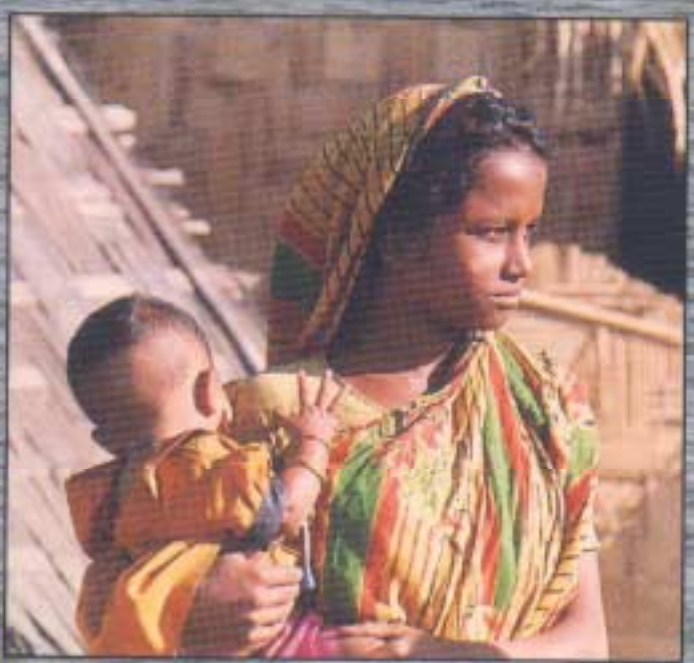
POST-HARVEST FISHERIES OVERVIEW

BANGLADESH



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POST-HARVEST FISHERIES OVERVIEW OF BANGLADESH

Post-Harvest Fisheries Project
Department for International Development
Chennai, India

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This "Overview study" of post-harvest fisheries in Bangladesh was produced by the Department for International Development's Bay of Bengal Post-Harvest Fisheries Project (DFID-PHFP) and updated by the project's partner organisations and local staff.

This Overview study could serve as a planning tool and a source of reference for organisations active in post-harvest fisheries who seek interventions to solve specific problems. The Overview will be useful to policy makers, government and non-governmental organisations, the private sector and other agencies to inform them of the constraints and options within this sector.

The Project works with small-scale artisanal fishing communities to reduce post-harvest losses of fish; develop low-cost improvements in handling, processing and marketing; and provide technical support, advice and training to government and non-governmental organisations, fisherfolk associations and women's groups.

The Project is funded by the Government of the United Kingdom and covers three countries within the Bay of Bengal region — India, Bangladesh and Sri Lanka.

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ABBREVIATIONS AND ACRONYMS

AZAD	-	Association of Zonal Approach Development
BCSIR	-	Bangladesh Council for Scientific and Industrial Research
BFDC	-	Bangladesh Fisheries Development Corporation
BOBP	-	Bay of Bengal Programme
BRAC	-	Bangladesh Rural Advancement Committee
BSUS	-	Bangladesh Samaj Unnayan Samity
CODEC	-	Community Development Centre (Bangladesh)
DFID	-	Department for International Development (UK). Formerly, ODA (Overseas Development Administration)
DFID-PHFP	-	Department for International Development — Post-Harvest Fisheries Project
DOF	-	Department of Fisheries
DUS	-	Dwip Unnayan Songstha
EPB	-	Export Promotion Bureau
EU	-	European Union
FRI	-	Fisheries Research Institute
FRSS	-	Fisheries Resources Survey System
GDP	-	Gross Domestic Product
gm	-	gramme
GUP	-	Gono Unnayan Prochesta
ha	-	hectare
IGA	-	Income-generating Activity
JBPB	-	Jatio Bandhujan Parishad, Bangladesh
kg	-	kilogram
km	-	kilometre
MOFL	-	Ministry of Fisheries & Livestock
mt	-	metric tonnes
NGO	-	Non-Governmental Organisation
PMUK	-	Proshika Manobik Unnayan Kendra
SBN	-	Set Bagnet
sq **km**	-	square kilometre
Tk	-	Bangladeshi Taka
UDDIPAN	-	United Development Initiatives for Programmed Action

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1. INTRODUCTION AND REPORT STRUCTURE

1.1 INTRODUCTION

1.1.1 Background to Project

The DFID Post-Harvest Fisheries Project is funded by the British Government's Department for International Development, and is based in Chennai. with a satellite office in Kakinada, Andhra Pradesh. The project carries out a range of activities addressing the needs of a wide target group amongst the rural coastal poor. It also supports a general raising of awareness of post-harvest needs in the region and of pronioting increased regional co-operation and communication. The focus is on identifying solutions to post-harvest problems and on assisting local institutions, such as fishermen's organisations, to overcome these problems. Three countries within the Bay of Bengal region participate in this project: Bangladesh, India and Sri Lanka.

The principal objectives of the project are:

- To enhance the incomes of artisanal fishing communities and petty fish traders in India, Bangladesh and Sri Lanka;
- To identify and develop the potential for increasing the diversity of fish products marketed by these communities: and
- To strengthen the ability of agencies working in the fisheries sector and of fisherfolk associations to replicate and secure sustainable benefits from project activities.

The project focusses on working with small-scale fishing communities in the marine artisanal fisheries sector. These communities traditionally suffer from natural disasters, environmental degradation, over-fishing and population pressures. Climatic changes and rising sea levels associated with global warming will also lead to an increasing instability in the coastal areas.

Over the years, fishery capture and production-oriented practices have placed an enormous strain on the common pool of resources in the sea. Therefore, it is essential that these resources are sustainably managed and the usage of such resources is maximised. The project has pursued this aim by improving the efficiency of post-harvest handling, processing and marketing of sustainably produced products. However, the project has always taken a much broader approach in working with coastal communities by addressing issues that affect their lives and has been working towards sustainable livelihood strategies.

The project has always followed a process approach by developing, demonstrating and promoting new techniques, technologies or ideas to help improve the conditions of small-scale fisherfolk communities. The project has limited its field work to the areas where post-harvest were considered particular priorities by the member states at that time, that is in India, Bangladesh and Sri Lanka. In India only the east coast states were involved.

The approach adopted by the project has been flexible, reactive and catalytic. Flexible in the sense that it was very openly defined at the design stage, allowing the project to adopt a process approach to activity planning. The project had the scope to identify, design and appraise a series of sub-projects within a broad project framework. *Reactive* in that its function was to respond to the needs of coastal communities, or to the needs expressed by other agencies as and when post-harvest problems became apparent. Catalytic in that the project aimed to find solutions to problems, develop methodologies for resolving them, and then to mobilise local institutions to implement and disseminate ideas. The project then took the essential lessons and methodologies from the localised situation and made them regionally available. In that way the benefits from project activities could reach a wider audience across the region.

The project started in 1987, and is currently in its Third Phase, which ends 31 March 1998. The project operated on the principle that it was at best a temporary mechanism to raise awareness on post-harvest fisheries; but ultimately local institutions would have to take up the project's role.

The project has operated over a large geographical area in trying to address a wide range of development problems. An important element of the project has been the strong partnerships formed between the project, other donor projects, government departments and non-government organisations in the three countries. Government staff have played a vital role in identifying key problem areas to be addressed and in facilitating solutions.

The partnerships with NGOs have also been crucial to the project's success. They have provided a vital mechanism for close interaction with the communities, especially those NGOs that have their origins in the fishing communities themselves. The project has placed considerable emphasis in recent years on forging strong partnerships between NGOs and government, and this is important for the sustainability of work with coastal communities once the project closes.

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As part of the effort in the post-harvest subsector an Overview study has been completed with the following objectives:

To serve as a source of reference to enable interventions concerning key problems in the post-harvest subsector.

To serve as a planning tool to other organisations active in post-harvest fisheries in the region.

The Overview has taken a wide perspective of the post-harvest sub-sector without limiting its concerns to areas within the specific mandate of the Project. This has enabled all post-harvest issues to be addressed, and has allowed the project to support a wider process of development through other institutions within the post-harvest sub-sector.

1.1.2 The Scope of the Overview

The Overview attempts as wide a perspective of the sector as possible. This allows both macro and micro-level problems and possibilities to be identified in broad terms and related to each other.

1.1.3 The Intended Audience of the Overview

The Overview will be published and distributed widely to representatives of government, the private sector, NGOs and fisherfolk community organisers.

1.2 THE STRUCTURE OF THE OVERVIEW

Post-harvest fisheries encompasses activities and features between the time the fish is landed at the point of capture (either on a vessel or on the shore depending on the harvesting method and the level of investment or the type of technology used), to the time the fish is consumed. This does not limit post-harvest fisheries to technologies associated with processing and preservation as it is sometimes narrowly thought of. It includes the policy. environmental, economic, institutional, socio-cultural and technological aspects of demand, supply and transformation of product.

The driving force behind the expansion of fish supply, and the associated innovations in its transformation from the point of landing to consumption, is that of demand. Without a demand for the product there would be little point in attempting to catch it, preserve and process it, or distribute it. This is often forgotten while considering post-harvest fisheries development and the factors that constrain it.

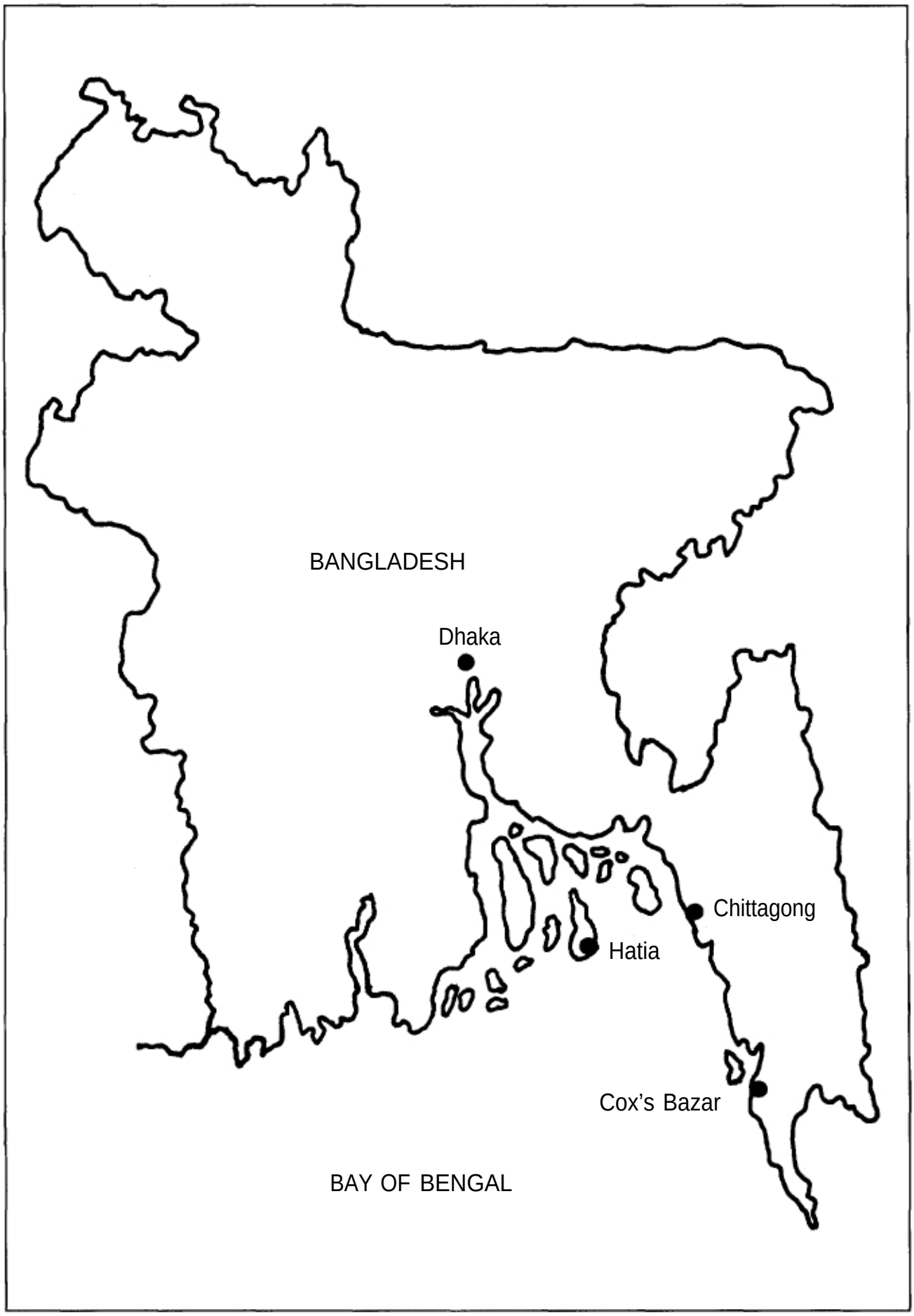
This Post-Harvest Overview is demand-led. It takes the perspective that demand, within the limits of the available resources, skills and finance, determines which fish is landed, when and where, and how it is transformed (changed in quantity, quality, form, price and location) before it is consumed.

