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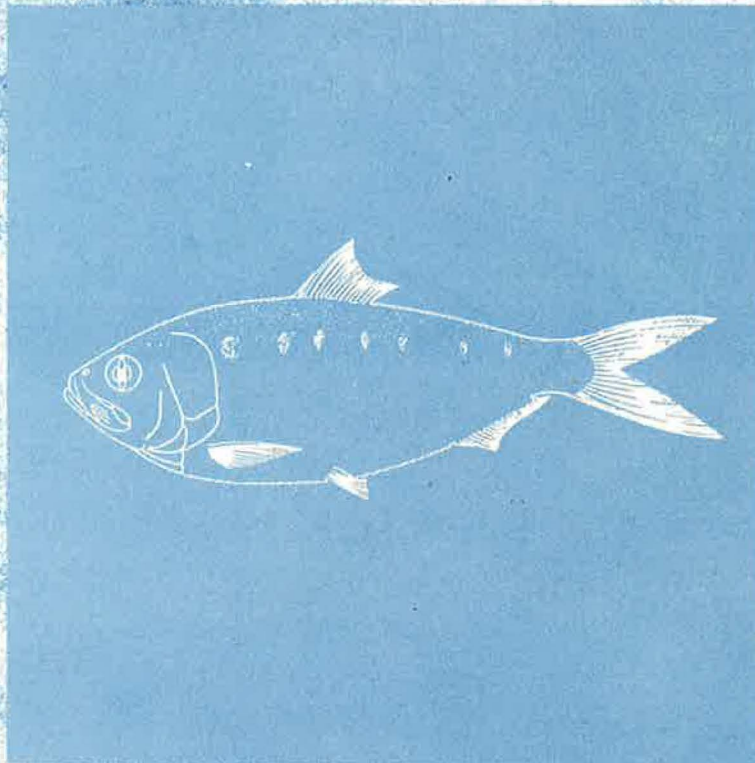
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**THE HANDLING, PROCESSING AND
MARKETING OF FISH
IN BANGLADESH**

J.P. COULTER and J.G. DISNEY

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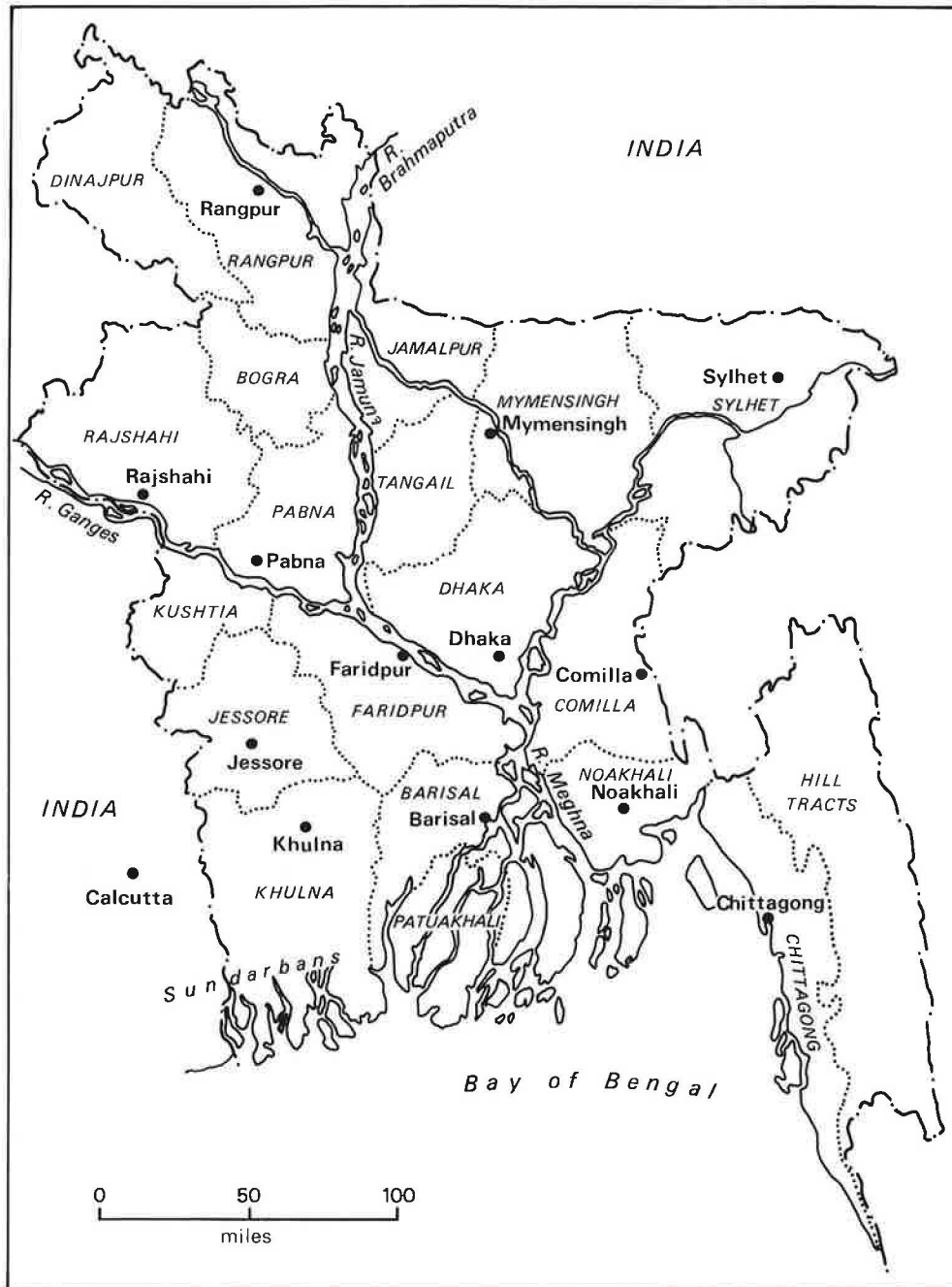
GLOSSARY OF ABBREVIATIONS

ADB	Asian Development Bank
BCSIR	Bangladesh Council for Scientific and Industrial Research
BFDC	Bangladesh Fisheries Development Corporation
DOF	Department of Fisheries (part of MLF)
DUS	Dwip Unnayon Sangstha (Association for the Development of Hatiya Island)
FAO	Food and Agriculture Organization of the United Nations
MLF	Ministry of Livestock and Fisheries
ODA	Overseas Development Administration
ODNRI	Overseas Development Natural Resources Institute (the scientific unit of ODA)

CONVENTIONS USED IN TABLES

—	nil or negligible
●	not available
C&F	carriage and freight
IQF	individually quick frozen

MAP OF BANGLADESH SHOWING REGIONS AND MAJOR CITIES



Summary

In May 1987, a three-man team from the United Kingdom visited Bangladesh to review the post-harvest fisheries sector and to identify projects for British aid. The former activity resulted in the present report on the handling, processing and marketing of fish in Bangladesh.

According to official figures, fish production in Bangladesh was 794,000 tonnes in 1985/86, approximately the same level as two decades previously. Of this quantity approximately 34,000 tonnes were used for export, while the remaining 760,000 tonnes were destined for the home market. Due to population growth, consumption per capita has fallen over the last two decades, from a level of 12 kg per annum to 7.6 kg per annum.

The catch for 1985/86 came from inland capture fisheries (56% of the total), marine fisheries (26%) and culture (18%), with the latter two growing at the expense of inland capture fisheries. The main types of fish caught are hilsa, an anadromous fish which migrates up the Ganges Delta to spawn, carps and catfish. Exports consist mainly of frozen shrimp (marine and freshwater), while frogs' legs, frozen and cured finfish have also been of significant value.

Fish production is expected to increase up to the turn of the century mainly as a result of aquaculture, but it is doubtful whether it will be possible to maintain current levels of per capita consumption.

The physical handling of fish in Bangladesh leaves room for much improvement and the following problems exist: lack of ice, lack of roads and adequate transport, lack of insulation during transport, inadequate packaging, lack of sanitation and reliance on slow non-mechanised collector boats. With the exception of a few facilities belonging to the Bangladesh Fisheries Development Corporation, landing facilities and fish markets are totally inadequate in relation both to fish quality and public health. As a result of these problems and of the practice of discarding shrimp by-catch at sea, there are substantial losses, both quantitative and qualitative. These are summarised below.

Fish marketing is almost exclusively a preserve of the private sector, and this is considered efficient compared to alternative systems which might be established. Nevertheless, there is scope for more competition, particularly in the assembly phase, which links fishermen to primary wholesale markets.

The most serious marketing difficulties seem to occur in remote fishing communities in the Bay of Bengal and enclosed inland waters which lack regular supplies of ice and transport, and where fishermen are in a particularly weak position in relation to intermediaries. In such locations much fish has to be processed into lower valued cured products and the process of curing often involves considerable losses through spoilage and infestation.

Shrimp production is one of the most dynamic areas of the Bangladeshi economy, now contributing over 10% of export revenue. However, the quality of most shrimp exported suffers from poor handling between the catching areas and the processing plants, and from poor hygiene in the plants themselves. This has resulted in the 'blocklisting' of Bangladeshi exports in the United States in 1979 and bans on imports by Saudi Arabia and Italy. There is an urgent need to establish a larger and more thorough official quality control service than that currently operating, for which purpose further technical assistance by FAO is planned.

