and semi-intensive shrimp farming.

- *Rice-Shrimp Mix Farming.* A pilot (model) project may be designed to closely examine the scheme which employs semi-intensive shrimp culture during the first half of the year, and then, during the second half of the year, employs marine/brackish water fin fish culture, sweet water fish culture or rice cultivation, depending on the land type. By encouraging this traditional practice, the long-term gains will be maximised in terms of both productivity and land quality. There may be shared leasing between the crop farmers and the shrimp farmers for the shrimp-rice cultivation cycle. In this practice, since the rice farmers have to maintain the quality of their land to produce rice, they will therefore have to take measures to stop land degradation. Furthermore, the shrimp farmers will have to allow the monsoon sweet water to wash away salinity in the shrimp cultivating lands. It may serve the dual interests of land owning small farmers and landless poor people of the area. It would also support protection of environment.
- *Semi-Intensive Shrimp Farming.* As a principle, semi-intensive shrimp cultivation should be encouraged with necessary safeguards. A pilot project could seek to understand hydro-morphological land changes associated with this practice, and examine technologies to overcome related problems.

#### *Regulatory or Command-and-control Based Measures*

The command-and-control measures discussed below simply draw on the existing policies and regulations. These measures include land zoning, mandatory forest development, a ban on trawler shrimp catching, licensing, and strengthening of property rights and legal reforms.

*Land Zoning.* There is a tendency for the horizontal expansion of shrimp farming which is responsible for destruction of mangrove forests and agricultural lands. There should be definite guidelines for use of the resources of brackish water areas for the cultivation of marine and freshwater shrimp, as well as other suitable species of shrimp and fish. Criteria for selection should be based on topography, tide fluctuations, salinity, soil quality, etc. The government, making reference to an extensive survey of the geographical and environmental features of current shrimp culture locations, should decide which areas remain suitable for shrimp cultivation. Accordingly, there should be clear area demarcations and land zoning for shrimp cultivation with a view to minimising the conflict between shrimp culture and agriculture and ensuring protection of the environment.

*Licensing.* Licensing of shrimp farms should be reintroduced. This will help to control the indiscriminate and unplanned expansion of shrimp cultivation.

*Mandatory Forest.* It should be made mandatory for the shrimp cultivators to develop a green belt of mangrove forest to maintain the biodiversity of the area. It should be at least 30 per cent of the total cultivated area. It will maintain the aquatic and plant diversity of the coastal area. Tradable mangrove conservation obligations may be introduced and developed.

*Ban on Trawler Shrimp Catch.* Trawlers contribute to only 3.5 per cent of total shrimp production and they catch mainly mature and gravid shrimp. Shrimp catch of trawlers should be banned to increase the supply of broods for hatcheries and to enhance the productivity of the natural breeding cycle.

*Strengthening of Property Rights.* Land use rights favouring local people are one of the prerequisites for sustainable shrimp culture activity. At present *khas* government lands are leased out to the shrimp cultivators on flexible terms, leading to inefficient use of land. Expanded programmes in land registration and titling are needed to clarify property rights. Adequate compensation for those people losing lands to shrimp cultivation should be ensured. The government can introduce a minimum cost for per-unit leasing of agricultural land for shrimp farming.

Securitisation of property rights will reduce institutional constraints that prevent “buy-outs” or prevent the mixing of shrimp and rice farming activities. Strengthening of security rights may also be attractive for equity reasons.

*Legal Reforms.* Apparently, there is no shortage of policies or regulations directly concerned with the environmental impacts of shrimp cultivation. These include, the Fish Act (1950), the Shrimp Mohal Management Policy (1992), the Tiger Shrimp Cultivation and Pond Regulation Policy for Bagerhat District (1993), the Shrimp Cultivation Tax Act (1992) and the National Fish Policy. Documents such as Bangladesh Environment Conservation Act (1995), the National Environment Management Action Plan (NEMAP), the National Conservation Strategy, etc., also have relevance for developing sustainable shrimp culture.