The Overview is organised in three distinct sections related to:

- Demand
- Supply
- Transformation

Each of these sections considers the characteristics, sources and factors affecting them, key problems. current interventions and any action needed.

MAP OF BANGLADESH



2. BACKGROUND TO POST-HARVEST ACTIVITIES IN BANGLADESH

2.1 FISHERIES IN THE NATIONAL ECONOMY

Bangladesh is located hetween 20.34" and 26.36" N and between 88.01" and 92.41" E. The land area is about 144,000 sq km and consists mainly of the deltaic floodplains of the rivers Ganga, Brahmaputra and Meghna, with their tributaries and branches. Bangladesh thus has a vast fishery potential within her boundaries and the territorial and economic zones of the sea.

The total area of perennial inland water is estimated at I .58 million ha while the area of inundated paddy fields and other low-lying regions — which retain monsoon water for about five to six months. allowing seasonal fish culture — is estimated at 2.83 million ha. The country has a coastline of 480 km and approximately one million ha of territorial waters. The nation's exclusive economic zone extends 320 km out to the sea from the coastline.

The role and contribution of the fisheries sector in the economic development of Bangladesh is quite significant, in terms of national nutrition, employment of a major segment of its rural population. and through increased foreign exchange earnings from exports of fish and fish products. More than 3.5 per cent of the National Income and almost 10 per cent of the earnings from the agriculture sector come from fisheries. Fish provide over 80 per cent of the per capita animal protein intake in Bangladesh. The total population engaged in commercial fisheries around the year is close to I.2 million. while the number depending on fishery at least seasonally brings the population directly or indirectly dependent on fishery to 10 million, or ten per cent of the national population.

Fish exports annually contribute almost 9 per cent of Bangladesh's export earnings, just after readymade garments and jute. From annual exports worth Tk 35 million in 1972-73, fisheries exports increased to Tk 620 million by 1979-80, which further increased to Tk 2,330 million by 1984-85. In 1989-90, the quantity of fish exports was 25,000 tonnes, worth Tk 5,000 million.

There exists a vast potential in freshwater, brackishwater and marine fishery resources, which may. through planned development, contribute very significantly to reducing malnutrition. providing additional employment, and the creation of opportunities for developing ancillary industries. thereby increasing the Gross Domestic Product (GDP) of the nation.

A review of the impact of past development activities reveals a mixed experience of both success and failure. There are hardly any reliable statistics to go on until 1979-80, when a Fisheries Resources Survey System (FRSS) was established and started operating. The available data indicate a sudden drop in fish production from the early 1970s level of over 800,000 tonnes to only 640.000 tonnes in 1975-76. It took over a decade before production increased to the early 1970s level.

There has been a decline in the daily per capita fish intake over the last three decades. From 33 gm/ capita/day, fish consumption in 1962-63 declined to about 18 gm/capita/day in 1982-83. There was a marginal increase in consumption in 1993-94 to 24 @capita/day.

The total production of fish in Bangladesh was 1,025.952 mt in 1992-93 of which 775,472 mt came from inland sources and 250,480 mt from marine sources, a ratio of 3: 1. Clearly, marine fish production lags behind. This, to a large extent, is because of a consumer preference for freshwater species. There has been a steady increase in the production of inland fish from 6 16 mt in 1989-90 to 775 mt in 1992-93, an increase of 26% over 4 years. It needs to be noted that the proportion of cultured fish in total inland fish produced also increased from 21% to 33% during the same period. The increase in marine fish production, however, has been more or less static with production increasing from 239 mt in 1989-90 to 250 mt in 1992-93, an increase of 4%. The production of shrimp and prawn from both inland and marine sources increased by 30% during the same period.

There has been a perceptible decline in open water fish production. The causes for this decline are threefold — natural, man-made, and human-induced. Large scale shoaling and changes in the river courses have affected many fisheries. Man-made causes include flood control, irrigation and drainage projects converting traditional fish breeding and grazing grounds into agricultural fields. Use of agro pesticides and chemical fertilisers, fishing of undersized and brood stock, annual leasing of the beels and baors (open water floodplains). encouraging the total harvest of the fish stock, and non-existence of sanctuaries for brood stock to allow regeneration of the aquatic

system, have all played their role in the decline in open water fish production.

In addition to the various natural causes and resource-use conflicts mentioned, there are institutional and social reasons which stand in the way of fisheries development. These include inadequate investment, lack of appropriate technologies, lack of infrastructure facilities in potentially good but remote production or landing centres, inadequate extension services, inherent institutional weaknesses in planning, implementation and monitoring in the fisheries sector, and lack of appropriately trained and motivated manpower.

The major strategies adopted and programmes undertaken during this period were (i) open water fisheries conservation and management, (ii) fresh water and brackishwater aquaculture, (iii) artificial seed production, (iv) improvement of preservation, processing and marketing facilities, (v) training and extension, (vi) fisheries research, surveys and feasibility studies and (vii) marine fisheries development.

The broad objectives of the Fourth Five-Year Plan (1989/90-1994/95) with respect to fisheries development are as follows:

- To raise production and increase availability of fish to the people leading towards improvement of the national nutritional status:
- To expand employment opportunities in fishery and ancillary industries;
- To improve the socio-economic conditions of the fisher-folk, fish farmers, and others engaged in the fisheries sector:
- To increase the volume of exports and export earnings by further developing selected fishery products:
- To improve the general environment and public health;
- To help increase GDP.

The potential for increasing production for both domestic and export consumption is considerable. Marine production may increase with expansion of deeper water fishing and significant brackishwater aquaculture of shrimp. The potential in inland water fishery lies more in the intensive fish farming practices fast catching on among the rural population.

3. POST-HARVEST OVERVIEW

3.1 DEMAND FOR FISHERIES PRODUCTS

The following perspectives may help us in our investigation of the demand for fisheries products:

- Demand characteristics
- Demand segmentation
- Factors affecting demand
- Key problem areas facing demand
- Current intervention in post-harvest activities
- Further action

3.1.1 Demand Characteristics

The characteristics of the demand for fish and fisheries products can be looked at from the following perspectives:

Current quantitative demand

The total demand for fish at current prices is not known as appropriate information is not available. A rough estimate of the demand for fish for 1992-93 for an estimated population of 120 million based on per capita requirements varies from 1.05m mt (if 8.8kg is used as the per capita requirement) to 3.00m mt (if 25kg is the Asian average). The shortfall in production varied from 0.03m mt to 2.8m mt.

Product type, species composition and quality demanded

The different types of fish demanded, the composition of fish species, and the quality demanded are discussed below:

Fresh fish

An estimated 30% of the fish was marketed as fresh fish in 1985. This proportion has perhaps dropped with the opening of new production facilities for ice in various parts of the country. The market channels operate through a distribution network, which enables major metropolitan/urban and suburban consumers to access them. The inland fishery supports the majority of the population and the preference for fresh inland species dominates the market, even when prices per kilogram are much higher than meat (beef, mutton, chicken) prices. Among freshwater species, the major species is carp, the local varieties of which command high prices (rohu, katla and mrigal). Other hybrid carp species (common carp, silver carp, grass carp) are becoming available in the market, with the expansion of aquaculture, at almost 60% of the prices commanded by local varieties. The other noteworthy freshwater species are river hilsa, pabda, tangra, pangash, foli, chitol, boal, bata, chanda and baila.

The coastal people prefer marine species as they are easily accessible and cheaper. The marine fish species most preferred in all Bangladesh is hilsa. For almost half a year, this species dominates the market in terms of supply. Other marine species preferred and hence commanding good prices are bhetki (sea perch), croaker, pomfret and shrimp. Low-value species include sardines, anchovies and eel.

Quantitative information on the variability of demand with respect to quality is not available at the moment, but preference patterns revealed by consumers at markets reflect a strong preference for fresh fish.

Frozen fish

The use of ice for preservation has been spreading rapidly. An estimated 40% of the fish is iced (BOBP 1985). It is likely that this proportion is even higher. Icing is adopted for both domestic and international markets. Most frozen fish are intended for export and are mainly shrimp (both marine and freshwater) and pomfret. However, seasonally, during gluts in the harvest season, some species are frozen to be preserved for 15 days to a month, so that they can be sold later as fresh fish in the market. Fish in large urban grocery stores are sometimes stored in deep freezes. Shops which cater to expatriates, in particular, store marine fish in deep freezes. These include lobster, squid, crab and marine fish.

Driedfish

Where the quality of fresh fish is not good round the year, or when there are supply shortages, dried fish is preferred. There are also some species like loita, churi, chepa and shrimp which are preferred in dried form by a large part of the population as a delicacy all round the year. Some fish is dried by small scale fisherfolk to be consumed during the off season. About 20% of the production is said to be dried (BOBP 1985). Some 40 – 50 species of fish are dried for local consumption, with a dozen species dominating the scene. The major dry fish wholesale market in Chittagong houses at least 100 major wholesalers and over 500 semi-retailers and does brisk business with traders arriving from all over the country. There is export demand for dried croaker, shark and potka.

Salted fish

The preference for salted fish domestically arises from communities living with little access to fresh fish all round the year. About 10% of the fish

produced is converted into salted fish (BOBP 1985). People in the northern districts and in the Mymensinh and Sylhet districts prefer some salted fish species.

Fishmeal

Fishmeal is primarily used in the poultry industry in Bangladesh. Consequently, the demand for it varies with poultry prices.

Canned fish

Canned fish is mostly imported from Asian and European countries and sold in shops in major urban centres. There is no information on local fish which is canned.

Live fish/prawn fry

Demand for live fish is mainly for the following species: Taki, shol, gojar, koi, shing and magur.

Bagda ***(Penaeus monodon)*** and galda ***(Macrobrachium rosenbergii)*** are the main fry demanded live for the hatchery trade and aquaculture. Also noteworthy is the rise in fry demand for carp, catfish, and other species for fish farming.

Value-added products

In Gulshan Market, New Market, and other major markets in urban centres, considerable processing of fish into value-added products (gutting, filleting, cutting, slicing and selling in small quantities) is carried out for the higher as well as lower income market segments.

Variability in demand

In Bangladesh, consumers generally prefer freshwater fish, and almost 75% of the total fish consumption is of freshwater fish. This is higher in the rural sector while a larger share of marine fish is sold in the urban centres. Furthermore, the types of fish consumed in rural areas vary from one location to another. Also, during the holy month of Ramzan, fish demand is specially high.

3.1.2 Demand Segmentation

In trying to define meaningfully the segments of the Bangladeshi fish market, it is necessary to define groups with significant differences in their demand characteristics, and for members of each segment to be sufficiently similar in their demand characteristics to allow generalisation.

The segmentation of demand at the retail level in Bangladesh is dependent to a large extent on income distribution and location. This relates in the main to the segmentation of customers (i.e., those who buy the fish) rather than that of consumers. The buying patterns of the customers are ultimately influenced by the demands of the consumers they serve. Some buyers of fish are not themselves consumers but buyers for consumers outside the state or country.

The method of segmentation also depends, to some degree, on whose perspectives it represents. In this case, our primary concern is for small-scale traders and thus our segmentation should reflect, but not be restricted to, that group. Segmentation of demand should not, however, only reflect those segments of the market which the small-scale trader supplies but rather those segments which influence their operations. Here the segmentation of the market is based on those points at which the fish is removed from the sphere of influence of, or access by, the small-scale traders, or is converted into something else.

Demand can be segmented in the following ways:

- Coastal retail
- Dhaka retail
- Inland retail
- Institutional
- Industrial
- Overseas exports
- Prawn farms

This segmentation includes the customers of the small-scale producers, processors and traders and also reflects the wider demands on fish entering the market which will affect the overall supply available to small-scale participants.