Quantification of post-harvest losses is very difficult, but on the basis of limited information currently available the authors have made the following estimates:

	Quantity/value	Type
Internally consumed:		
Quantitative losses	at least 35,200 tonnes (4.6% of the catch)	discarded by-catch and dried fish loss
Qualitative losses	US\$ 96 million	downgraded fish
Shrimp exports:		
Quantitative losses	US\$ 2 million	excessive washing
Qualitative losses	US\$ 7 million +	downgrading

The authors discuss possible measures to diminish these losses and generally improve the efficiency of the marketing system, as follows: assistance targetted specifically at remote fishing communities; an improved system of mandatory inspection for seafood exports; the building of a series of modern

landing and wholesaling facilities; training and extension in improved handling and processing for all those handling fish; research into various topics of concern to the post-harvest fisheries sector; various other measures to improve export performance. For Bangladesh to undertake such a programme would require considerable outside technical and financial support, especially training of a very practical kind in fish quality, handling and processing technology.

The suggested improvements would benefit the Bangladeshi economy in the following ways: increasing the availability of fish, at reduced prices and with better quality; increased revenue to fishermen and processors; increased foreign exchange earnings; environmental improvements resulting from modern landing/wholesaling facilities.

Section I

Introduction

In May 1987, a three-man team from the United Kingdom visited Bangladesh to carry out a review of the post-harvest fisheries sector and to identify projects for British aid. It was decided that the first part of this assignment, the review of the post-harvest sector, should be written up as an ODNRI publication and made available to all governmental and non-governmental institutions interested in fisheries development in Bangladesh, and to the public at large.

This has resulted in the present report on the handling, processing and marketing of fish, and which is divided into the following sections:

- Section 2: An analysis of the overall supply and demand for fish and shellfish in Bangladesh and for export.
- Section 3: A discussion of the way fish is handled and marketed for domestic consumption, quantitative and qualitative losses, and marketing efficiency. The role of the Government and co-operatives in fish marketing is also discussed.
- Section 4: A discussion of the way shrimp is handled and marketed for export, associated losses and attempts to establish a system of quality control.
- Section 5: A discussion of the main constraints preventing improved handling, processing and marketing, and the type of measures needed to overcome them.

The information required in the preparation of this report was obtained from two sources: (a) past reports and publications, and (b) a programme of field visits in the following towns: Dhaka, Narayanganj, Khulna, Chittagong, Cox's Bazar, Sylhet, Sunamgonj and Habiganj. The authors were surprised at the amount of valuable information contained in past reports and which it is hoped to make more widely known through the present publication. One report of particular note was a PhD thesis by Ahmed (1983), containing a detailed investigation of the efficiency of domestic fish marketing. Apart from this a publication of the Bay of Bengal Programme provided useful information on the small-scale marine fisheries (FAO Bay of Bengal Programme, 1985), reports by DANIDA (1984a, 1984b) gave in-depth descriptions of marketing in Barisal and Chittagong, while an ADB report (Aquatic Farms Ltd., 1986) provided a valuable review of the shrimp industry.

Section 2

Supply and Demand

2.1 FISH PRODUCTION

According to figures supplied by the Department of Fisheries (DOF), fish production in 1965/66 was 801,000 tonnes. For the next nine years it stayed at around 800,000 tonnes, but it then fell to about 650,000 tonnes during the following six years. Since then it has more or less recovered to the former level, reaching 794,000 tonnes in 1985/86 (see Table A.1, Appendix A). Given the immense difficulties involved in collecting catch data for such a widely dispersed fishery, the foregoing figures should be interpreted with a degree of caution. Changes in collection procedures may be partly responsible for the large drop in the figures for inland landings between 1974/75 and 1975/76.

In 1985/86, approximately 442,000 tonnes or 56% of production was accounted for by inland capture fisheries, 145,000 tonnes (18%) by culture, and 207,000 tonnes (26%) by marine fisheries. The main components of these fisheries are as shown in Table I.

Table I

Main components of Bangladeshi fishery production

	Catch ('000 tonnes) 1985/86	Change 1983/84- 1985/86
Inland capture fisheries:		
Commercial fishing in rivers, estuaries and sundarbans	206.5	- 4%
Commercial fishing in large natural depressions (beels)*	45.3	- 12%
Subsistence fishing in the floodplain	187.4	- 17%
Culture:		
Pond culture, mainly of carp species	123.8	+ 15%
Shrimp culture for export	20.0	+ 143%
Marine fisheries:		
Artisanal fisheries	195.5	+ 30%
Trawl fisheries	11.9	- 18%

Source: Table A.2 (Appendix A)

Note: * An estimated 64% of catches take place in Sylhet and Mymensing districts in the north-east

Over the 20 years from 1965/66 to 1985/86, inland fisheries have experienced a substantial decline, from 720,000 tonnes per annum to 589,500 tonnes per annum according to official figures, and this is attributed to the following causes: (a) increased flood control, drainage and irrigation structures, as a result of which breeding and feeding grounds for fish are diminishing, (b) reduction in the volume of river flow due to construction of dams (in India) and sedimentation, preventing hilsa fish from reaching the spawning grounds. This decline was however partially offset by increased fish culture, which advanced by 24% in the two years from 1983/84 to 1985/86.

About 94% of the marine catches are from the 'artisanal fishery', which consists of both mechanised and non-mechanised boats using gillnets, seine nets and set bag nets. The remaining 6% of catches consist of shrimp and demersal fish caught by the trawl fishery. Due to increased mechanisation and improved gear, growth in the marine catch has been substantial, 150% over the last two decades, and has prevented an overall decline in the country's catches.

Of the 794,000 tonnes produced in 1985/86, it is estimated that about 760,000 tonnes were destined for domestic consumption and the remaining 34,000 tonnes for export.

2.2 EXPLOITATION OF ENCLOSED INLAND WATERS

The system by which the exploitation of enclosed inland waters is regulated is presently undergoing an important change, and for this reason is worthy of special mention. Such waters include *baors*, which are ox-bow lakes, *haors*, which are depressions in floodplains, *beels*, which are more permanently filled depressions from which fish migrate to the floodplains during the wet season, and Captai Lake, which is a major lake in the Hilltracts area.

For some time the DOF has regulated fishing in Captai Lake and the baors around Jessore, where a World Bank funded stocking project has been operating. In these locations DOF has licenced fishermen who have been paid a percentage of the proceeds from the fish landed. Fishing in other publicly owned waters has been regulated by the Revenue Office, which licenses individuals to fish. The beneficiaries have generally been urban people who employ local fishermen to land the fish on a share-cropping basis, with the lessee taking care of the marketing.

The Government has decided that this system should be changed since it involves uncontrolled fishing without concern for the preservation of the resource, as well as being disadvantageous to the fishermen. For this reason responsibility for all inland waters is being passed to DOF, which is beginning to implement a new policy, consisting of licencing the local fishermen to exploit waters directly. Licence fees are paid according to the net size. DOF moreover plans to build on this policy, by instituting re-stocking programmes which will increase the catch in the enclosed waters and in the surrounding floodplains.

2.3 SPECIES AND PRODUCT FORM

2.3.1 Species

The main types of fish caught are hilsa, carps and catfish.

Hilsa is an anadromous species which migrates from the Bay of Bengal up the rivers of the Ganges Delta to spawn. Commercially speaking, hilsa is classified as sea-hilsa or river-hilsa, according to where it is caught; river-hilsa is normally preferred by consumers on account of its taste at the time of spawning. Hilsa is the main traded species in Bangladesh and catches for the 1983/84 season are reported to have been 90,000 tonnes in the rivers and 46,000 tonnes in the sea (Marr, 1985). However, with the silting-up of the rivers and the development of the marine fishery, an increasing proportion is caught at sea. Landings peak twice in the year, in September/October coinciding with the monsoon, and between January and March.

Carps include both indigenous species and fast-growing introduced species; they are caught inland in rivers, beels and haors, in floodplains and in Captai Lake. They

are also the main species cultured in ponds. The most common species and those most popular with consumers are rohu, catla and mrigal, but in order to make optimal use of plant material other species are being introduced, including silver carp and grass carp. Catches of carp are greatest in the months January to March, being particularly abundant as the floodplain waters recede.

Various kinds of catfish are caught both at sea and inland. Other important types of fish caught at sea are croakers (especially jewfish), Indian salmon, snappers, carangids, giant sea perch (bekti), skates and rays, and shrimps. Also common in inland fisheries are certain species which are traded in live form such as shingi and koi (or climbing perch), as well as chital, aur and freshwater prawns.

Scientific names for some of the above-mentioned species are given in Appendix B.

2.3.2 Product form

According to FAO (FAO Bay of Bengal Programme, 1985), about 30% of fish landed is marketed fresh (uniced), about 40% is iced, 20% is sundried, while the remainder is frozen, salted, smoked, canned or made into fish meal. Ahmed (1983) estimates that 15% is cured, either by drying, salting or smoking, and finds that this percentage is declining over time due to improved communications and use of ice.

Fresh and frozen fish is normally marketed whole, whether it is destined for domestic consumption or for export. Processing at landing sites, wholesale and retail markets, etc., is limited, though very large fish such as bekti are normally cut into large steaks.

Increasing quantities of fish are being frozen, mainly for export. Following the example of the Bangladesh Fisheries Development Corporation (BFDC), some traders are storing hilsa for resale on the domestic market during the lean season (see Section 3.4.4). Freezing has come into vogue largely as a result of surplus freezing and cold storage capacity built for the shrimp industry.

Shrimp and frogs' legs are frozen for export and are packed according to normal international specifications. The 2 kg inner carton is normally used for this purpose, although sometimes the 5 lb carton is used for the United States market (see Section 4.4).

2.4 DOMESTIC CONSUMPTION

Population pressure has resulted in a large fall in annual per capita fish consumption over the last two decades, from about 12 kg in 1965/66 to 7.6 kg in 1985/86. It should be noted that these figures are subject to any inaccuracies in national production statistics and that they do not take account of unofficial cross-border trade with India. Notwithstanding such reservations there is no disputing the conclusion that per capita consumption has experienced a major decline during this period.