Most of these policies and regulations are never implemented properly. Often there is an absence of necessary supportive legislation. At the same time, relevant rules have not been formulated as provided for under these policies. Thus, there is a need to review all of these documents and come up with a comprehensive law (e.g., Sustainable Shrimp Culture Act) which encompasses all aspects of the activity.

### **5.3 Institutional Initiative for Sustainable Shrimp Culture**

Currently, a plethora of public agencies are involved in one way or another in regulating shrimp culture in Bangladesh. These include the Ministry of Fisheries, the Ministry of Land, and the Ministry of Forests and Environment. While the Ministry of Industries is involved in the shrimp processing phase, the Ministry of Commerce deals with exports of shrimp. Scientific and technological support with respect to shrimp cultivation is supposed to be forthcoming from Fisheries Research Institute (FRI), Bangladesh Agricultural University (BAU), and Khulna University. Law enforcement agencies are quite often involved in mitigating shrimp cultivation related violence.

Besides public institutions, a host of private bodies and NGOs are actively engaged in the industry. The Bangladesh Frozen Food Exporters Association (BFFEA) is the most representative trade body of industry entrepreneurs. The NGOs (e.g., Nejera Kori) and the political parties are involved in mobilising the small and marginal cultivators, as well as landless labourers, to protect land rights, and limit growth of the shrimp cultivation industry.

Against the background of the overall problem of governance, the inter-dependence and complementarity of these institutions may be achieved through a tripartite initiative involving the government, the private sector and NGOs. For such an initiative to yield results, the Department of Environment has to emerge in a leading role, whereas the private sector has to commit itself to a socially responsible (environment sensitive) code of conduct. Last but not the least, the local community should be involved through a social mobilisation process which may be catalysed by the NGOs.

TABLE 5.1

**Instruments and Regulations for Environmental-Friendly Shrimp Culture**

Policies	Instruments	Risks	Objectives/Benefits	Actors
Market-based	Land use tax	Resistance from cultivators may undermine short-term competitiveness	Revenue earning; reduce over exploitation	Ministry of Land, Finance Ministry, Ministry of Fisheries and Department of Investment (DoI)
	Effluent charge on water pollutants	Difficult to establish differentiated rates	Revenue earning; reflect correct price	DoE
	Soil Conservation Fund	Abuse of facility and diversion of funds if at given free costs or at cheaper rates	Soil conserved; production raised	MO Finance, DoE, DoF, Ministry of Land, Geological Survey, SPARSO
	Rice-shrimp mix and semi-intensive farming	Fall in rice productivity, threat of virus attack	Productivity loss minimised	Agric. Ministry, Ministry of Land, Agriculture University
Command-and-Control	Land zoning	Lack of land use related technical knowledge; Infringement on private land use rights	Land less degraded	MO Land/DoE, BAU Concerned NGOs/CBOs
	Property rights	Involves protracted legislative process	Land used efficiently;	MO Law/Land Ministry Concerned NGOs/CBOs
	Shrimp cultivation policy	Difficult to establish compatibility with other laws and possibility of weak enforcement	Parameters of shrimp culture development specified	MO Agriculture, DoF, DoE, Concerned NGOs/CBOs
	Institutional strengthening	Overall weak governance in the country	Monitoring and enforcement ensured	DoF/DoE

If undertaking a pilot scheme on sustainable shrimp culture under a tripartite initiative seems to be a difficult exercise, the proposed joint initiative may launch a voluntary eco-labelling project that may ensure quality standards at all levels of production and protect the country against possible loss of its overseas market due to a poor image of the Bangladesh shrimp industry.

Concurrently, building social institutions like schools, health care centres for the local people near the *ghers* and ensuring sanitary and safe drinking water facilities in the areas is an important task. Also, there should be some provisions to ensure that the shrimp farms employ the majority of their workers from the locality. It will decrease social tensions and rising unemployment caused by the loss of land to shrimp cultivators.





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