These are outlined below although only limited information is available about each.

Coastal retail

The coastal retail market is characterised by trade among coastal communities revealing preferences for estuarine/marine fish species. The poor condition of the community members in the coastal area is manifested in their demand for low-value/priced species.

Dhaka retail

The Dhaka retail market caters to a population of wealth and cultural diversity. The species in demand are also quite varied. The main preference is for freshwater fish. Where marine fish are preferred, hilsa, bhetki, and pomfret are popular. Carp is the major freshwater species in demand.

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Inland retail

Freshwater fish, mainly from the khals (canals), beels, haors and rivers are mainly preferred in haats and bazaars in the inland retail market. The Sylhet, Mymensinh and Chittagong regions reveal a preference for some species in their dry form as opposed to their fresh form.

Institutional

Institutional fish buyers include:

- The Army
- The Navy
- The Police
- Hospitals
- Prisons
- Hotels/restaurants
- Schools/colleges/madrasahs

Institutional huyers tend to be in urban areas and rely on large quantities and consistency of supply. They do not generally constitute a customer segment of the small-scale trader **but** could have a very significant impact through affecting overall demand and thus the availability and price of fish to which the small-scale trader may have access. They tend to buy their fish by tender and mix it with other forms of protein. Very little is recorded on the institutional demand segment.

Industrial

The industrial segment includes those operators who wish to make fishmeal out of trash fish and small species from bagnet fisheries. There are a few distributed in the coastal belt, buying their fish directly from fishermen or from village fish processors. Also, there is a modern Surimi plant at Chittagong as well as a modern fishmeal plant, Saudi Bangla Fish Feed Limited. near Dhaka.

Overseas exporters

These are mainly large-scale shrimp and prawn exporters who either buy processed products from commercial processors or huy raw stock from the fishermen/fish farmers and process it themselves. Some exporters also export fresh fish, frozen fish, dried shark fins. **fish maws** and live mud crab.

Prawn farms

These farms buy live juvenile prawn which are then grown. They interact directly with the small-scale collectors, through a network of middlemen who manage and assure supply to farm owners.

3.1.3 Factors Affecting Demand

The demand for fish is affected by a range of different factors. These include:

Macro-economic policies

Demand is in large part determined by income levels, population and fish prices (particularly in relation to other forms of animal protein). Macro-economics can influence all of these areas by changes in fiscal, monetary, exchange rate, trade and development policy. Propagation of the benefits of eating fish is part of the national nutritional awareness campaign.

Sectoral policy and legislation

The domestic consumption of fish in Bangladesh has always been high and the problem has been perceived as one of supply rather than demand.

The government, through the Export Promotion Bureau (EPB), has promoted demand for Bangladeshi products overseas and this has directly benefited the growing prawn farming industry and, to some extent, its fish export business.

Environment

Perceptions of fish as a healthy form of food are prevalent amongst the more educated groups of consumers. However, as it forms the major animal protein available, there is the danger of an excess demand situation which confronts the country. Some species, both freshwater and estuarine, face the threat of being completely wiped out.

The European Union (EU) import regulations in relation to fish and prawn products do not exert a significant impact at this stage as exports are mainly to Asian markets. This will, however, be a growing area of concern. The import regulations of other states such as Japan, USA and Singapore are also becoming more stringent and their impression of Bangladeshi products will have an effect on future demand.

Micro-economic factors

Price

The price elasticity of demand varies between different segments of the market and for different species. Both wholesale and retail prices of fish vary by season, area, fish variety and size. Likewise, variations in supply are so great on a day-to-day basis that trends in prices are difficult to determine.

Since fish demand is increasing faster than fish supply **(as** both population and income grow), fish

prices are increasing faster than the prices of other food commodities.

Changes in the price and availability of substitutes

From 1975/76 to 1987/88, the average retail price of fish grew from Tk 14.85 to Tk 78.06 per kg, while the average price of fowl increased from Tk 12.97 to Tk 54.98 per kg. The annual growth rate in prices was highest for fish, at 16.60 %, compared to 13.70 % for fowl, 12.80 % for masur (lentil), and 10.30 % for rice.

Viewed from the perspective of exports, the demand for products from Bangladesh will depend in part on the availability, quality and prices of alternative supplies of fisheries products and of attitudes to alternative protein sources.

Changes in taste

There is little information on changes in taste vis-a-vis fish. There is a growing increase in the perception of fish as a healthy food source both domestically and in the export market. This can only have a positive impact on demand.

institutional influences

One of the main factors affecting any perception of demand is the institutional capacity to monitor and analyse changes in that demand. Without this understanding, it is possible that policy influences on demand may inadvertently constrain demand. The institutions to monitor and analyse domestic demand are not well developed.

Technological influences

The major technological influence on demand is that of electrification. This has affected the distribution of refrigerators in homes and in local stores. In Bangladesh, less than 20 per cent of the villages have electrification.

Social, cultural and demographic factors

Population increases are likely to be the most significant factor affecting demand in the medium and long-term. Growth rates in Bangladesh are still high (2.1% per year for the period 1978/9-1988/9) and already dense populations will mean that less land is available for other forms of animal protein. This will in turn increase the demand for animal protein from the aquatic environment.

Different religions have different demands on animal protein as a food source. Nationally, 90.6% of the population are Muslims, 6.4% Hindus, 1.8% Christians and 1.2% Buddhists. The relative importance of fish in the diet of these different groups affects demand.

3.1.4 Key Problem Areas

There are several problem areas, which are affecting or will affect the demand side of the sub-sector in the future.

Lack of information

The most important problem is the lack of information on both demand and how changes in demand affect the participants in the sector. This is particularly important in terms of how demand will affect the supply available to the poorer consumer in the future. Changes in demand will also affect the way supply is distributed and this will have a direct impact on small-scale traders.

Rising prices for poor consumers

It is likely, as discussed above, that population and export-led increases in demand will cause increases in the price of fish which will directly affect the poorer consumers. Given their already low health levels, this could present a serious problem for them.

Export demand quality

The key problem facing demand from the export sector will be perceptions of quality and compliance with ever more stringent overseas import requirements.

3.1.5 Current Intervention

Intervention in demand promotion and understanding can take place at three levels:

Non-governmental sector

There appears to be no intervention by the NGO sector in promoting or understanding demand.

Private sector

Given the existing high demand for fish, there is little need for the private sector to promote demand. There may be some export promotion by the private sector but this could not be determined during the study.

Government

The EPB is the main body involved in the analysis of demand but this has an export focus. It has its head office in Dhaka which caters to the immediate needs of exporters. It monitors overseas market prices on a regular basis. The Project has also been involved in market research in Bangladesh on a preliminary basis (in Chittagong, with CODEC, an NGO, on wholesale market prices of hilsa, and door-to-door fish vendors).

3.1.6 Further Action

Improved information

There is clearly a need to understand the current structure of demand, the factors causing demand change, and how changes in demand may be used for the benefit of the small-scale producer and distributor, and the poorer consumer.

Increased monitoring of export quality needs

The changing and ever stricter requirements of the export trade need to be closely monitored and translated into practical action which suppliers can implement if demand in products from Bangladesh is to be sustained and expanded.

3.2 SUPPLY OF FISHERIES PRODUCTS

The supply of fish can be looked at in the following ways:

3.2.1 Availability and Sources of Supply

The supply of fish in Bangladesh is made up entirely of local production. The country is ideally suited for fish production. Fisheries fall broadly into three categories: (1) inland capture (floodplain fishery), (2) inland culture (primarily pond fishery and coastal aquaculture) and (3) marine sources. In 1993-94, the total landing of fish from inland capture fishery was 552,000 mt, inland culture 275,000 mt, and marine sources 260,000 mt. (source: FRSS, DOF)

The origin of supply will affect the species, sizes, seasonal variability and quality of fish reaching the market.

Freshwater supplies

Freshwater fish constitute the bulk of the landings in Bangladesh, far exceeding marine landings. In fact, Bangladesh ranks third (after China and India) among the world's largest inland fish producing countries. About 4.9 million ha, or 34% of Bangladesh's area, is under water almost 6 months a year. The rivers and streams total 22, 155 km in length (1989 BBS state yearbook). The coastline is about 480 km long. In 1987/88, the area of inland fisheries totalled 4.3 million ha, of which 94% was open water capture areas (which accounted for 7 1% of inland fish production), and the remaining 6% was closed water culture fisheries (29% of inland fish production). However, data shows that from 1983-84 to 1987-88, inland capture fishery declined at the rate of 2.7% a year, while inland culture fishery increased by 10.7% a year.

Freshwater fish farming is an ancient practice in the country but has recently undergone major improvement through the use of stocking, extension and investment.

Marine and estuarine supplies

Marine and estuarine fish are caught by a range of fishing methods including gillnets, bagnets, seines, longlines and trawls. Vessel types range from small unmotorised inshore craft, used mainly in the estuarine waters, to large offshore trawlers. A large proportion are traditional craft.

A study on fish marketing identified 18 major landing centres/wholesale markets as outlined below:

Chittagong

The supply sources are estuarine and deep sea. The outflow to local markets is about 20% of the total fish landed, while the bulk of over 80% volume flows to distant markets.

Chandpur

This is one of the main inland landing centres supplied from Nil Kamal, Bhola and Patuakhali. The pattern of fish flow is similar to that at Chittagong.

Khulna

This major landing centre is located in the coastal belt and is supplied by freshwater, estuarine and marine sources. Some fish arrive from Chittagong, Satkhira and Chandpur. The centre supports the local market with 40% of the total volume landed, while the remaining 60%, mostly shrimp, is exported. Marine trawlers and mechanised and non-mechanised boats bring most of the fish while shrimp farms send their produce through whatever means are practical.

Sylhet

This landing centre is located in the northeastern part of Bangladesh and is mainly supported by fish from haors, beels and rivers and supplies from Ajmiriganj as well as the Chittagong and Chandpur landing centres. Only about 18% of the outflow is to local markets, while 88% goes to distant markets.

Barisal

This landing centre is used by fisherfolk who operate mostly in the Barisal, Perojpur, Jhalakathi, Patuakhali, Barguna, Bhola, and offshore islands. The supplies arrive from freshwater, brackishwater and marine sources. About 80% of the fish landed here are forwarded to distant markets, mainly Jessore and other western and northwestern districts, by trucks or by mechanised boats. This is a notable landing site of crabs.

Cox's Bazar

The bulk of the national marine catch is landed at this centre located at the southern tip of Bangladesh adjacent to the Bay of Bengal. The local demand offtake is about 5% of the volume landed, while the rest flows to distant markets including exports.

Goalondo

This is another important river landing centre in the central region. Supplies come from the river Padma, Madaripur and Barisal.

Mohanganj

This is yet another inland landing centre. Supplies come from Joyshree, Sachna, Ajmiriganj, Goglajore and other haor areas.

Kuliarchar

The fish sources of this centre are Mita Moain, Ajmiriganj, Taherpur, Kumira and Sachna.

Satkhira

This landing centre is located near Khulna and receives supplies mainly from the estuary, Khulna and Paikgacha.

Dhaka

The landing centre is known as Sawarighat on the bank of the river Buriganga. Supplies arrive from Barisal, Bhola, Chandpur, Chittagong, Rangamati, Faridpur, Mohanganj, Kuliarchar, and local sources.

Rajshahi

The supply sources of this landing centre in northwest Bangladesh are Cox's Bazar, Khulna, Kuliarchar, Chittagong and Barisal.

Dinajpur

The supply sources of this landing centre in north Bangladesh are Khulna, Kuliarchar, Chittagong, Barisal, Mohanganj, Rajshahi and local sources.

Rangpur

The supply sources of this landing centre in north Bangladesh are Cox's Bazar, Kuliarchar, Chittagong, Barisal, Mohanganj and Jessore.

Mymensinh

This landing centre located northwest of Dhaka gets its supply from Chittagong, Chandpur, Kuliarchar, Mohanganj and Dhaka.

Bogra

Supplies come from Rajshahi, Chittagong, Chandpur, Mohanganj and local sources.

Pabna

Supplies arrive from Chittagong, Chandpur, Barisal, Khulna, Kuliarchar and beel areas.

Jessore

The Jessore landing centre is fed through supplies from Khulna, Chittagong, Cox's Bazar, Barisal and baor areas.