Consumption of 7.6 kg per head per annum is low compared to most countries in southern Asia (see Table 2), but in Bangladesh fish accounts for about 80% of total consumption of animal protein. Scarcity of fish is therefore a major factor contributing to protein deficiency which is believed to affect 80% of Bangladeshi households.

Some general observations may be made concerning consumer preferences, as follows:

- Outside coastal communities, freshwater fish are preferred to marine fish, and this is reflected in the higher prices of the former. In most inland communities, sea-hilsa is the only kind of marine fish which is accepted, though in Dhaka other species of marine fish are increasingly consumed. Promotion of marine fish by BFDC may have contributed to this change (see Section 3.7.1).

Table 2

**Annual per capita consumption of fish and shellfish
for human food, southern Asian countries,
1980-1982 average**

	Kilograms per capita
Malaysia	47.6
Philippines	33.4
Singapore	32.6
Thailand	20.2
Sri Lanka	14.9
Burma	14.5
Indonesia	11.8
Vietnam	11.4
BANGLADESH	7.5
Laos	5.2
India	3.2
Pakistan	2.3

Source: FAO, Rome

● Uniced fish is preferred to iced fish (when there is no difference in quality), and iced fish is preferred to frozen fish. All of these are generally preferred to cured fish, although there are specialist markets for the latter. None the less, prejudice against ice is declining as its use becomes commonplace.

● More expensive fatty fish like rohu, catla and hilsa tend to find markets in the more lucrative markets of big towns. In country areas much of the consumption consists of very small fish, including juveniles, this being evidence of the unrestricted fishing of inland waters referred to above.

● Cured fishes are in demand in a few areas only (e.g. Chittagong, Sylhet-Mymensingh, Rangpur, Rajshahi and Dinajpur) and demand is probably falling.

2.5 EXPORTS

2.5.1 Products and destinations

Since the early 1970s, Bangladesh's exports have increased rapidly, reaching a figure of US\$ 121 million by 1985/86, equivalent to 14.4% of total exports. The volume of exports in the same year was 22,614 tonnes or 20,615 tonnes if frogs' legs, which are not strictly fisheries products, are excluded. Of course, this quantity is less than

Table 3

Fisheries exports of Bangladesh

	Value (US\$ millions*)					Volume (tonnes)
	1972-73	1982-83	1983-84	1984-85	1985-86	1985-86
Total	4.6	75.3	78.5	90.0	121.1	22,614
<i>of which:</i>						
Shrimp — frozen tails	3.0	65.1	62.8	77.8	92.7	13,900
Frogs' legs — frozen	0.1	5.2	7.8	4.0	10.4	2,449
Fish — frozen	—	3.3	5.7	5.8	12.6	5,057
— chilled	1.4	—	—	—	—	—
— dried	—	0.3	0.4	0.2	3.5	786
— salted/dried	—	0.6	1.3	1.4	1.7	422
Shark fins and fish maws	—	0.8	0.5	0.8	0.4	●

Source: Export Promotion Bureau, Bangladesh

Note: * Values are converted to US\$ from Thaka

the 34,000 tonnes of exports mentioned previously because it refers to net product weight and not biomass weight.

Over 75% of the value exported is accounted for by frozen headless shrimp, mainly tiger shrimp (*Penaeus monodon*) and freshwater shrimp (*Macrobrachium rosenbergii*), while frogs' legs, frozen finfish and cured fish are also of significant value.

Penaeid shrimps account for most shrimp exports and are mainly shipped to Japan while the larger freshwater shrimps go to Europe and the United States.

Table 4

Exports of frozen shrimp by country of destination

	Value (US\$ millions*)			
	1982/83	1983/84	1984/85	1985/86
Total	65.1	62.8	77.8	92.7
of which to:				
Japan	28.4	30.1	45.2	43.9
European Community †	24.9	21.8	22.3	14.3
United States	10.0	10.0	8.7	33.4
Other countries	1.8	0.9	1.6	1.1

Source: Export Promotion Bureau, Bangladesh

Notes: * Values converted to US\$ from Thaka
 † Includes Belgium, United Kingdom, Federal Republic of Germany, Netherlands and Italy

Frogs' legs are likewise exported mainly to the United States and the European Community.

The trend in exports of frozen finfish is clearly a rising one, with the value of the same more than doubling in 1985/86. Most of the product is hilsa and carps shipped whole to the United Kingdom, the Arabian Peninsula and South-East Asia. The main destinations for the year 1985/86 were as follows: United Kingdom (39% by value), Kuwait (17%), Malaysia (14%), United Arab Emirates (13%), Oman (7%), Qatar (3%) and Saudi Arabia (3%). The fish are mainly consumed by Bangladeshis and Indians residing in the countries concerned.

Exports of cured fish increased more than threefold in value between 1984/85 and 1985/86, reaching US\$5.2 million in the latter year. The main markets were Hong Kong with 57% of the total, Japan (19%), United Kingdom (7%), Canada (6%), United Arab Emirates (3%), Sri Lanka (3%) and Saudi Arabia (2%). Most of the cured fish exported to Hong Kong is now small jewfish, salted and sundried in Cox's Bazar under the supervision of buyers from Hong Kong.

Some fresh and dried fish are undoubtedly contrabanded to India though the quantity cannot be estimated. Fresh hilsa and carp are shipped through the Sundarbans and the western districts, with Calcutta being the principal destination, while fresh carp and dried fish are shipped to Assam in the east. (Assam is one of India's main consuming areas for dried fish, receiving large shipments from Gujerat.) There is a large price differential between the two countries, it being reported in Khulna that border prices for fresh fish were typically 60% higher than those in Bangladesh. Such large differentials make it very difficult indeed to eradicate such trade.

2.5.2 International demand

SHRIMP

The main markets for shrimp are Japan, the United States, and Western Europe, in that order. Japan imported 213,000 tonnes in 1986, and consumption has been growing at an average of 5% over the past five years. United States consumption reached 181,000 tonnes in 1986, having grown at an average of 9% over the past six years (Globefish, 1/87).

Due to the very high level of demand, most capture fisheries for shrimp around the world are being fully exploited, or are close to full exploitation, with the growth in demand being mainly satisfied by increasing output from aquaculture. Outside of Ecuador and Taiwan, the development of aquaculture has been relatively sluggish, and shrimp has continued to enjoy a sellers' market. Even in Ecuador, growth of cultivated output has been seriously retarded by a shortage of post larvae for stocking ponds, and slow progress in the development of hatcheries.

Shrimp will continue to enjoy a sellers' market until such time as the growth in pond output outstrips the growth in demand, a scenario which may materialise at some time during the 1990s.

FROGS' LEGS

Frogs' legs enjoy strong demand in North America and Europe. Ecologically-motivated restrictions on harvesting in India have strengthened Bangladesh's position as a supplier, and the resulting scarcity of supply suggests the need for frog-culture to satisfy demand.

FROZEN FINFISH

International markets for finfish are characterised by the inability of supplies to keep pace with demand. In the past, international trade in fish has been dominated by a few groundfish species from the northern hemisphere, like cod and saithe, and by tuna. However due to scarcity of the former, a variety of previously little-known species, such as Alaska pollock and New Zealand orange roughy, are now being drawn into international trade. This change is significant for Bangladesh and suggests that exports are likely to follow a continuing upward trend.

In few parts of the world are demand and supply so poorly balanced as in the Indian sub-continent. In India, a major market investigation carried out around 1981 forecast that there would be a supply deficit of 940,000-1,340,000 tonnes by 1985 (Indian Institute of Management, Ahmedabad, 1984). This scenario seems to be materialising, as evidenced by the increased real prices for some fish species. In the early 1970s, small pelagic species (sardines and mackerel) could be converted into fish meal, but they are now too expensive for this purpose and are being marketed as fresh fish. Even for canning they are proving too scarce and expensive. This contrasts with the situation on the west coast of South America where millions of tonnes of such species are converted into fish meal used in making animal feed, there being no alternative use for most of this catch.

CURED FISH

World-wide consumption of cured fish is falling as a percentage of overall consumption, due to preference for fresh fish and increasing use of ice as a means of preservation. Nevertheless Bangladesh has been able to increase its exports due to demand from speciality markets in Hong Kong and Singapore. While potential markets for cured fish are not comparable with those for frozen fish, there will continue to be strong demand in a number of southern Asian markets (e.g. Sri Lanka, Malaysia, Hong Kong, Singapore, Assam State in India).