Bhery culture in the estuarine and brackishwater environment has progressed rapidly over the past two decades. In 1984-85, there was 64,000 ha of land under shrimp cultivation which rose rapidly to 115,000 ha by 1993-94. The total area under shrimp culture by the year 2009- 10 is expected to be 175,000 ha. The type of aquaculture used in the estuarine areas is mainly extensive and is sometimes paddy-cum-fish culture producing carp. The areas under semi-intensive farming are 423 ha in Cox's Bazar and 119 ha in Khulna. There are also some experimental semi-intensive farms focussing on both carp and the freshwater prawn, *Macrobrachium rosenbergii*. The main area of brackishwater culture is in the district of Khulna and Cox's Bazar. The brackishwater areas have very high potential for expanding aquaculture. This culture is mainly of tiger prawn, *P.monodon*, and milk fish.

3.2.2 Supply Characteristics

Species composition of supply

Inland

Major carp account for 52% of pond fishery. Other noteworthy species are catfish (e.g. *Pangasius pangasius*, boal, magur, singi,) chitol, foli, climbing perch and tilapia. The main carp species are rohu *(Labeo rohita)* and katla *(Catla catla).* Among hybrids, silver carp is a new arrival from fish farming. Golda *(Macrobrachium rosenbergii)* is the most important freshwater shrimp. There are no known local supply sources of aquarium fish in Bangladesh.

Marine

The DOF figures show that catfish, followed by jewfish and Indian salmon, make up the largest group of marine species landed. Hair-tails, ribbon fish and clupeids are also important. Bombay duck, hilsa shad, pomfret, shark, skate, and perch make up the bulk of the remainder. Mackerels and sardines are negligible. Marine aquaculture supplies mainly *P.monodon.* This is particularly important to the many small-scale producers who supply the fry collected from the wild to the farms.

Quality of supply

The freshwater fish from catching points arrive in the main landing centres of Chittagong. Cox's Bazar, Barisal, Dhaka and Chandpur Market in good condition, usually well iced and insulated. Marine fish from Cox's Bazar, however, arrive in fair condition but are still of medium quality. Fish from freshwater and estuarine farms also reach the market very shortly (between 24 to 48 hrs) after harvesting and are thus in good condition. Some fish, such as koi, shing, magur, foli, taki, shol, gojar and boal arrive at the market alive, as customers prefer live fish in particular species.

Local vessels operating out of Bangladesh mostly go to sea for fewer than fourteen days. Those smaller non-mechanised craft on day trips do not use ice but land their catch in fairly good condition. Vessels on longer trips tend to use ice and catches are reported to be landed in reasonable condition. Vessels staying at sea for longer periods experience quality control problems, especially with hilsa. This is to some extent determined by the season. From February to September, the weather varies from high rolling seas to cyclones and fishing trips tend to be of short duration.

The quality of estuarine hilsa seems to vary strongly with the stage in the spawning cycle. Some of the inland fish is supplied to the market in live form. The quality is usually good.

The juvenile prawns supplied to the prawn farms are said to be of variable quality on account of poor handling. Mortality rates during juvenile transfer from collection point to aquaculture farms are high and could reach 60% of the total stock.

Variability of supply

There are both geographical and seasonal variations in the supply of fish. Geographical variation, in terms of the sources of supply, is discussed in section 3.2.1 above. Geographical variation has a range of effects on the quality of the product placed in the market, its cost and timing.

In Bangladesh, the main marine fishing season is from October to February although this is being extended as improved vessels allow fishing to continue during the off-season. However, the hilsa season begins in July-August (Joishtho-Ashar) and extends until October (Ashwin). This seasonality does have some impact on availability and species reaching the market but little information is available on this. During other months, the fishing tends to focus on the estuarine resources. Inland fish catches are not so weather-dependent and can supply the market all the year round.

Based on the information obtained from DOF, the main marine gear in use is set bagnet. However, the number of bagnets fell from 16.500 in 1983/84 to 12,6 15 in 1987-88, while the number of gillnets and seinenets increased during the same period from 3,650 to 6,389. The gillnets mainly catch hilsa. Other important species caught are threadfins, pomfret. croaker, rays, ribbon fish and mackerel.

Supply is low during the holy month of Ramzan when demand is high.

3.2.3 Losses in Supply

A major source of supply loss is the dumping of trash fish from larger commercial vessels. This trash fish is generally caught by vessels targeting high value species such as prawn. The cost of operating such vessels is high and bringing back low value non-target species is, in the main, not offset by the returns. The loss of fish caused by this method is considerable in Bangladesh. It is estimated that the vessels operating in the waters dispose of some 30,000 mt per year. The supply loss from set bagnets ranges from 5% to 15% of the catch on an average.

3.2.4 Participants in Supply

Inland producers

Inland fishermen are mainly those who harvest rivers, reservoirs, canals, open floodplains (beels, haor, baor) or tanks, and fish farmers. The latter are mainly small-scale operators although some larger fish farms are now established. Many of the producers are part-time, either for subsistence purposes or for cash sales. Others are engaged in full-time commercial production.

Marine producers

The coastal fishing population is estimated to be about 500,000 commercial fishermen, of whom about 25-30% are active only part-time in fishery. They may also engage in such commercial and subsistence activities outside the sub-sector in agriculture or day labour. Some fishermen also process their catch and take their produce directly to the wholesale market. Their vessels vary from very small craft powered by sail or oar to medium-sized commercial trawlers and gillnetters.

The traditional professional fisherfolk are Hindu scheduled castes (Jalo and Malo). They are traditional fisherfolk with many generations of fishing experience. This pattern is, however, changing, as pressure grows from other sections of society to enter

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into fishery. Nearly all the new entrants in this activity are Muslims exercising the only option open to them.

Women are involved in the supply-side of the sector only to a limited degree. Some use cast nets in inshore and pond waters. An important role of women may be that of collecting shrimp fry for farms. Poor women harvest on foot with nets from the shallows, alongside men and children.

People are also involved in fish farming in the coastal regions. Many of these are larger-scale operations producing shrimp.

Ancillary participants

In addition to the fish producers themselves, there is a wide range of other participants in the sector who contribute indirectly to the supply-side. These include financiers of vessels, credit suppliers, fuel suppliers, boat builders, gear suppliers, gear repairers, ration suppliers and ice suppliers.

Women are particularly important in the repair and making of nets.

3.2.5 Factors Affecting Supply

Macro-economic policies

Policy choices at the macro-economic level may have a very direct impact on the development of the supply side of the sector. Some of these are outlined below:

- Sectoral support to fisheries relative to other sectors
- Support for urban or rural development
- Support for large-scale or small-scale operations
- Promotion of private sector or public sector growth
- Focussing on primary production growth or other growth in other manufacturing and services
- Support for export or domestic market growth
- The use of fiscal or monetary policy instruments

The choices made between these policy areas and within each one, at both the national and district levels, have a significant impact on how the supply side of the fisheries sector develops and who has access to the benefits from, and opportunities in, the sector. The Government provides guidance on these choices and directs development efforts through the allocation of funds.

There was insufficient time to study the effects of macro-economic policies on the supply-side of the sector.

Sectoral policy and legislation

Sectoral policy at the national levels also affects the supply-side of the industry. Common policy choices include:

- Support for large-scale enterprises or small operations
- Promoting export production or domestic food security
- Promoting inland or marine fisheries expansion
- Promoting capture or culture fisheries

The promotion of large-scale export oriented industries will remove support opportunities from the small-scale sector and thus adversely affect the smaller producers. Likewise, a focus on export industries will tend to promote those particular species which have an export market and thus open opportunities for those people focusing on them. The promotion of capture fisheries or culture will change the species available and change the target market.

Again, sectoral policy is formulated at both the national and state levels. The various central government development plans have progressively changed the emphasis of development efforts between the various options noted above. All the four five year plans since independence have emphasised three key national objectives for the fisheries sector: (I) to increase fish production and improve human nutrition, (2) to increase employment opportunities, and (3) to increase seafood exports. The fourth plan (1990/91- 1994/95) adds three new objectives: (1) to help increase GDP, (2) to improve the general environment and public health, and (3) to improve the socio-economic conditions of fisherfolk, fish farmers, and others engaged in the fisheries sector.

Since 1980, there has been a growing emphasis on the scientific basis of aquaculture to increase production.

The fisheries sector has always been underfunded both in the budget as well as in the actual expenditure of budgeted funds. Past government support for aquaculture has provided a strong base which supplies both domestic inter-state markets and export markets alike.

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Current plans for the sector include the expansion of prawn and inland culture and the upgrading of fish landing centres and post-harvest activities.

Environment

Environmental factors affect the availability of supply over time. Seasonal weather changes as discussed above affect both species and quantities available. Cyclones can destroy fishing craft and gear and floods can damage fishponds or cause the death or release of stock. Drought may also significantly constrain fish farming.

The local geography and oceanography also affect supply. Bangladesh has expansive freshwater, brackish and marine resources and a wide continental shelf to exploit. The conditions are reasonable for wild capture and very promising for expansion of culture. This natural legacy will enable supply to be expanded in the future as aquaculture production is increased.

The sustainability of the supply of fish to the market is, however, directly related to the condition of the environment. Degradation of the aquatic environment takes the following forms:

- Depletion of resources
- Loss of biodiversity
- Destruction of habitats
- Pollution
- Loss of amenities

From the perspective of supply, depletion of resources can result in fewer fish reaching the market; loss of biodiversity can result in fewer species being available: destruction of habitats can result in a change in both species and quantity landed; pollution can result in a reduction in the carrying capacity of the environment and thus resource depletion; and loss of amenity can pose a threat to the fishing communities themselves.

In general, the main factors affecting the environment are:

The small-scale fisheries sector

The small-scale fisheries sector directly contributes to environmental degradation through the over-exploitation of resources. This may be the over-exploitation of inshore resources through the use of destructive fishing techniques such as poisons or fine meshed nets, which may harvest juvenile species, or using current jal, a net of fine mesh, or intensive bagnetting in the estuary.

Fish production in the marine industrial sector has reached the maximum sustainable levels and has limited growth potential.

Although poorly documented, the information available on inland water resource utilisation indicates some capacity is yet to be used up in production. In 1987-88, of the total fish ponds in Bangladesh, 52% were being used for fish culture, and a promising 3 1% of the existing ponds were culturable. It is unknown if any traditional resource conservation measures are, or were, in place. There was no report of the existence of property rights over the fishery at the time of the study.

The small-scale harvesting of juvenile prawn is believed to be subject to intense pressure. This is fuelled by the poverty of the participants, their growing numbers and the demand for export products from the commercial prawn farming industry. The long-term survival of these stocks must be sustained if this area of employment is to continue. The interaction of small-scale operators, mechanised boats, offshore trawlers and prawn seed collectors is poorly understood but expansion of the fishing effort in all of these areas is eventually bound to place excessive pressure on the resources.

The large-scale fishing sector

The status and performance of the 52 trawlers operating during 1987/88 reveal that eight were operating in the public sector under the Bangladesh Fisheries Development Corporation. Two of these eight are mini trawlers. The remaining 44 trawlers are privately owned and 33 of them trawl shrimp exclusively. The annual catch per shrimp trawler for shrimp was, on the average, 102 mt. The average annual yield for other trawlers with mixed catches was 357 mt. Any growth of the trawler sector must be carefully considered keeping the sustainable capacity of the marine aquatic environment in mind. Export-oriented policies could increase the threat to the sustainability of future resources unless careful consideration is given to the trade-offs involved in inter-generational resource availability.

The uncontrolled use of small-mesh nets, especially in the inland khals, and estuarine set bagnets, and also to catch jatka, the juvenile hilsa, poses a potential problem for juveniles of other important inshore stocks. Chitol and foli *(Notopterus chitala* and *Notopterus notopterus),* mohashol *(Tor tor),* puti (of Puntius gr.), kaun *(Mystus menoda),* rita *(Rita rita),* pabda (Ompok), koi *(Anabas testudineus)* and khoilsha *(Kolisa fasciata)* are some of the species under threat.

The continued dumping of trash fish by large-scale vessels represents a major loss of supply. If this can be overcome, the supply situation could be dramatically changed. This seems unlikely in the short-term.

Aquaculture

Aquaculture can, and has increased the supply of fish. For Bangladesh, where demand for fish at current prices is so high, this has been a vital development for the consumer. In the last twenty years, fish prices have risen faster than rice prices.

Aquaculture can, however, damage the aquatic environment through habitat destruction (through land drainage and clearing or mangrove cutting), the introduction of genetic changes in the wild stocks; pollution, and introduced disease. Given the importance of aquaculture to Bangladesh, this is clearly an area which will require monitoring in the future, especially as the estuarine waters of the coast are the nursery grounds of so many important species. Salinisation of paddy fields adjacent to prawn culture ponds poses a potential problem, which may affect future supplies of either rice or prawn. Aquaculture can also affect the biodiversity of wild stocks through the introduction of new or changed breeds into the wild stock or by displacing wild species altogether. The extent to which these factors pose a problem in Bangladesh is not fully understood.

Other human interactions

Other human interactions include forestry, agriculture and livestock. industry, infrastructure development, tourism, shipping, urbanisation and mineral extraction. Bangladesh is among the most densely populated countries. Such a density is bound to concentrate human activities and increase their negative environmental impact. Much of the countryside is deforested, particularly where it matters most, and this leads to increased water run-off, flooding and soil erosion. Soil erosion and the resultant increased aquatic sediment loads reduce light penetration in rivers, lakes and coastal areas, choke lagoons and rivers, and affect filter feeders, sea grasses and coral reefs. There is already considerable siltation of coastal landing sites although the cause of this is unknown. Flooding can also adversely affect aquaculture as explained above. Agricultural activity also contributes to soil erosion and the extensive use of pesticides and fertilisers contributes to pollution of the aquatic environment. Such pollution not only threatens the survival of the fish resource but also greatly reduces the amenity of the fishing communities.

Industrial development is a major threat to the resource. High tidal flushing may remove much of the pollution, Such industrial activity must be considered a significant factor in the future supply of fish to all demand segments of the market. Infrastructure development, — e.g., roads and dams — is particularly damaging where it interrupts the natural flow of water or migration of fish. The production of sewage can have a very significant effect on the carrying capacity of the aquatic environment. The use of sewage in the increased productivity of aquaculture can, however, be a significant benefit.

Natural causes

One of the main environmental factors affecting the supply of fish is the weather. During the monsoon, the offshore fishing is limited to the type of vessels which can withstand the weather. There is a distinct shift in the composition of species landed away from marine environments and more towards estuarine species and a fall in overall availability during the monsoon.

Micro-economic factors

Growth opportunities

If no growth opportunities for increased production exist, then there is little scope for expansion of supply beyond improved use of available resources. Unfortunately, with expanding population, there is growing pressure for increased harvesting of existing resources and this can lead to declining returns to current users. The possibilities for expansion in capture fisheries for the marine sector are non-existent and for inland waters, quite limited. Growth opportunities do exist in aquaculture, in open floodplains and more so in semi-intensive shrimp and fish farming.

Credit availability

Although growth opportunities exist, access to them may be restricted or biased towards certain groups. Perhaps the most important micro-economic factor affecting the potential distribution of opportunities on the supply side of the sector is the availability of finance to different groups within the sector. This causes changes in access between groups to available resources and to any growth opportunities on the supply side which may be identified. The availability of credit, and the conditions under which it is supplied, to the small-scale sector directly influence its ability to take up supply growth opportunities.

The government has been particularly active in supplying credit to potential buyers of mechanised

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boats and those wishing to initiate or expand aquaculture production.

Smaller vessel operators, who may not own their own boats, obtain credit less easily. The low levels of education amongst many fishermen limit their access to formal credit sources. This is compounded by their lack of collateral. Women have little or no access to credit. Some fishermen do, however, obtain short-term credit in the form of advances from commission agents and aratders/dadonders and other loans from **the boat** owners. An important source of credit are NGOs such as the Grameen Bank, CODEC, BRAC and Proshika.

Small-scale enterprise skills

Where growth opportunities exist, the best use may not be made of them due to a lack of micro-enterprise skills. This is particularly so in poor communities with limited access to education. Most of the fishing communities in Bangladesh are poor and many, if not all, of the participants are illiterate. The extent of their business management skills is generally low.

Opportunity cost of labour and capital

Where the supply does offer opportunities for increased activity and where the small-scale operators have the ability to access those resources, the benefits may be dissipated by surplus levels of labour and capital expanding into the fishery. Where few other opportunities exist for their use, income from the sector, no matter how low, may encourage increased entry to the fishery if exploitation levels are not controlled. This will lead to the dissipation of benefits, reduced viability of capital and resource depletion. This is likely to be much more pervasive in the coastal fisheries where access to resources is less controlled by tenure systems. It is not known whether people would leave the coastal fishery of Bangladesh if alternative income-generating opportunities existed.

Market opportunity, access and information

Market opportunities are extremely good, given the high demand for fish. Access to markets is, however, restricted in the coastal region by poor roads and fragmented communities. This limits the market knowledge available to the poorer producers and thus their ability to negotiate realistic selling prices for their products. Similarly. the lack of capital accumulation by fishermen necessitates their entering into debt relationships to provide appropriate levels of capital. Their isolation from formal credit mechanisms increases their dependence on informal systems of borrowing, which may be particularly expensive.

The growth of world demand for fish and the static supply from many countries is liable to raise world prices and encourage countries to export more. This could affect supplies of exportable species reaching the domestic market in the future.

Institutional influences

The level of institutional organisation within different groups of the supply-side of the sector greatly influences their ability to co-ordinate their actions, communicate their needs and aspirations, and achieve economies of scale in selling produce and buying inputs.

The degree of organisation of small-scale producers is fairly poor and this has a direct impact on their well-being.

Political influences

The close proximity of the resources to India, Burma and Thailand and to the harvesting activities of fleets from those countries present intergovernmental resource management problems which could affect future resource supplies.

In the medium-term, the harvesting capacity will have to be controlled and important and difficult decisions will have to be made regarding the distribution of catching opportunities between different harvesting/ culture groups. These decisions will ultimately affect who participates in the fishery.

Technological influences

The technology of the capture side of the fishery allows different participants to access different resources. Small craft have limited range and tend to focus on the inshore and estuarine resources. Motorised vessels can go further offshore. The larger vessels alone can venture far during poor weather.

The changes in the construction of nets as new techniques are developed and new materials are introduced, will affect the opportunities available for women engaged in the production of nets.

Different levels of technology within **the** aquaculture sub-sector also affect the quantity and quality of the fish produced.

Access to levels of infrastructure affect the ease with which the product is supplied to the market under different weather conditions. Given the poor level of access roads in the coastal and estuarine area of the Khulna-Barguna-Patuakhali-Noakhali-Chittagong coastal belt of Bangladesh, this will represent a major constraint.

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Social, cultural and demographic factors

Differences in education levels within communities and households, social systems, and levels of power and wealth influence access to development opportunities and determine who suffers most from changes in resource availability. The involvement of different groups in the fishery also affects the species of fish entering the market and their quality. The relative roles of men and women are particularly important in this regard. The education, extension, and health services which the state supplies all affect the ability of different groups to contribute to the supply-side. The role of women in looking after the home and raising children limits their inputs to the sector. Social and cultural prohibitions may also reduce women's roles. and restrictions on their behaviour may limit their access to extension services.

In the past. the supply side of the sector has been dominated by the Hindu jalodas. These may have limited entry into the fishery and acted as both a constraint to development and an inadvertent resource management measure. The growth of the market, changes in technology and population pressures in areas adjacent to resources have changed this situation, Indebtedness of fishermen to outsiders has also resulted in the transfer of capital assets out of traditional castes and into the hands of traders and moneylenders. The expansion of export markets has prompted an inflow of capital, from outside traditional castes, into both capture fishery and aquaculture. The availability of high cost technology. beyond the means of traditional producers, has prompted changes in capital ownership patterns and the relationships between producers and traders. Such changes have also resulted in changes in the relative roles of women in the sector, especially as the aquaculture sub-sector has grown.

The expansion of resource-adjacent populations has increased the pressure for more people to enter the harvesting side of the sector, both within traditional fishing castes and from outside.

Changes in the micro-economic factors affecting the supply side affect different groups in different ways. Social and cultural biases at the community or household levels can change the access which different groups have to benefit. A changing micro-economic environment can have particularly negative effects on the role which women play in the sector. At present, these factors are of national concern.

3.2.6 Key Problem Areas

The key problem areas facing the supply-side of the sub-sector are as follows:

Lack of supply-side information

There is a general lack of easily accessible information on the supply-side of the market in terms of where the product comes from. who produces it and what factors control supply. This lack of information places planners in a potentially difficult situation, particularly in relation to planning for the needs of the small-scale sector at the production. processing and marketing levels.

Low profitability of producers

Some of the smaller producers have limited control over the market as a result of weak market information and poor communications. They are thus given low prices for their produce, increasing their indebtedness and general poverty.

Limited opportunity for coastal aquaculture for small-scale producers

Investment in coastal aquaculture requires considerable capital from savings or borrowings. The poorer coastal dwellers are extremely poor and have very limited education. These are obstacles to their active participation in aquaculture investment. Furthermore, their lack of business skills limits their survival rate if they do become established.

Loss of supplies or supply potential through environmental degradation

Environmental degradation — through the over-exploitation of resources, pollution from industry, increased sediment loads because of deforestation and agriculture, and urbanisation — poses a significant threat to the long-term sustainability of supplies from the marine environment and may pose a threat to inland supplies.

Loss of supplies or supply potential through use of destructive gear

The type of gear used, especially mesh sizes, has been an area of considerable concern. Set bagnets, commonly used in inland open water and estuarine fishery, have been recognised as being destructive owing to the small mesh sizes used, which results in the capture of juveniles. There is currently a proposal to ban this type of gear.

Cyclone damage to coastal villages and vessels

Many of the coastal communities are exposed to cyclones which destroy houses and boats. This severely limits individual access to resources and thus affects supplies.

Lack of alternative income-generating opportunities

The lack of alternative income-generating opportunities, especially in the coastal communities,

reduces the opportunity cost of labour and capital to a point where it continues to be employed in fishery in spite of very limited returns.

3.2.7 Current Intervention

Non-governmental sector

Considerable effort has been made by NGOs to reduce the stress on fishery resources. This is especially true of set bagnet (SBN) communities which now face the prospect of having to move out of fishing altogether. The intervention has been in the form of identifying and implementing alternate income-generating activities. This is done by providing the requisite training and capital to undertake such activities using funding from the Project.

The following are some of the NGOs active in the post-harvest sub-sector:

Association of Zonal Approach Development (AZAD)

Established in 1970, AZAD works amongst SBN communities located in Khurushkul in Cox's Bazar district. Its initial intervention amongst these communities was the provision of relief during cyclones. In 1993, it began a programme of exploring income-generating activities for these communities using Project funding. Credit was used as the point of entry. Skills in account-keeping, net-making and improved post-harvest methods were sought to be transferred to the community. AZAD works with the Rakhain community which is indigenous to Myanmar.

Bangladesh Samaj Unnayan Samity (BSUS)

Formed in 1984. BSUS works in the Sandwip thana of Chittagong district. BSUS has formed credit and savings groups with SBN communities in the area. Its intervention has been to introduce income-generating activities in the area. Improved post-harvest methods, poultry and backyard vegetable cultivation are some of the interventions made. The organisation also undertakes adult literacy and social action programmes.

Community Development Centre (CODEC)

CODEC started operations in 1985 and works exclusively with artisanal fisherfolk in the districts of Chittagong, Luxmipur, Patuakhali and Barguna. The thrust of its interventions has been to ensure better returns for producers. CODEC has also started lGAs in Bakkahali and Barabkunda in Chittagong district. Credit groups provided the institutional base for its intervention. Its activities centred on the transfer of skills in net-making and fish processing. Efforts were made at marketing the produce, making the intervention relatively successful. CODEC, by far, is the most experienced NGO working with artisanal fisherfolk in Bangladesh.

***Gono** Unnayan Prochesta (GUP)*

Gono Unnayan Prochesta (GUP) works with SBN communities in Banshkali thana of Chittagong district. These communities are entirely Hindu, which makes them susceptible to attack from Islamic fundamentalists. Credit has been used as the entry point for intervention. The petty fish trade has been introduced amongst women from these communities. This is made possible as the practice of purdah does not apply to them. Skills in marketing, accounting, fish handling and processing have been transferred. A total of 113 women have taken to the trade as a result.