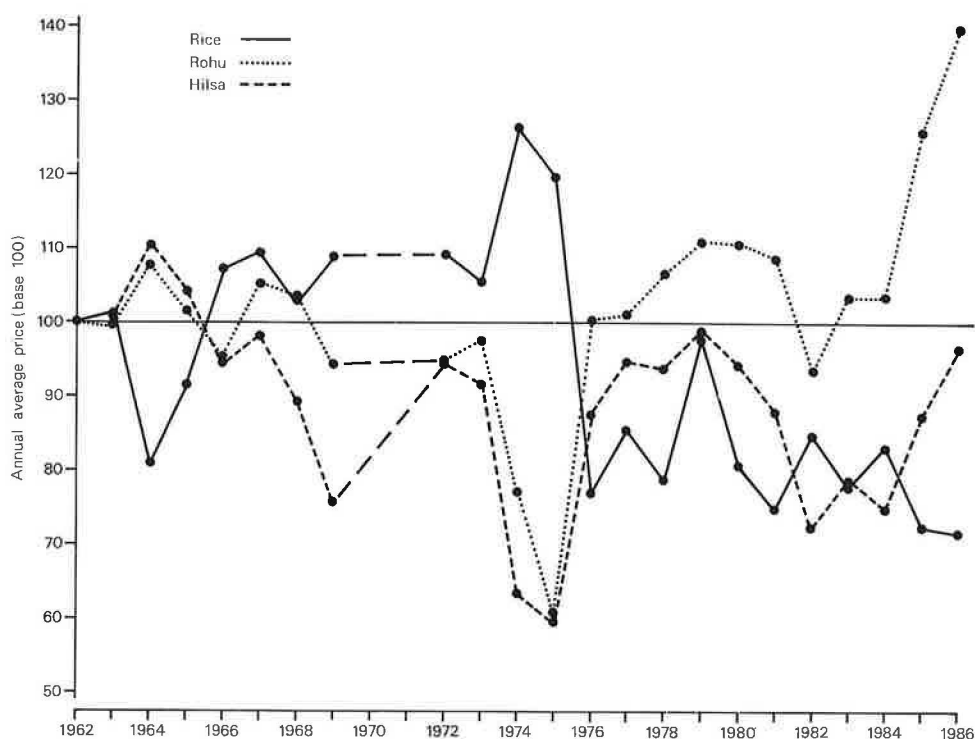
2.6 PRICES

2.6.1 Long term price trends

Figure 1 compares annual average wholesale prices for rohu and hilsa since 1962 to prices for rice over the same period. It will be seen that since the mid-1970s the price of rice has fallen relative to both species of fish, and that the price of rohu has risen

Figure 1

Annual average prices* of fish and rice



Source: Directorate of Agricultural Marketing, Ministry of Agriculture, Bangladesh

Note: *at constant prices, 1962 = 100

considerably relative to hilsa and rice. The former trend may be attributed principally to the declining per capita fish supplies, the latter to the decline in the inland capture fishery. Supplies of river-hilsa are also believed to have fallen due to the silting-up of rivers, but this has been compensated for by a greater marine catch.

2.6.2 Seasonal price variations

As previously indicated there are considerable seasonal price variations due to the uneven supply pattern for major species consumed. Variations in Dhaka wholesale market are shown in Table A.3 (Appendix A) for 1985 and 1986. Prices for hilsa are lowest from September to March, though they tend to rise in the middle of this period (December-January), when there is a hiatus in supplies. The price of carps (rohu and catla) are lowest from January to March due to intensive fishing from receding floodplains, beels, etc. Given the good communications between traders, price differences between the major wholesale markets are not large.

In addition to the official information quoted above, aratdars in Khulna provided monthly price information for river-hilsa and sea-hilsa based on their own experience. River-hilsa is available all the year round, whereas sea-hilsa, which accounts for some 75% of the total quantity marketed, has only a short season from July to November.

The prices given by the traders suggest a much larger degree of seasonal variation than the official information, which does not distinguish between sea- and river-hilsa. Wholesale prices for sea-hilsa reaches a low of Tk 11-13 per kg in August and September, while river-hilsa reaches Tk 43 per kg in the lean period, a difference of between 230% and 290%. In contrast the Directorate of Agricultural Marketing's figures show prices in the lean season to be only 75% to 89% higher than in time of greatest abundance. The discrepancy between the two sets of figures may be partly due to traders having a selective memory and remembering highest and lowest

prices and not averages in the months concerned. However if their figures are only partly true, they clearly explain the increasing use of freezing to preserve sea-hilsa for the lean season (this is discussed in Section 3.4.4).

2.6.3 Prices for individual types of fish

The most expensive finfish in Bangladesh are the major carps (rohu, katla and mrigal), pomfret, and species sold live such as koi. Hilsa and all marine species except pomfrets, which are exported, command considerably lower prices, reflecting the overall preference for freshwater fish. Table A.4 (Appendix A) shows relative prices for different species consumed internally. Tables A.5 and A.6 show international prices for finfish, shrimps and frogs' legs from Bangladesh.

2.7 FUTURE OUTLOOK

In 1985, a major investigation called the 'Twenty Year Fishery Development Plan for Bangladesh' was carried out by John C. Marr Associates under FAO/UNDP auspices (Marr, 1985). The report by this mission, known as the 'Marr report', concluded that a net increase in total fishery production of about 375,000 tonnes was possible by the year 2005 (see Table 5).

Table 5

Projected increase in fishery production by year 2005

Source	'000 tonnes		
	Year 1984	Year 2005	Increase (Decrease)
Aquaculture			
Fish	106	483	377
Shrimp	8	89	81
Inland capture fishery	465	327	(138)
Marine capture fishery	172	227	55
Total	751	1,127	375

Source: Marr (1985)

The report forecast losses of 138,000 tonnes from the inland capture fishery due to water development projects, but that this would be more than offset by a 513,000 tonnes increase due to aquaculture (89%) and marine fishery (11%). The increase in aquaculture production was expected to come about mainly from: increased productivity of existing ponds (187,000 tonnes); 'replacement aquaculture', i.e. the digging of new ponds by water authorities to counteract losses of output due to water development projects (138,200 tonnes); and, coastal shrimp aquaculture (79,200 tonnes).

The forecast production increase of 375,000 tonnes would allow Bangladesh to maintain its current level of per capita consumption but not to increase it.

A World Bank report (Roider, 1986) questions the Marr report's emphasis on aquaculture as the main source of increased production. Priority should be given to the stocking of floodplains with carp fingerlings, as this could result in a doubling of the inland capture fishery within 10 years. In the same time period it is foreseen that an increase of only 35,000 tonnes could be achieved by increasing yields in ponds, through use of extensive polyculture.

In line with the World Bank recommendations, DOF is presently planning a major stock enhancement programme with funding from the Asian Development Bank

(ADB). While technically feasible, it is possible that stocking of floodplains will encounter practical problems due to the difficulty in enforcing effective management (closed seasons, sanctuaries, net size regulations, etc.).

In the authors' opinion, fisheries output will continue increasing up to the end of the century, but probably not in line with the growth of population. Marine fisheries output is likely to increase significantly, as forecast by the Marr report. Aquaculture output will also increase, but the high yields projected and the targets for replacement aquaculture may prove hard to attain. The prospects for stock enhancement programmes are even more uncertain. At the same time an increasing proportion of Bangladesh's finfish catch is likely to be exported, due to strong international demand.

Given a scenario of continuing scarcity of fish, with static or falling per capita consumption, it is necessary that Bangladesh seeks all means to increase its catch and to reduce post-harvest losses. The latter subject is further discussed in the remainder of this report.

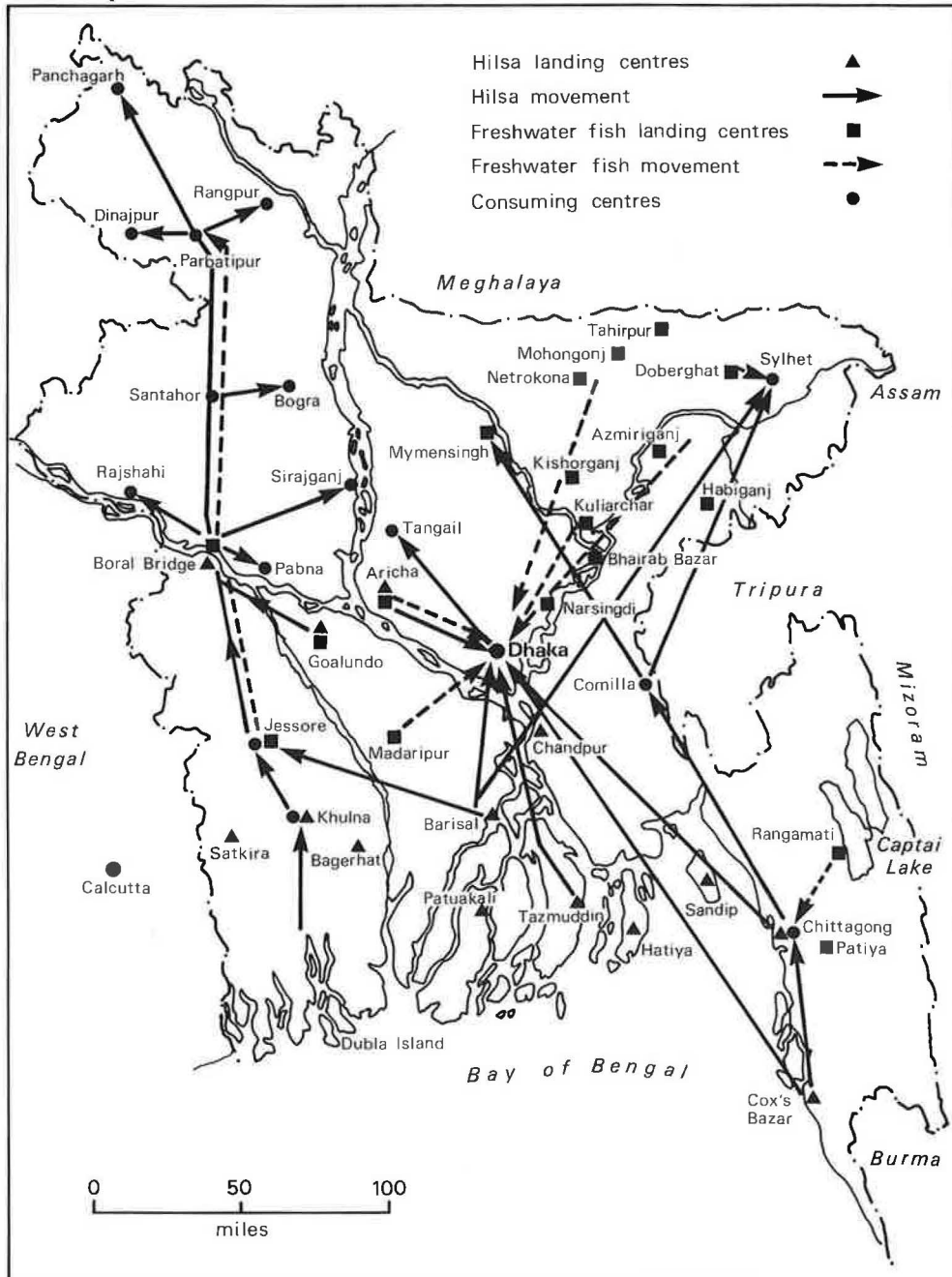
Section 3

The Marketing of Fish for Domestic Consumption

3.1 TRADE FLOWS

Figure 2

Map of Bangladesh, showing major movements of fish for internal consumption



Source: Ahmed (1983) and authors' observations

Much of the catch, particularly from inland waters, is consumed locally by the fishermen or within the same district. However there are areas which consume less than they produce and therefore have a surplus which can be 'exported' to other areas of the country. These are as follows:

(a) The coastal marine fishing areas and southern estuaries, with major landings taking place at Chittagong, Barisal, Khulna, Cox's Bazar and Chandpur. Hilsa constitutes most of the fish shipped from these locations.