Jatio Bandhujan Parishad Bangladesh (JBPB)

A local level organisation, JBPB, has been working in the district of Bhola since 1982. The organisation has intervened amongst SBN communities in the district. The introduction of duck rearing and revolving loan funds are the primary interventions made. One of the problems faced with respect to the fish trade is the lack of access to large markets. As a result, interventions in the post-harvest sector were not viable. Health and education programmes have been pursued rather vigorously. The result has been 100% immunisation and literacy in the SBN communities with which the organisation works.

Proshika Manohik Unnayan Kendra (PMUK)

Established in 1976, PMUK or Proshika, as it is popularly known, is one of the largest NGOs in Bangladesh. Proshika works with SBN communities in Bhola district. Its intervention has been in the areas of credit and IGAs. IGAs have been in the areas of paddy husking, the betel nut trade, backyard gardens and raising of small ruminants like goats. Training in entrepreneurship, accounting and leadership has resulted in most of these activities becoming self-sustaining. Water supply and sanitation are thrust areas for Proshika. Community wells and individual latrines have been provided to both communities.

United Development Initiatives for Programmed Action (UDDIPAN)

United Development Initiatives for Programmed Acton or UDDIPAN, works in four thanas in four districts — Daudkandi in Comila, Bheramara in Kushtia, Pirojpur in Pirojpur and Banshkali in Chittagong. Established in 1984, UDDIPAN has worked with SBN communities in Banshkali,

Chittagong and Pirojpur. Net-making, the petty fish trade and processing were the IGAs that were started with capital being provided through revolving loan funds.

All major NGOs apart from those listed provide cyclone relief to the coastal communities.

Private sector

The private sector refers here to all those entrepreneurs and employees engaged in the capture of fish, or its promotion, outside the public service. The majority of the fish producers are private sector operators and thus most of the supply is controlled by the private sector. Commercial banks and money-lenders alsd provide the bulk of the finance for the capital development and operational expenditure of the sector.

Government

Government support is currently concentrated on inland fish production. This partly reflects the preferences for inland fish, especially from the floodplains and through aquaculture. Also, the sustainable levels in the marine environment need to be considered.

Government support for motorisation of the fishing fleet began in the 1970s. This allowed vessels to fish further offshore and thus increased the quantity of fish landed and the range of species. There has been support, although very little compared to the requirement, for the expansion of shore-based facilities and for improving access to markets through the co-operative movement. The various state-based agencies and departments associated with support to the supply side of the sector are outlined below:

Of the many national government agencies that deal with the fisheries sector, the most Important is the Ministry of Fisheries & Livestock (MOFL). Earlier, it was part of the Ministry of Agriculture, which has overall responsibility for the development of the fisheries sector. Other key fisheries institutions and their functions are:

Department of Fisheries (DOF)

National fisheries management, development. extension, training, conservation, quality control, law enforcement, policy advice, and information collection.

Bangladesh Fisheries Development Corporation (BFDC)

Autonomous national development of marine fisheries, management of the Kaptai lake, and the marketing and processing of fish.

Fisheries Research Institute (FRI)

National fisheries research on riverine fisheries. marine fisheries and aquaculture.

Ministry of Lund

Administration and leasing of public bodies of water (more than 20 acres) for fisheries. These bodies of water will be gradually transferred to MOFL under the New Fishery Management Policy.

Thana Parishad

Administration of small bodies of water (up to 20 acres) for fisheries and fisheries extension.

Ministry of Irrigation, Flood Control and Water Development

Assessment of impact on fisheries from projects related to FC, WD, and Irrigation.

Ministry of Local Government

Inclusion of the fisheries component in rural development projects, development of fisheries co-operatives, and collection of revenue from small bodies of water (up to 20 acres).

Ministry of Industry

Licensing of fish processing plants and trawlers for marine fisheries

Ministry of Commerce

Export of frozen seafood.

Ministry of Shipping

Registration of fishing boats.

Ministry of Education

Control of fisheries-related education and research.

Ministry of Finance

Budget and administration of externally funded fisheries project.

Forestry Department

Management of fisheries in reserved forests.

Nationalised Banks

Provision of credit for fisheries.

Planning Commission

Planning of the fisheries sector, as part of the overall national planning.

The FAO-BOBP has been involved with the Government in the past in the marine fisheries sector's development initiatives.

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3.2.8 Further Action

There is clearly a need for further action in the sector in support of government and NGO efforts and to promote the private sector at all levels of its involvement. Some of these areas have been outlined below. It is possible that efforts are already being directed at these problems but information was not available at the time of the study.

Improved supply-side information

There is clearly a need to understand the supply-side of the sub-sector in more detail and to define much more clearly the factors affecting supply. This will assist in both supply-side management and also in the processing, marketing and distribution of the products.

Improved market information for producers

There is a shortage of market information at the level of the fish producer for domestically consumed products. For exports, product information is supplied by the Export Promotion Bureau (EPB) and there is a need to identify an appropriate mechanism for improving market information for domestic products.

Improved business management skills for small-scale producers

There is a need to identify the extent and magnitude of the problem of lack of business management skills and how this affects the viability of small-scale suppliers. On the basis of this. appropriate support can be designed.

Improved credit availability for small-scale producers

There is a need to identify current credit sources for the small-scale producer, to determine the ease of access by different social and economic groups and to design appropriate interventions where necessary.

Improved understanding of the environmental factors affecting supply

The extent to which future supplies will be affected by environmental degradation is poorly understood. This is a vital area of knowledge if future supplies to the small-scale processors and traders are to be continued and domestic food supplies ensured. It is only on the basis of this knowledge that appropriate resource management strategies can be formulated and implemented.

Alternative income-generating opportunities

There is a need to increase the availability of alternative income generating opportunities for the small-scale fish producers as both a complement to fishing during the lean season and to draw out excess capital and labour from fishery.

3.3 TRANSFORMATION OF FISHERIES PRODUCTS

After the initial supply of fish. it is transformed in several ways before being finally consumed. Transformation leads to changes in the product itself (processing and preservation), to its location (distribution), to its image in the eyes of consumers, and to changes in price.

The transformation process is carried out by a range of operators, many of whom are in the small-scale sector. The process is subject to a wide range of factors which affect it and which cause problem areas. These are described below:

3.3.1 Types of Transformation

A. Product transformation

Product transformation occurs mainly to add value to fish or to preserve it, and can take many forms. The most common methods in Bangladesh include icing, drying, salting. freezing, and fishmeal production. Packaging of fish is also a method of product transformation.

The various methods of physically transforming the products are discussed below:

Gutting and filleting

There is very limited gutting of fish before sale. Fish are generally not filleted although larger fish are cut into steaks for retail purposes. Gutting and filleting are more common in the higher value markets like New Market, or Gulshan Market in Dhaka.

Icing

Most of the fish landed by smaller vessels has not been iced as these vessels have been at sea for a short period. Vessels going to sea for more than a day generally carry ice. Fish is iced when transported to markets. Iced fish may be transported in woven bamboo baskets, plastic boxes in insulated trucks or in insulated wooden chests.

The majority of marine fish are reported to be sold to consumers in the fresh state. Much of the smaller estuarine fish is dried except in the wet season. Fresh fish landed by smaller boats may or may not be iced at the landing site prior to auction or transportation.

There are reported to be some 100 ice factories in the coastal city of Chittagong alone with a capacity of I 100 mt/day .

Freezing

The freezing capacity utilisation is very low as it is mainly targeted at export quality prawns, frog legs and a mixture of different types of fish, The capacity utilisation rate, based on a 300 working day year for the 75 plants in operation in 1987/88, was only 17 per cent. While the annual capacity stood at 148,350 mt, the quantity frozen annually was only 25,963 mt. Prawn producers sell their production to processors who may then sell to exporters or export directly. Most of the produce reportedly goes to Asian markets. There are some plants registered for export, many of which retain their own quality control staff. Some frozen fish does enter the market but this is generally frozen onboard the larger fishing vessels.

Salting

The main fish to be salted are shark. Hilsa is also sliced and salted. This is done in coastal catch centres such as Kuakata and Hatia and is mainly targeted at the markets in the northeast. Salting is usually carried out by brining in tanks. The product is then sun dried for sharks, while hilsa is sliced and salt is liberally applied. It is stored in metal/earthenware containers.

Drying

In the past, drying of fish was a common practice, mainly using the produce from bagnet fisheries. The drying season is generally between October and March. Due to the rising demand for fish, the need to dry fish has reportedly decreased, and less is now dried. Drying is usually carried out near the site of landing.

Fish is dried for two main purposes: human consumption and fishmeal. Fish for human consumption takes many forms. The most popular marine species are pomfret, churi (lizard fish), loita (Bombay duck), surma, popa, bhetki, lakha, faisha and shrimp. One of the most potentially valuable processes is the drying of poa or jewfish. This is currently exported by Bangladesh to Hong Kong, Singapore and Taiwan.

Drying is done in all coastal districts as well as in the haor and bee1 areas. In Khulna, the Dubla fishing ground is an important drying centre. Maheshkhali, Sonadia, Khurushkul, Chokoria, Teknaf, St Martin, and Airport Bing in Cox's Bazar are major drying centres. In Patuakhali and Barguna, as well as Noakhali, fish is dried during the set bagnet season.

Fish meant for export is dried on racks, hung vertically (in the case of Bombay duck) or on the ground on mats. Low-value fish is dried directly on the sand.

There are some 16 entrepreneurial dry fish processor-cum-exporters of different sizes. Of these, seven are leaders. In each of these plants, two or three buyers' technicians work in order to meet their own quality standards. The price of fresh poa (jewfish) which meet export requirement is Tk 75 to Tk 100 per kg. The fresh fish can be kept for 24 hours and dried for 4-5 days after which the weight is reduced to about 38% of the original weight. The poa dryers use the landing and wholesale market as well as the cold storage facilities of the Bangladesh Fisheries Development Corporation (BFDC). The export price of dry poa is US$ 8-10 per kg. Other dry fish, including pomfret, are sold at around US$ 5 per kg.

Packaging

There is no significant packaging of fish for the domestic market except during distribution. Proper packaging is carried out for export. Fish is packaged in bamboo baskets for transport between distant landing sites and markets. The fish are very neatly packed, often by species, and layers of fish are alternated with layers of ice. The sides of the basket are often extended by woven leaves and the top is covered by a gunny sack. The basket is then tied up with rope. Other fish may be packed in tea chests with insulated packing.

Value-added products

There is some value-addition of products in the markets targeting higher income consumers. The BFDC has made several attempts to produce processed products like fish kababs. The produce is gutted, filleted and then cut into thin slices. Prawns are shelled, deheaded and deveined.

Other

Attempts have been made by the private and public sectors to extract oil from shark on a commercial basis. It is not known if oil extraction is currently in practice.

B. Place transformation

Fish is moved from the fishing ground to the point of landing, and undergoes a range of relocations until it reaches the final consumer.

Marine fresh fish

After harvesting, the fish is transported to the landing site. In places where the shore is easily accessible, it is unloaded directly onto the beach. In other cases, it may be necessary to transfer the product to smaller craft which carry the fish ashore. The fish is transported in bamboo baskets and may be carried to the godown of a trader or commission agent by a headloader or, if some distance from the landing site, by a rickshaw operator. Some fish may be directly

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sold by fishermen to retail traders. The retail traders may then take the fish by headload or on their shoulders to their customers in neighbouring villages. Most fish is, however, sold through commission agents (aratder) or to traders. Sometimes there is a trading or debt linkage between the boat and the agent and thus the fish goes preferentially to that person. In some cases the trader owns the boat and thus gains preferential access to the fish. If the producer has no obligation link then he may sell or auction through any trader. If the fish is not landed at the producer's normal landing site, perhaps because of tides or weather, he may sell to, or through, an aratder at another site.

After landing, fish is taken for processing, then retailed locally or transported to one of the main wholesale markets. Most of the landing sites are connected to outside markets by road. Some of these roads become impassable during the wet season. Where roads do not exist or are unusable, fish is transported by water. At Sawarighat in Dhaka and in Barisal, Bagerhat, Cox's Bazar, and the new BFDC landing centre-cum-market in Chittagong, the fish is landed directly into the wholesale market.

Those who catch fish in the shallows or in small boats may take their fish directly to neighbouring villages where they sell it to consumers. Women and children catching prawn fry, hold them in small containers or in pits in the ground, until a buying agent arrives. They can keep them up to 12 hours this way but high mortality is observed.