(b) Important river points in the interior such as Nilcomol, Goalundo, Madaripur, Narshingdi, Munshiganj, Bhairab Bazar, Kuliarchar, Bhayggokul and Aricha.

(c) Areas of heavy inland fishing from floodplains, beels, haors, baors and lakes. The most important area is the Sylhet-Mymensingh floodplain, with landings taking place at many locations including Doberghat and Joikalash (Sunamgonj), Azmiriganj, Habiganj, Mohongonj, Netrokona and Kishorganj. Other important areas include the beels of Bonwarinagar-Faridpur (Pabna), the baors of Jessore and Kushtia and Captai Lake.

Most of northern Bangladesh, Dhaka and all other urban centres form the deficit areas and receive shipments from the surplus areas described. Of course many regions are both surplus and deficit areas depending on the season — for example, the Sylhet region has a short three-month season during which most commercial

Table 6

Estimates of annual quantities of fresh and frozen fish traded through selected cities and landing points

	1981 (Ahmed)	1985		1985-86 (Rapport Bangladesh Ltd.)	1987*
		(ADB)	(DANIDA)		
Dhaka	28.2 †	20		8.4 †	42 †
Narayanganj					11.7
Chittagong	15.0 ‡	18	31-36.5 §	18.5 ¶	
Chandpur	13.6	12		13.8	
Barisal	29.8	15	15-18	7.1	
Cox's Bazaar				6.2	
Sylhet				10.0	
Daborghat (in Sylhet floodplain)					9 †
Khulna	2.6 **			12.7	4.3
Rajshahi				6.0	
Goalundo				5.7	
Dinajpur				3.5	
Rangpur				3.3	
Mymensingh				3.0	
Mohongonj	12.9			2.6	
Bogra				2.5	
Kuliarchar	6.1			2.2	
Pabna	1.7			1.2	
Jessore				1.0	
Satkira				0.6	

Sources: Ahmed (1983), Aquatic Farms Ltd. (1986), DANIDA (pers. com.), Rapport Bangladesh Ltd. (1986)

Notes: * Estimates made on basis of data supplied to the authors
 † Includes Swarighat market. Ahmed (1983) estimates that other markets account for 28% of the quantity wholesaled in Dhaka
 ‡ Does not include landings at Chittagong Fish Harbour
 § All landings included
 ¶ Includes Eakubnagar wholesale market only
 ** Total landings at Ghat No.5

catches occur. Throughout the rest of the year, the district is a net importer of fish, with large quantities of hilsa being shipped from the south of the country. Figure 2 illustrates the movement of fish from surplus areas to deficit areas.

It is difficult to determine the proportion of fish which is marketed through commercial channels and how much is simply consumed locally without passing through markets. Some data and estimates on quantities of fish passing through major landing points and wholesale markets are shown in Table 6.

The most exhaustive survey is that carried out under contract to FAO (Rapport Bangladesh Ltd., 1986), where 8 aratdars in each of 18 markets were interviewed throughout a 12 month period (February 1985-January 1986). Total trade through the 18 markets was found to be 108,000 tonnes, about 14% of national production — a low percentage if one considers that some fish had passed through two markets and had therefore been double-counted. Estimates obtained from other sources suggest that volumes traded in Dhaka, Chittagong, Barisal, Sylhet and Mohongonj were larger than shown in the survey. The discrepancy may be due to sampling bias and/or non-co-operation of respondents, a major hazard in this kind of survey.

The figures in Table 6 show major centres of trade to be Dhaka, Chittagong, Chandpur, Barisal, Cox's Bazar, Khulna, various points in the Sylhet-Mymensingh floodplain, Rajshahi and Goalundo.

3.2 MARKETING CHANNELS

Almost all fish traded internally passes through private channels. The market structure varies from area to area, but in general terms can be summarised as illustrated in Figure 3, which is largely based on a description by Ahmed (1983). He divides the market into four stages: primary market, secondary market, higher secondary market and final consuming market. The system operates as follows:

(a) *The primary market*

Here the fisherman sells to a mobile assembler, who may be known as a *mahajan*, a *jogandar* or a *faria*. The assembler uses a collector boat or a truck to collect the fish. When buying in estuaries or rivers, he may buy through a local agent (*dala*) who typically earns a 1% commission for his services. Normally the fisherman receives credit known as *dadan* from the assembler by virtue of which he is bound to deliver his catch to the same. It should be noted however that fishermen with mechanised vessels are often financially independent of middlemen and obtain bank credit.

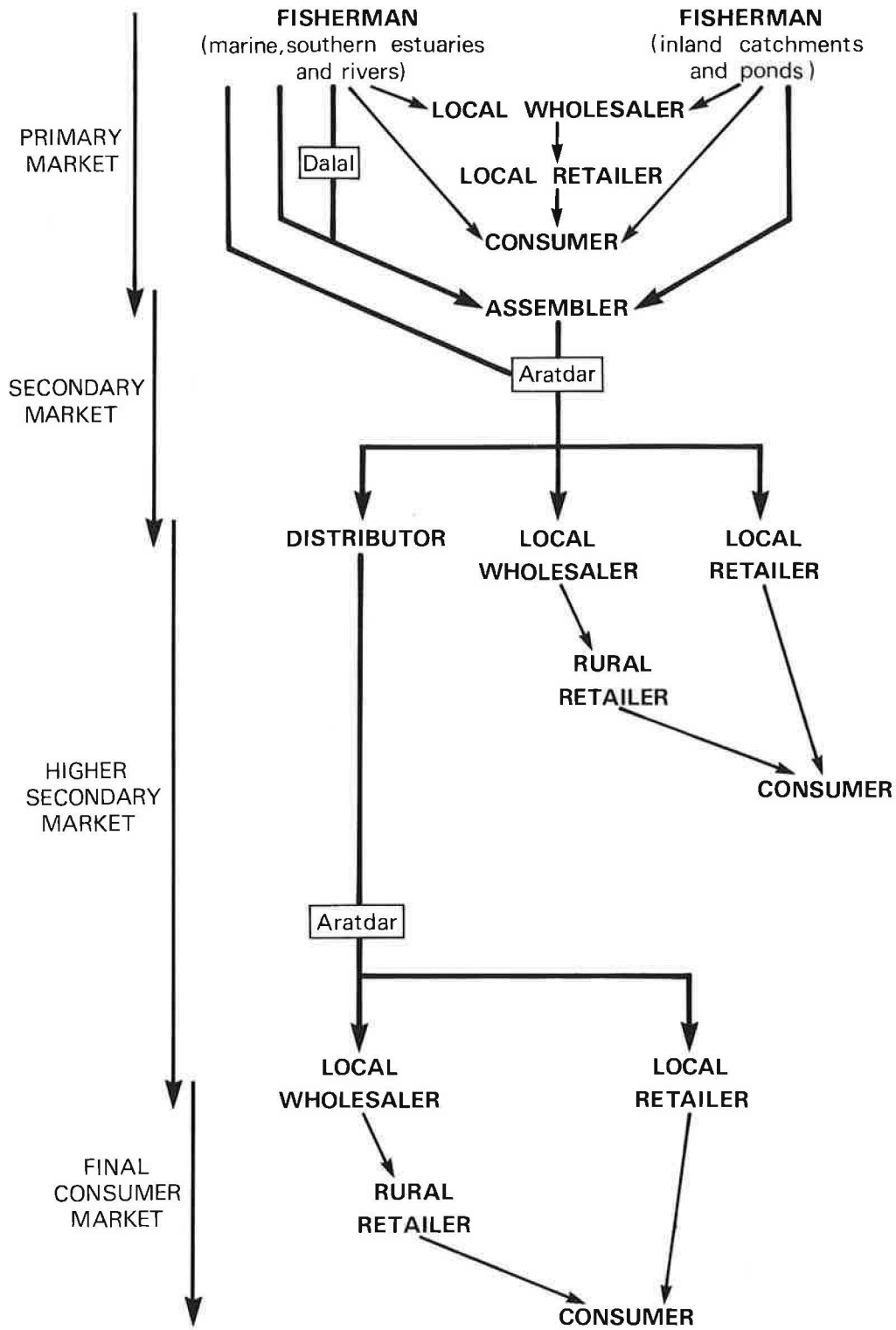
(b) *The secondary market*

The assembler sells the fish in a wholesale market to local retailers (*nickaries*), local wholesalers (*paikers*), or distributors who transport the fish to other districts (*beparis* or *chalanis*). The sale is normally carried out through the medium of a commission agent (*aratdar*) who conducts public auctions. In some markets fish is weighed during auctioning but more often it is not. Hilsa is typically sold by the count of 80 fish, this measure being known as a *pon*. The aratdar also extends seasonal advances to his suppliers and short-term credit to the buyers. His basic remuneration is his sales commission, which is charged to sellers at rates normally between 3% and 6%. A rate of 3% is typically charged to sellers who owe no money, while up to 6% is charged where credit is outstanding.