Dhaka is the main destination for fish and there are several large markets there including Sawarighat and New Market, which are important wholesale markets. New Market handles mainly cultured fish from inland sources; it receives products from smaller operators. Satkhira is a smaller market which usually handles brackishwater products. Cox's Bazar and Chittagong are the two main marine fish markets.

Fish taken to major wholesale markets is handled by commission agents who sell it for the wholesalers. Fish traders in the other markets tend to be wholesalers (bepari) rather than commission agents (aratder).

After the fish is sold, it is carried by headloaders to the buyers' vehicles and transported to the retail markets in Dhaka or inland. Within Dhaka, fish is distributed from the main wholesale markets to the urban retail markets. Most (75%) of these markets are under the control of the Dhaka City Corporation. The rest are owned by the private sector association. Fish is also retailed by headloaders and cycle van traders operating in their own communities.

Freshwater fresh fish

This is either harvested from open water bodies like rivers and canals on a continuous basis, on a seasonal basis from the baor, beels and floodplains, or periodically harvested from culture tanks. With the exception of a few large water bodies like the Kaptai lake, inland fisheries are widespread. When fish is caught from open water bodies, it is sometimes sold by the fishermen directly to local retailers such as headloaders or distributed to the nearest urban markets with or without ice. There are faria (middlemen) who usually collect the catch of a few fishermen and take these to the local market.

When harvested from a culture area, the farmer informs a trader who agrees on a price and arrives on the day of harvest with transport and ice. The fish is packed in ice and taken by the trader or commission agent to Khulna and Chittagong in the case of prawns or one of the other markets in the case of other culture fish like major carp, silver carp, magur (catfish) or tilapia. It then follows the same route as above. The main inland landing points are Gualondo, Kuliarchar, Ajmirigonj, Hobigonj, Rangamati and the beels of Jessore and Kushtia.

Frozen fish

Fish is purchased from wholesalers, frozen by fish processors and then sold to exporters who ship the produce in refrigerated ship containers to the port of destination. Some fish is landed frozen from trawlers. The estimated average export prices for frozen seafood products (mostly headless shrimp) ranged between US$ 6.09 and US$ 7.77 per kg between 1982/83 and 1989/90.

Salted fish

The bulk of the salted fish is sold by the processor to specialist salted fish traders, mainly in the Adamganj dry fish wholesale markets in Chittagong, who ship the produce to distant markets, generally in the northern part of the country.

Dried fish

After dried fish is processed for human consumption, it is packed in gunny sacks and transported by road, rail or boats to the wholesale markets in Khulna, Chittagong and Dhaka. Specific markets exist for dried fish including Adamganj in Chittagong and Karwan Bazaar in Dhaka, which receive most of the product from Cox's Bazar, Chittagong, Noakhali and Patuakhali. Dried fish is sold mainly in Chittagong, Mymensinh, Sylhet, Dhaka and the northern districts.

Value-added products

These are generally sold directly to the customer by the processor.

C. Image transformation

The image of fish can be changed through active promotion programmes by the government, NGOs and the private sector.

The government promotes fish, as a healthy source of protein, through education programmes on radio, television or in the press. Such education may also be channelled through school curricula or through community extension programmes. Government poverty alleviation programmes may also promote fish through subsidised distribution, for instance, school meals. NGOs may likewise promote the consumption of fish through health and nutrition programmes.

Private sector traders and businesses generally promote fish in order to increase sales or selling price. They may use messages similar to those used by the government and NGOs but their motives for doing so differ.

The extent of image transformation in Bangladesh is not known but it is believed to be limited because of the continuous and traditional high demand for fish.

D. Price transformation

There is little information on the transformation of price along the market chain as few statistics are collected. Fish markets scattered around the countryside were estimated to be over 6,500, with 4,500 in the primary villages, 1,500 assembly level, 450 secondary level and 50 terminal city (wholesale and retail) markets.

Almost the entire marketing is in the control of the private sector which is managed, financed and controlled by intermediaries known as aratders (commission agents) and mahajons (financiers or money-lenders). Wholesale fish prices are dominated by a powerful cartel of aratders who restrict the entry of newcomers. The aratder provides advances to fish traders who in turn are compelled to bring fish to them for sale. This is the traditional dadon system. The commission ranges between 2 to 6 per cent of the value of the auction, as well as a little of the fish. Hilsa, is sold by the kaon (3200 pieces or 16 pon), pon (80 pieces) or hali (4 pieces), carp is sold by weight, live fish like koi, shingi and magur are sold by kuri (20 pieces).

At the fish assembly stage, competition is rare as most of the fisheries consist of the small scale sector fisherfolk, hardly collectivised enough to organise their own operation. The assembling of fish from fishermen is one of the most profitable activities in the entire marketing chain, as fishermen not only lack access to credit, ice and market information, but also do not have much bargaining power. There is evidence of extraction of high rents from fishermen by traders and lease holders as well as poor payment in terms of prices as well in quantity.

The main features of price transformation for each type of product are outlined below:

Fresh fish

The isolation of the fishermen and women, compounded by the often weak road linkages, means that fish producers have poor market information and are potentially subject to price manipulation by the traders.

In many cases, fish producers are indebted to godown owners (aratders) at the beginning of the fishing season as a result of the lending of capital or operating costs necessary to start fishing. Fishermen may thus become bound into a relationship with the aratder over that or subsequent seasons. This tradition-bound **system** of dadon may appear exploitative in that fish producers'may receive low prices for their catch, but the prices paid often incorporate loan repayment, interest and other services provided by the aratder. During the auction, the price paid to the fish producer also varies according to the selling system and how the commission paid to the auctioneer is deducted. These systems vary between locations within Bangladesh and these various transaction costs must be considered in the price transformation process.

Likewise, as the fish moves along the marketing chain, various inputs are made by transporters, traders, storage agents and commission agents, all of which contribute to increasing the price. Understanding the relative benefits accruing at different stages is often difficult.

Frozen fish

Most of the frozen fish are exported. Trends in the value of annual seafood exports indicate their share in all exports to be about 10 per cent. Between 1975/ 76 and 1989/90, earnings from frozen shrimp rose from Tk 145 million annually to Tk 4,143 million in 1990.

Dried fish

The average price of cured fish (dried, salted or smoked) appears to be cheap when its fresh state price

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plus curing cost in an urban market are considered. This shows that there is a lack of proper facilities for economic marketing of fresh fish by big producers to consuming centres.

Fresh fish caught in large quantities by small-scale fisherfolk in the remote parts of the country (the haors of Sylhet, Dubla Island, Hatia, Moheshkhali and Kuakata in the coastal belt) are often inaccessible by road or rail and when accessible, very irregularly or seasonally (during winter). The peak fishing season is the monsoon, and that is when it is most difficult to get around in time. Insufficient ice supply makes the producers and assemblers anxious about the problems of fish deterioration. As a result, they are compelled to transform the high-priced fresh fish into often low-priced cured fish.

The dried fish trade appears to be dominated by a few traders and it is likely that they also exert considerable control over the price paid to fishermen. Again the traders or commission agents are likely to input various services during the product, place and image transformation of the fish which is reflected in the returns each receives. The degree to which one stage manipulates or exploits the other stages in the chain is not known.

3.3.2 Participants in Transformation

The main participants in the transformation of fish are men. Women appear to play only a limited role. Part of this lack of participation may be due to the fact that men often migrate to fishing camps for the fishing season and leave the women behind. In some fisheries, they are hired to participate in the sorting and drying of fish. The extent of this involvement is not known. They also play a role in fish marketing, particularly at the retail end of the chain. The actual extent of their input is poorly documented.

Distributors

There are many small-scale people involved in the transfer of fish between vessels and the shore and between the shore and markets. Within markets, there are also headloaders who move fish between traders or to and from trucks and boats.

The initial point of transformation is the primary market, where the assemblers, like mahajans and aratders-cum-mahajans, procure fish from the catchers mostly with the assistance of dalals (brokers/ representatives).

Assemblers bring the produce from the primary markets to the assembly points or landing ghats which also double as wholesale markets. At this secondary level, such assemblers sell their fish to the distributors, usually called bepari. This is done with the help of aratders or commission agents who auction or sell the fish. After purchasing the produce from the assemblers at the secondary markets, the beparis bring it to the main distribution markets which are usually located in the district towns. They sell the fish to another level of distributors, called paikars. This exchange is again achieved through commission agents and aratders. After fish from the wholesale market in urban centres is sold by the paikars, it goes to fish markets.

At the rural level most of the fish is consumed locally, so much of the subsistence catch does not enter the market.

The participants in the fresh fish marketing chain are both Hindus and Muslims. The actual selling of fish is predominantly controlled by the southern districts and the wholesale fish market players. The distributors of fish are from a wide range of backgrounds. They have close ties with the fishermen and often provide funds in advance at the beginning of the fishing season.

Women play a minor role in the wholesale distribution and sale of fish although they are more involved in the retail trade.

Processing agents

There appear to be differences from area to area in the people involved in drying fish. In the coastal districts and the islands, fishermen reportedly dry their own bagnet-caught fish before selling it. In some communities, there is greater division of labour with different people acting as fish processors and producers. The hilsa cutaru (cutter) possesses a skill which catchers often lack as they may also be separated from those who do the drying of croakers, Bombay duck and other exportables.

The fishermen involved in seasonal bagnet fishery in the estuary sell their dried fish to aratders. These agents transfer the produce to dadondars or wholesalers mainly in Adamganj in Chittagong city. Dadondars are predominantly Muslims.

Ancillary participants

The ancillary participants involved in the supply of ice, salt and fuel are generally the larger operators. Women make bamboo baskets and cycle operators provide transport. Local bus services are also often used to transport fish, even in islands like Hatia in Noakhali.

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3.3.3 Factors Affecting Transformation

Macro-economic factors

Policy choices at the macro-economic level may have a very direct impact on the development of the supply side of the fisheries sector in Bangladesh. Some of these are outlined below:

- Support for urban or rural development
- Support for large-scale or small-scale operations
- Promotion of private sector or public sector growth
- Focussing on primary production growth or growth in other manufacturing and services
- Support for export or domestic market growth
- The use of fiscal or monetary policy instruments

The choices made between these policy areas and within each one, at both the national and district levels, will have a significant impact on how the supply-side of the fisheries sector develops and who has access to the benefits from, and opportunities in, the sector. The government provides guidance to the sector on these choices and directs development efforts to some extent through the allocation of funds.

Sectoral policy and legislation

Sectoral policy can have a significant effect. Sectoral policy formulated at the national government level influences the transformation of fisheries as discussed under 3.2.1 and 3.3.2 above. The main policy options include:

- Support for large-scale or small-scale operations
- Promotion of export or domestic consumption
- Promoting inland or marine fisheries expansion
- Promotion of capture or aquaculture operations

The policy inputs for the fisheries sector come from the five year plans of the government. The objectives of the Fourth Five-Year Plan (1990/9 1 - 1994/95) for fisheries development were:

- To raise production and increase availability of fish to the people, leading to improvement in the national nutritional status
- To expand employment opportunities in fisheries and ancillary industries
- To improve socio-economic conditions of the fisherfolk, fish farmers, and others engaged in the fisheries sector
- To increase the volume of export and increase export earnings by further developing selected fishery products
- To improve general environment and public health
- To help increase the GDP.

The targets set to be achieved were pursued by strategies and development programmes in inland open water stocking and management, seed production, feed, marine fisheries development. fisherfolk welfare and community development, fish export, fishmeal import, fisheries credit, research, surveys and studies, training and extension. fisheries education. data base and information systems. strengthening planning/implementation/monitoring/ evaluation. and of course, post-harvest fisheries.

The strategies and programmes in the post-harvest fishery sub-sector emphasised: " Reasonably good access to all the baors. beels, haors, shrimp farms and other big fish landing centres, including those along the coast, will be established or improved: this will ensure quick transportation and encourage healthy competition among the local monopolisers and the distant buyers. creating opportunities for the producers to get a better deal for their fish and shrimp. New fish landing and tnarketing facilities will be created or improved at selected points. Improvements in the traditional drying and salting methods will be introduced."

Out of the public allocations for programmes. landing. processing, preservation and quality control amounted to only 6.5 %. The policies relating to the transformation of fish have always been implicit in central government policy but emphasis has tended to be on increased production, particularly in the earlier plan periods. Later, the focus on post-harvest transformation increased, especially in line with the drive for increased export. This emphasis has also manifested itself at the state level where improved landing facilities, roads and markets have long been a thrust of development.