(c) *The higher secondary market*

Fish consumed at a distance from the secondary market is transported by distributors (*bepari* or *chalani*) to other distribution markets, usually wholesale markets in district towns. Here they sell to local retailers (*nickaries*) and wholesalers (*paikers*) through local aratdars who render similar services to the first level aratdars referred to above.

Figure 3
Marketing channels



Source: Based on descriptions by Ahmed (1983) and DANIDA (private communication)

(d) *Final consuming market*

After procuring fish at the higher secondary markets, local wholesalers (*paikers*) sell to retailers (*nikaries*) of outlying upazilla markets* and of village markets (*hats*), through whom the fish finally reach the consumer. Sometimes the wholesaler doubles as a retailer when the upazilla markets or hats are close to the supply source.

It should be added that at each tier of the distribution system there are wholesalers and retailers supplying the needs of consumers in their respective localities.

While the above is a description of the normal trade channels, there is of course much variation between locations and types of fishermen. For example fishermen sometimes by-pass assemblers and sell directly at the secondary markets, this being particularly common with mechanised vessels landing fish at major southern ports.

Communication between the traders in different markets is generally good and takes place by telephone and this keeps wholesale prices in line throughout the country. The least informed party is the fisherman, because of his physical isolation from the markets and because there are no radio broadcasts carrying information on wholesale prices. Other factors which weaken the fisherman's bargaining position are his dependency on credit and illiteracy.

At the other end of the scale of power and influence are the aratdars in the major secondary markets, including the following:

Market	Number of aratdars
Dhaka — Swarighat	72
— Newmarket	12
Narayanganj	12
Chittagong	54
Barisal	22
Khulna	12

In such markets aratdars have formed themselves into powerful associations with far-reaching influence. To varying degrees they have been able to create closed shops, preventing new aratdars from setting up in competition, though it appears that this situation does not prevail in northern markets. Mackintosh and Palfreman (1987) found no evidence of a closed shop in Saidpur, Rangpur and Siranganj markets.

The aratdars are at the centre of the entire marketing system and their role goes far beyond what one would normally expect of a commission agent, including financing of suppliers and buyers, and often dealing on their own account.

They usually finance assemblers by extending advances for the duration of the fishing season, and through the assemblers they are also financing the fishermen. Loans (typically Tk 50,000-100,000 in Khulna) are interest free, but commit the assembler to use the aratdar's services when selling. Aratdars also give short-term credit to buyers (*beparis*, *chalanis* and *paikers*) up to a week's duration. Additional facilities are often provided to buyers and sellers, including accommodation, entertainment and temporary storage of fish. In such ways aratdars are able to guarantee sources of supply, a regular stream of bidders and good-will from all parties.

Some aratdars own ice-factories, while some extend their activities to fishing or to the assembly of fish as *aratdars-cum-mahajans*, fitting out boats for these purposes. In Chittagong some aratdars act as buyers for frozen fish, having formed parties to bid for fish landed by the trawlers. Others have taken on the role of *chalanis*, distributing fish to other cities on their own account. In view of these activities, there is clearly a potential conflict of interest between the aratdar's traditional role as a commission agent on the one hand and as a dealer on the other.

3.3 MARKETING MARGINS

Ahmed (1983) analysed the marketing margins of representative intermediaries acting between inland producers on the one hand, and consumers in Dhaka and Pabna on the other. The species of fish considered were hilsa, rohu and shingi (*Heteropneustes fossilis*, a species marketed in live form). In all cases it was found that producers were receiving between 50% and 65% of the retail price (see Table A.6, Appendix A). The bulk of the marketing margin was earned by the assembler and the distributor (where applicable) and retail margins were only 5-10% of the consumers' price.

An investigation into margins earned through the marketing of marine fish in 1979 (Sabur and Rahman, 1979) produced similar results. Margins between fishermen and consumers in Chittagong and Cox's Bazar were computed for four species (see Table A.7, Appendix A), it being found that average fishermen's share was 60.1% to 63.4% depending on whether he sold on land or at sea. Notably intermediaries' costs represented a larger portion of their gross margin than in Ahmed's (1983) study.

The authors' observations tend to confirm the findings of these studies, but some further comments can be made:

(a) The most profitable part of fish trading appears to be in assembling the fish and bringing it to the major wholesale markets (secondary and higher secondary markets). The latter stages of wholesaling and retailing are relatively competitive and margins are keen.

(b) Fishermen's shares are much lower when they are physically isolated from the main wholesale market, have difficulty obtaining ice and do not have mechanised vessels, because in such situations their negotiating position is weak. This is the case in seasonal fisheries in the Sundarbans, in the more remote islands of the Bay of Bengal, and in some beel fisheries (e.g. in the Sylhet-Mymensingh floodplain). It is reported that aratdar-cum-mahajans operating in Dubla Island charge interest of 30-40% on loans for a period of 3-4 months (DOF, private communication).

(c) Unusual use of weights and measures provides middlemen with additional opportunities for profit. For example a maund auctioned at Chittagong weighs 40 kg to allow for weight loss in handling (compared to a true weight of 37.324 kg). In Khulna 42 kg is allowed, whereas in many markets fish is sold by count. Generally assemblers buying from fishermen buy by count making it difficult to quantify margins.

3.4 MARKETING INFRASTRUCTURE

3.4.1 Landing facilities and wholesale markets

The association between landing facilities and wholesale markets tends to vary according to the part of Bangladesh. In the southern estuaries, the coastal zone and in Dhaka, wholesale markets tend to be side by side with landing points, but in northerly areas much of the fish traded comes from the south and the markets are often independent of local landings and form part of wholesale markets dealing in a variety of produce other than fish.

Landing facilities and wholesale markets belong either to BFDC, municipal authorities or private individuals. Sometimes, as in Chittagong, intermediaries have formed co-operatives to rent facilities. BFDC has installations at Chittagong, Cox's Bazar, Khulna, Rangamati, Patharghata, Khepupara, Barisal and Rajshahi.

The Chittagong facility was built with Soviet assistance and consists of a fishing port designed to accommodate vessels of up to 33.5 m, 2 ice plants, a freezing plant, cold stores, a boat yard and a net factory. The port is used for landing and auctioning catches from BFDC trawlers, approximately 1,100 tonnes per annum. Unfortunately

it is not used by private boat operators to unload their catch due to problems of siltation and its inconvenient location. Most fish is landed and auctioned at a privately owned facility on the opposite side of the estuary at Eacubnagar.

BFDC's facilities at Khulna, Cox's Bazar and Rangamati are, by contrast, fully used by private operators who pay a commission (3% at Cox's Bazar) on the value of the fish sold. They are the best facilities available in the country. Landing pontoons are available at Khulna and Rangamati, and all three facilities have concrete auction halls and are kept clean. Another facility has been constructed at Barisal with Danish assistance, but has not been occupied because of disagreement among aratdars. BFDC is planning to install two further facilities of this kind, one at Chittagong adjacent to the existing private facility at Eacubnagar, and one at Doberghat in the Sylhet floodplain.

The above-mentioned facilities were built or are proposed mainly for use by private traders and fishermen. Two further facilities have also been built at Patharghata and Khepupara in southern Bangladesh with the aim that BFDC should buy directly from the fishermen without recourse to intermediaries. However various difficulties have affected the operation of these facilities, including problems of location, design and siltation, and they have not attracted a significant amount of business.

The state of landing and wholesaling facilities, and particularly the privately and municipally owned ones, is generally inadequate for the handling of a perishable commodity like fish. The following problems have been identified:

- Lack of landing facilities (jetties or pontoons) at most markets.
- Silting, soil erosion and lack of water depth for landing.
- Flooding in sales area during the rainy season.
- Lack of adequate drainage.
- Lack of facilities for washing down.
- Floors dirty or earthen.
- Lack of auction space at peak periods.
- No access for vehicles. Fish has to be carried into and out of the market by headload or pushcarts involving unnecessary handling.
- Lack of parking space.
- Lack of roofs to provide shelter from sun and rain.
- Lack of toilets.
- Lack of mechanical weighing equipment.
- Shortage of ice in many markets (see below).
- Lack of insulated storage facilities for holding iced fish.

Conditions such as these are on the one hand a public health hazard for the surrounding communities. On the other hand they result in an excessive amount of handling under poor conditions of hygiene, and this inevitably results in deteriorated fish quality.

3.4.2 Retail markets

The conditions of urban retail markets are generally unsatisfactory with regard to sales area, parking, sanitation, ventilation, water supply and provisions for preservation. Further details are given by Rapport Bangladesh Ltd. (1986).

3.4.3 Supply of ice

Ice production is concentrated in the major landing and market centres, particularly in the south of the country where both the marine fish landings and the burgeoning shrimp culture industry have created considerable demand. According to FAO (FAO Bay of Bengal Programme, 1985), there were in 1982-83 145 ice plants with a combined daily capacity of 1,396 tonnes located in Chittagong, Barisal, Patuakhali, Khulna and Noakali. Most of the capacity was for making block ice (89%) which is

preferred to flake ice (11%), with manual methods being used to convert the blocks to crushed ice.

In inland fishing areas, ice plants are generally fewer and farther between, and often are part of ice-cream factories. Outside Dhaka, Cox's Bazar, Chittagong and Khulna there are no ice storage facilities.

There is clearly a shortage of ice particularly at peak periods, and this was demonstrated by the Rapport Bangladesh survey (1986) which showed that supplies were generally adequate in only 8 out of 18 wholesale markets. In Mymensingh, Mohongonj, Goalundo and Bogra wholesale markets, it was reported that fish deterioration was frequently due to shortage of ice, affecting 10-20% of the fish depending on the market and season concerned. Ice is scarcest in locations with difficult communications, a subject which is further discussed below.

Shortages of ice occur at peak fishing periods and this is reflected in the prices charged for the same. In Chittagong prices vary between Tk 10 and Tk 330 per 125 kg block depending on the state of demand. Such fluctuations would be reduced if there were adequate insulated ice stores, as this would allow stocks of ice to be held to cover days of extraordinary demand. It would also prevent ice melting in the open air while waiting to be used as presently occurs.

The water used in icemaking is of very uneven quality and is often not chlorinated.

3.4.4 Cold storage facilities

Most cold storage facilities belong to the private sector (see Section 4.2) and are used for freezing and storage of shrimp and other seafood destined for export. However for several years BFDC has been freezing and storing fish procured in the fishing season for resale in Dhaka during the lean season. Sometimes the fish has been thawed before being retailed. This activity has not proved profitable and the main explanation advanced for this is the very limited acceptance among consumers of frozen fish or previously frozen fish for which reason it must be sold at a discount.

Notwithstanding this experience, traders in Khulna have found that they can profitably store frozen sea-hilsa for sale in the lean season. They also confront an acceptability problem among consumers for which reason they have to accept prices Tk 3-5 per kg less than for fresh fish. However they have been able to find a ready market in north Bangladesh, where consumers are more willing to accept the frozen fish.

Given that export packers of seafood have massive excess capacity in their cold storage facilities, it is expected that increasing quantities of fish will be frozen for the domestic market in this way. It is moreover probable that prejudices towards frozen fish will gradually be eroded as consumers grow more accustomed to it.

3.5 HANDLING AND TRANSPORT OF FISH

Water, road and rail transport are all used to carry fish over longer distances from collection points to markets and between markets. In the case of the marine fishery, mechanised boats with insulated holds are generally used to collect fish from fishing areas, but in inland waters traditional non-mechanised craft are mainly used. For transport on land, road transport is mainly used as it is found to be more flexible, safe and speedy compared to the railways, though the latter are sometimes preferred for small loads, i.e. box-loads, which cannot economically be transported by road.

In urban areas fish tends to be carried by headload, baskets suspended on poles, push carts and rickshaws.

The time taken for fish to reach its destination varies widely according to location. For fish to reach distant urban centres (e.g. in north Bengal) from the south of

Bangladesh, requires 7-9 days from the time of catching. This is less than the normal shelf life of many tropical species if stored and handled under ideal conditions, but conditions are in fact far from ideal, and there is consequently much spoilage. Transit times between catching and retail were researched by Ahmed (1983).

Packaging materials include bamboo baskets, wooden boxes, oil drums (for live fish), plastic bags, jute bags and other local materials. Modern plastic or metal fish boxes, which can be cleaned and sterilised, are not used at all. Other natural materials such as hogla leaves, banana leaves, water hyacinths and mosses are used to provide protection and insulation, with or without ice.

The system has a number of features which lead to deterioration in the quality of the fish marketed, as follows:

(a) *Non-availability of ice/lack of transport.* This problem is particularly serious in certain inaccessible areas, such as the beel and haor areas of the Sylhet-Mymensingh floodplain, Faridpur, Pabna, Bogra and Rajshahi, as well as in some island fishing communities in the Bay of Bengal, e.g. St Martins Island, Kotupdia, Dubla.

In the inland areas mentioned, inaccessibility is due to the lack of roads. At peak fishing periods, fish is kept in bamboo baskets or simply piled up without ice until a sizeable quantity is caught. It is then carried by headload, sling or animal to the nearest road, which is the first point at which it can be iced. Deterioration results from the delay in icing and this motivates the conversion of much of the fish into lower valued dried products. Knowledgeable persons interviewed by the authors in the Sylhet floodplain region estimated that between 25% and 40% of the annual catch was indeed converted into dried fish. Ahmed (1983) has demonstrated that the prices of such cured products are low compared to their fresh equivalents.

Likewise in the remote island communities referred to above, as much as 40% of the catch has to be dried to prevent decomposition, there being a lack of transport and no ice locally available. The process of drying itself involves heavy losses through infestation by insects. It was reported that this occurs in Dubla Island when fish is dried during cloudy weather which continues for many days on end. In such locations, the lack of power supply and/or the high cost of the same have tended to impede the establishment of ice plants.

(b) *Insufficient application of ice.* Ahmed (1983) found that average rates of ice usage were inadequate, with fish to ice ratios ranging from 1:0.49 in winter to 1:0.68 in summer compared to appropriate levels of 1:1 and 1:1.5 respectively. When insufficiently iced, fish cannot be kept at a sufficiently low temperature (0°C to 5°C) to maintain it in optimum quality throughout the distribution chain.

(c) *Lack of insulation.* Many collector boats still do not have insulated holds, resulting in considerable wastage of ice. Ahmed (1983) found that between 8% and 65% of the mechanised collection boats in riverine areas had such holds, depending on the area studied. However the majority of inland boats are non-mechanised and these generally have no insulation. Ice is carried to collection areas under matting made of hogla leaves which have an insulating effect, with saw-dust and rice husks also being used to reduce melting.

No insulated or refrigerated transport is offered either by the railways or the road hauliers, though BFDC has a few insulated trucks for its own use. It is not known whether the operation of insulated wagons or trucks would be financially attractive for private operators.

(d) *Inadequate packaging.* The case for substituting traditional packaging materials with modern sterilisable materials is complex, depending on considerations of cost and hygiene. No study is known to have been carried out on this subject in Bangladesh, but it should be noted that attempts to introduce such boxes in developing countries have often proved unsuccessful.

It can however be stated that boxes used at present are too large, unwieldy and non-uniform. They also tend to be overfilled, resulting in crushing of the fish inside. Baskets are likewise difficult to handle, holding up to 3 maunds (112 kg) of fish.

Live fish are generally packed in drums with insufficient water, and this results in a high rate of mortality. No supplementary oxygen is used to keep the fish alive.

(e) *Lack of sanitation.* Sanitation receives a low priority at all stages of marketing. For example cleaning and washing of fish and containers is not common practice, and most retail markets fail to use chemicals (bleaching powder, etc.) to sterilise surfaces.

(f) *Reliance on non-mechanised collection boats.* These are the kind of boats most used for collection in inland areas and are disadvantageous in terms of speed, fish quality and cost. With regard to cost, freight rates have been found to be higher for non-mechanised boats (Ahmed, 1983) and the slower speed makes it necessary to carry more ice.

(g) *Infrastructural problems.* The lack of adequate infrastructure, mentioned above, causes movement of fish to be slow, results in more handling stages than desirable, decreased hygiene and greater cost than would otherwise be the case.

3.6 LOSSES

3.6.1 Introduction

Losses can be classified as quantitative or qualitative. Quantitative losses include fish which are disposed of because of low commercial value and physical losses through spoilage or insect attack. Qualitative losses consist of losses in commercial value, but not in physical biomass, through loss of quality. Sometimes preservation by curing or manufacture of fish meal is a means of avoiding quantitative loss which none the less results in a qualitative loss due to the lower commercial value of the processed fish compared to its fresh equivalent.

3.6.2 Quantitative losses

The two largest sources of quantitative losses are through spoilage and insect attack on fish being dried and/or salted, and by-catch (also called 'trash fish') from shrimp trawling which is discarded at sea.

It is very difficult to estimate the volume of losses in dried fish, because of the lack of any detailed surveys, though losses of between 10% and 35% have been variously reported in marine areas (Doe *et al.*, 1977; Ahmed *et al.*, 1978; various private communications). These observations indicate that the loss of protein through spoilage of dried fish is a serious problem meriting further investigation.

Shrimp by-catch consists mainly of small fish discarded by trawlers because it does not command a sufficiently high price to merit being stored on board. Some by-catch is normally landed by trawlers, but this is only a small part of the total catch caught

Table 7

Estimate of by-catch discarded by trawlers

Year	No. of trawlers operating			Estimated production (tonnes)		
	Shrimp trawlers	Non-shrimp trawlers	Total	Shrimp landed	Fish landed	Fish discarded
1981	8	6	14	700	●	●
1982	14	5	19	1,020	1,800	5,200
1983	22	25	47	1,700	2,000	8,000
1984	27	46	73	4,500	10,000	25,000
1985	30	37	67	3,140	9,300	22,700
1986	31	14	45	3,848	7,561	14,439

Source: Shahidullah (1986b)

towards the end of cruises. The quantity discarded is estimated to have peaked at 25,000 tonnes in 1984, but fell to 14,439 tonnes in 1986 due to a reduction in the number of trawlers permitted to operate.

With the inland catch quantitative losses are lower, firstly because the fishing areas are generally closer to the assembly and distribution areas, and secondly because there is practically no inedible fish caught inland.