In addition to improvements in the distribution and marketing of products, sectoral policy has also aimed at distributing the benefits of that transformation process across as wide a range of beneficiaries as possible with emphasis on the poorer segments. Support for private sector growth has also been an important policy of government, although stale-run institutions have played a significant role in the development of the sub-sector and commercial participation in its growth.

In more recent years, there has been a move towards adding value to the produce of the sector, especially that aimed at the export market. This has had limited success but will be a growth area in the future.

Environment

Variations in the supply-side of the sub-sector as a result of seasonal changes in the environment and environmental degradation also affect transformation. Seasonal supply changes affect the availability of products and the price structure within the market. This changes the relative importance of different processing techniques. Changes in the weather also affect the transformation process itself. In the rainy season, very little drying can be carried out. Roads may be impassable and products may have to be moved by sea or be delayed reaching market, to the detriment of its quality.

The degradation of the environment may also lead to changes in species composition, the average size of fish or its quality. The quality of handling of products affects its appearance and this may affect its price along the different stages of the transformation process.

Fish retains its image of a healthy food source and for this to continue, it is necessary for the environment in which it grows to be free of pollutants and pathogens. There is clearly a need to ensure that the image of fish remains attractive to the consumer.

Micro-economic factors

The main micro-economic factors affecting the transformation-side of the sub-sector are:

Growth opportunities

Growth opportunities are largely a reflection of the supply-side of the sub-sector and emphasise the interconnections of the areas. Without increases in supply, few opportunities for increased transformation will arise. There are. however, some opportunities for increased value-addition for the export market and for reducing losses in quality due to poor handling and processing.

It is likely that some products will move from one market segment to another as demand changes over time. One important shift may be away from domestic consumption and towards greater exports. This will have significant implications for the transformation process.

Credit availability

Where growth opportunities exist, the benefits tend to accrue to those who can access finance to make use of the expansion options. This is largely affected by the supply of credit. The beneficiaries are those most able to access that credit. This will in turn focus opportunities into the hands of a few wealthy people, mostly men.

Small-scale enterprise skills

This is an area of transformation in which there is a large gap at present. The lack of business management skills affects the viability of most small-scale enterprises.

Those most able to benefit from the transformation on a sustainable basis are those most able to manage their finances and their businesses. Given the lack of education of the poorer community members, they tend to be exposed to higher risks than the more educated and established traders.

Market opportunity access and

The successful transformation of the produce depends on doing it the right way. at the right time and place, and at the right price. This requires good market knowledge and access to the markets. As markets become more sophisticated and market chains become longer, access to timely accurate information becomes essential.

The extent to which most of these factors affect the post-harvest transformation sub-sector in Bangladesh are poorly documented or were unavailable during this study.

Institutional influences

Some of the participants in the transformation within the private sector have institutional strength. This is particularly so in the case of the larger traders/commission agents. In Dhaka, Chittagong, Chandpur, Barisal, Khulna and all major fish centres, there are aratder and traders' associations which include many of the commission agents. It is likely that such organisations confer on their members considerable power over the transformation process. The smaller traders at the retail end of the marketing trade are less organised and thus more likely to suffer from changes in the operating environment.

At the government level, the past emphasis on the production side of the sector has limited the growth of institutional capacity and experience on the transformation-side.

Technological influences

Access to technology has a large influence over product transformation and may also reduce the cost of certain transformation processes.

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Of particular importance are access to the following levels of technology:

Onboard storage facilities

The availability of onboard technology for the storage of fish greatly affects the quality of the fish landed. In many cases, there is insufficient space on board to handle the icing of fish or the less valuable parts of the catch.

Shore landing facilities

One of the key technological elements in the transformation process is the provision of adequate shore facilities. The government has emphasised this in the past, and now there are appropriate landing facilities for most of the mechanised and larger vessels. These are affected by siltation to some degree.

The type of landing facility also affects the employment opportunities for different groups. Where landing and road facilities are well developed, only specialist groups are employed, but when the facilities are more limited, a wide array of carriers (small boat, head-loaders and cycle traders) are involved in moving the fish. This generates much local employment and the changing infrastructure should consider what alternatives exist for these displaced people.

Onshore processing facalities

The processing of fish requires certain types of technology which reflect the needs of the market and the capacities of the users. The drying of fish is achieved using very basic methods and these may well reflect the price which the market will pay. They may also reflect a lack of market information. Improved technology may well improve the product but this may not necessarily improve the returns to the processor. Benefits could accrue further up the marketing chain and the increase in price may cover the additional costs.

Transport and storage

The roads connecting the landing sites to the market play an important part in attracting traders and allowing access to public transport systems. At certain times of the year, the roads may become impassable because of the weather.

Fish is carried in bamboo baskets between the landing sites and godowns, between the godowns and trucks and between different stages in the wholesale market. They are also used on the backs of cycles and as headload carriers. The quality of these baskets affects the keeping quality of the fish over time and the prices paid to the traders.

Marketing facilities

The handling and trading facilities at the wholesale and retail markets affect the quality of the fish. In the main, the markets have limited cleaning facilities and the working conditions are poor. The surfaces are poorly drained and often not sealed. Dirt, debris and waste material are often not adequately cleared.

Ancillary facilities

These provide services such as the supply of ice. Their frequency, production. and location greatly affect the availability of ice to fishermen and to traders.

Social, cultural and demographic factors

The fish demand and requirement of Bangladesh are projected to increase from 1 ,018,000 mt in 1994/95 to 1,756,000 mt in 2009/10. Given the limited supplies, prices will tend to rise. It is likely that this will affect the availability of fish for fishmeal or drying for human consumption.

3.3.4 Key Problem Areas

The key problem areas associated with the transformation side of the sector are discussed below:

Post-harvest fish loss

On the basis of the limited information available, an estimated 39,800 mt of fish (4.6% of the catch) are lost as trash from trawlers and as dried fish loss every year. Downgraded fish further costs a value loss of approximately US$ 108.5 million each year. In shrimp export about, US$9 million is lost each year to excessive washing and downgrading. This represents a considerable loss of valuable animal protein which could enter the market. It is particularly important to the small-scale processors who depend on small fish for drying and selling.

Poor onboard handling of fish

The handling of fish onboard vessels is reported to be poor, especially in the motorised traditional craft and the larger vessels going to sea for extended periods. The quality is variable and the decline is aggravated by the often long marketing chains involved.

Inadequate landing facilities

Some of the landing sites suffer from siltation and a lack of physical infrastructure. The high tidal amplitude also restricts landing. This limits the ease with which fish can be landed, handled and transported to the market.

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Poor onshore handling of fish

The current standards of onshore handling of fish are low. This results in physical damage and reduction in the value of the fish.

Poorly dried low-value species

The drying of low-value fish has been identified as a problem area. Fish is reported to be poorly and unhygienically dried. resulting in a drop in monetary value and quality. The extent to which the market is prepared to pay for higher quality products is unknown.

Inadequate understanding of post-harvest problems

There appears to be a general lack of understanding ofpost-harvest issues within the government and the NGO sector. This limits feedback into policy formulation and sector planning.

Inadequate understanding of the needs and aspirations of the poorer porters, cycle carriers, processors and traders

As far as the small-scale traders, distributors and processors are concerned, there is very little information on who they are, or what their problems and aspirations are. These people represent a large and vulnerable group with little control over the factors affecting their lives and heavily dependent on the sector. A survey has recently been conducted by an NGO, Community Development Centre (CODEC), on itinerant fish traders in Chittagong city.

Inadequate conditions of market outlets

Lack of sanitation and size constraints of the market outlets characterise the region. Insufficient auction space at peak periods. lack of access for vehicles. lack of parking space. lack of mechanical weighing equipment, shortage of ice. lack of insulated storage facilities, and lack of appropriate handling equipment are the other prominent drawbacks of existing landing centres-cum-markets.

Lack of alternative income-generating opportunities

Many of the participants in the sector have access to work within the sector only on a seasonal basis. When the season is over, they must seek alternative income-generating opportunities. These are often not available and the people are reduced to poverty.

3.3.5 Current Intervention

Intervention to address these particular problems can take place at three levels:

Non-governmental sector

There is some involvement of the NGO sector in the transformation process. CODEC, as well as DUS, are increasingly expanding their efforts in post-harvest activities, towards processing and marketing. The Grameen Bank helps poor women in marketing and fish drying activities.

The fisherfolk co-operative movement is hardly involved in the production of ice and only to a limited extent in the marketing of fish.

Private sector

The private sector is the main driving force in the transformation process. It responds to the needs of the market as required.

Government

The Department of Fisheries has a Monitoring. Evaluation, Marketing and Statistics section which monitors the transformation process and provides data for planning purposes. EPB also plays an important role in the transformation of products for the export market. The government has made attempts to improve the landing facilities and has carried out some extension activities in the improved handling of products.

The Project has supported a market study on hilsa in Chittagong City.

Post-harvest fisheries research in Bangladesh under the government may be summarised as follows:

Fisheries Research Institute (FRI)

Located at Chandpur Station. under the Department of Fisheries. the FRI was engaged in post-harvest fisheries research until 1984. Originally, the station devised processes for refinement of shark liver oil for medicinal use. manufacture of fishmeal for poultry feed and manures for soil fertilisation, preparation of adhesives from fish scales and printers' ink from fish oil on a commercial basis. Some research activities relating to the preservation of hilsa in respect of fat, protein. ash and moisture content were carried out in the laboratory. However, no tangible results were generated and currently, no work is being done in this field.

Institute of Food Science and Technology

Under the Bangladesh Council for Scientific and Industrial Research (BCSIR) this institute also carried out post-harvest research.

Department of Fisheries Technology of the Bangladesh Agricultural University

This department conducts research projects on the nutritive value, bacteriological study and quality assessment of fish products.

Institute of Marine Science of the University of Chittagong

This institute also conducts research on post-harvest fisheries as part of the curriculum.

3.3.6 Further Action

A range of activities need to be carried out within the transformation area of the sub-sector. These are outlined below. Some of these may already be in progress but no information was available at the time of the study.

Improved onboard and onshore handling of fish

There is a need to quantify the problems associated with onboard and onshore handling, to identify the changes that may result in post-harvest gains in quantity, quality or value, and, if appropriate,to design and implement a programme of intervention.

Improved landing facilities

There is a need to define the extent to which inadequate landing facilities within the country reduce the quality or value of the fish. Information needs to be collected on behalf of the government for future infrastructure planning.

Improved access to markets and market information

There is a need to overcome the lack of access to market information which exists at the community level and which has led to the poor bargaining position of the poorer fish workers. The export market is well catered to through the work of the EPB but the domestic market is poorly monitored. The extent of the problem of poor access to the markets as a result of poor roads also needs to be determined.

Improved market handling facilities

There is a need to assess the current status of the facilities and problem areas associated with the major fish handling retail and wholesale markets and to identify improved handling practices and facilities. On the basis of this, appropriate development advice can be given to the government for inclusion in its planning process.

Improved utilisation of low-valuefish

The utilisation of low-value fish is of major importance to the poorer members of the fishing community. At present, prices received by the fishermen are low. There is a need to identify the extent of involvement of poor processors in low-value fish processing, how much is handled and where, what the major constraints are, and if there are ways of adding value to the products which increase the returns to the processors on a sustainable basis.

Improved understanding of the needs and aspirations of the poorer participants in the transformation process

Given their number and vulnerability to changes within the sector, there is a need to define more accurately who these participants are, where they are based, what access they have to support, their levels of organisation, and their needs and aspirations, and to design appropriate support and development mechanisms. Particular emphasis should be placed on understanding credit and business management training needs.

Improved training of NGOs and goverzzment staff in post-harvest issues

The efforts in the past of post-harvest training in both the government and NGO sectors need to be continued and strengthened, given the increased emphasis which will need to be placed on this aspect of the sector.

Improved information dissemination

The government collects a wide array of data on the sector, but this is not readily available to the participants in the sector. There is a need for a detailed assessment of what information is available and for that information to be made more accessible at state, national and regional levels.

Improved policy and planning in the post-harvest sub-sector

The extent to which knowledge of the post-harvest sector is included in policy and plan formulation at the state level needs to be assessed, and, where necessary, support provided to government through the information gained in the above activities and through training in policy formulation and planning of post-harvest activities.

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