Ahmed (1983) estimated that quantitative losses accounted for 6% of the marine catch but only 2% of the inland catch. His figure for the marine catch has clearly been surpassed as a result of the development of shrimp trawling. A more up-to-date estimate of marine losses could be made as follows:

Dried fish

Volume of catch for domestic consumption	200,000 tonnes
Percentage of catch dried	20%
	i.e. 40,000 tonnes
Percentage lost — conservative estimate	10%
	i.e. 4,000 tonnes

By-catch

Annual volume discarded — average	20,000 tonnes
-----------------------------------	---------------

Total	24,000 tonnes
	i.e. 12% of catch

If we assume quantitative losses to be 12% for marine fish (as above) and 2% for inland fish (as per Ahmed, 1983), overall losses can be estimated at 35,200 tonnes, i.e. 4.6% of total landings of the 760,000 tonnes destined for internal consumption in Bangladesh. This is equivalent to about 350 grams of fish per capita per annum. It is probable that further research would reveal losses to be somewhat greater than this figure. Dried fish losses at inland locations are a subject requiring further investigation.

Not included in these estimates are the fish wastes resulting from filleting and gutting in markets. Although there are small fish meal factories belonging to BFDC in Chittagong and Cox's Bazar, filleting and gutting waste is mainly disposed of in the drains, in the rivers or as refuse. Given the dispersal of the markets at which such waste accumulates, there are likely to be logistical problems in trying to make effective use of them.

Table 8

Average percentage price fall of nine commercial varieties of fish in Newmarket, Dhaka due to qualitative deterioration, 1981

	Winter (January-March and October-December)	Summer (April-September)
Hilsa (medium)	6.83	7.60
Ruhu (medium)	20.00	25.60
Katla (medium)	19.00	24.00
Pangas (big, medium)	10.60	13.24
Taki (small)	17.56	27.43
Puti (medium)	17.00	27.00
Shrimp (small)	16.00	18.00
Shingi* (medium)	21.27	30.73
Koi* (medium)	20.24	34.00

Source: Ahmed (1983), based on fortnightly observations during 1981

Note: * Fish marketed in live form

3.6.3 Qualitative losses

Ahmed (1983) attempted to estimate these for fish sold in Newmarket retail fish market in Dhaka, in 1981. Nine types of fish were classified into three grades on the basis of sensory evaluation, and the average price fall was determined as a consequence of fish not meeting the Grade I standard.

The fall in price was greatest for live fish (shingi, koi), in the range of 20-35%, as deterioration or death of these species results in a major fall in market value. The fall was particularly high in Summer, when metal containers tended to overheat. Carps were also severely affected with falls between 19% and 26%. Least affected were hilsa with 6.83% and 7.60%, it being found that this species is still regarded as edible even when considerably deteriorated.

Table 9

Extent of deterioration of fish stagewise in channel of distribution

	Month of observation	Overall distance — producing to consuming market — in miles	Percent of fish deteriorated			Total cumulative deterioration (%)
			Producing to assembly market	Assembly to wholesale market	Wholesale to retail market	
Fish sold in Dhaka						
Hilsa	August 1981	170	19	9	2	30
Carp	December 1981	190	14	7	1	22
Zeol (Koi, Shingi, etc.)	April 1981	190	16	10	1	27
Fish sold in Pabna						
Hilsa	August 1981	245	21	13	1	35
Carp	December 1981	60	8	4	1	13
Zeol (Koi, Shingi, etc.)	April 1981	60	10	4	1	15

Source: Ahmed (1983)

Note: Routes taken by fish:

Hilsa to Dhaka: Bhola — by water — Barisal — by water — Swarighat market, Dhaka — Newmarket, Dhaka

Hilsa to Pabna: Bhola — by water — Barisal — by road — Pabna market

Carp/Zeol to Dhaka: Sachna haor — by water — Mohongonj — by railway and road — Swarighat market — Newmarket, Dhaka

Carp/Zeol to Pabna: Bonwarinagar — Faridpur Beel — by water — Boral Bridge Ghat — by railway and road — Pabna market

Information obtained independently by the authors in various wholesale markets (Chittagong, Dhaka, Narayanganj, Khulna and Sylhet) indicated that the losses for hilsa were at least as high as indicated by Ahmed.

Ahmed also found that for fish sold in Dhaka and Pabna, most of the deterioration takes place between the place of catching and the assembly market, and least between the urban wholesale and retail markets (see Table 9). This suggests that spoilage is mainly a function of the time spent in the marketing channels and lack of ice and insulation, since both these problems are most serious at the catching-assembly phase. Mishandling and poor hygiene in urban markets clearly exacerbate the problem but is not the prime cause of deterioration.

It would be desirable to estimate the overall loss to Bangladesh resulting from deficiencies in post-harvest handling, but this is very difficult because of the lack of accurate data on quantities of fish traded and consumed locally (as discussed in section 3.1) and lack of information on losses for different locations within Bangladesh. An estimate based on certain broad assumptions gives overall qualitative losses for 1986 of Tk 3,550 million (US\$ 117 million) (see Table A.8, Appendix A). Losses due to

the downgrading of fresh to dried fish account for 52% of the total. The main assumptions used in arriving at this estimate are as follows:

Fifteen percent of the catch is cured.

Losses from downgrading to cured fish as per Ahmed's estimates * 0.75. Ahmed treats all cured fish as downgraded product, but this does not take account of speciality markets which will demand cured fish even at much higher prices. By applying a factor of 0.75 we are assuming that such speciality markets account for 25% of demand.

Local consumption of fresh fish is 50% of total catch, there being no losses as the fish is consumed quickly.

Of the 50% which is not consumed locally, half is hilsa and half is other fish. Qualitative losses are 7% for hilsa and 20% on average for other fish, based on Ahmed's data for Dhaka given in Table 8.

Because of the nature of these assumptions, the above estimate should only be taken as an indicator of the order of magnitude of the problem.

3.7 GOVERNMENT INTERVENTION IN FISHERIES MARKETING

3.7.1 A review of the activities of BFDC

The Bangladesh Government's main vehicle for influencing the way fish is marketed within the country is BFDC, a parastatal company under the Ministry of Livestock and Fisheries (MLF). The DOF is also under the MLF but has very little practical involvement in the marketing of fish.

Appendix C shows BFDC's present functions, while a list of its physical facilities is provided in Appendix D. The Corporation is involved in trawling, boat building, net making, resource surveys and several processing and marketing activities which are discussed below:

(a) *Provision of marketing infrastructure for use by the private sector.* BFDC's role as a provider of landing centres and wholesale markets was discussed in Section 3.4.1, there being important facilities operational at Cox's Bazar, Rangamati, Khulna and Rajshahi. In addition to these facilities, BFDC hires out its cold stores to private exporters, the 500 tonne capacity store at Pagla (Dhaka) being the most used. Five hundred and ninety-one tonnes of fish had been stored at Pagla in 1987 up to the end of May.

(b) *Buying and selling fish on its own account.* BFDC markets a quantity not in excess of 1,000 tonnes of fish per year, that is 0.125% of overall landings of nearly 800,000 tonnes. Most of this is fish caught by the Corporation's own trawlers which is not marketed by third parties and fish caught by contractors in Government-owned waters of the interior, e.g. Captai Lake and the Baor Development Project at Jessore. BFDC has several cold stores including two 500 tonne capacity stores at Dhaka and Mongla and these are used to store fish caught in the fishing season for

Table 10

Annual fish sales by BFDC in Dhaka

Year	Marine fish	Freshwater fish	Total
1982/83	304	515	819
1983/84	201	516	717
1984/85	82	380	462

Source: BFDC (?1986a)

resale in the lean season. In recent years, BFDC has been distributing both freshwater and marine fish in Dhaka, selling to the public through market stalls and rickshaw vans. According to BFDC's Annual Report (1984-85), there were 50 rickshaw vans (now 60), 17 privately owned retail stalls and 3 of BFDC's own stalls selling BFDC fish. Annual sales show a downward trend as shown in Table 10.

(c) *Manufacture of other fish products.* BFDC manufactures and sells fish meal and dried fish at its processing project in Cox's Bazar, and makes fish meal at Chittagong. The quantity of fish meal made at Cox's Bazar almost doubled in 1986/87, over the previous year, to 240 tonnes as a result of increasing demand for making poultry and shrimp feed. The Chittagong plant produced 74 tonnes in 1984/85 the last year for which figures were obtained.

(d) *New product development and marketing.* With assistance from FAO, BFDC has developed a range of snack-type frozen products from minced fish obtained from trawler by-catch. The products selected for development are as follows: fish burger, fish finger, fish ball and a minced fish block. A marketing test was carried out through ten stores in Dhaka with the product outselling the production of the pilot plant (Etoh, 1985). The marketing trial was declared a success (Etoh, 1985), and this opinion was confirmed by a marketing consultant who was called in to evaluate the trial and to make recommendations for future development (Elsy, 1986).

One of the most difficult issues in this project is the supply of raw material. Most of this is presently being dumped at sea and it is necessary to know how much processors must pay for commercial trawler operators to land it in a state fit for food use, also what quantity they will bring ashore. According to Elsy (1986), BFDC could procure 1,320 tonnes at a price between Tk 3,000 and Tk 4,000 per tonne, at which level processing is economic. This quantity is however only a small proportion of the by-catch presently being discarded (15,000-25,000 tonnes per annum) and it is not known what price would be needed to induce operators to land the bulk of this catch.

As part of the same project a survey was also carried out on the distribution system in Dhaka (Bhuiyan, 1986). One of the main conclusions was that consumers prefer to add spices according to their own preferences rather than receiving a pre-spiced product, and that for this reason a minced block was likely to create much higher demand as compared to any other prepared item.

BFDC is now seeking funding for a commercial-scale plant to manufacture the aforementioned products.

Small quantities of other frozen products (fish cutlets, etc.) have been developed at BFDC's facility at Pagla (Dhaka) and introduced into local markets.

(e) *Export of fishery products.* BFDC is a small packer and exporter of seafood (mainly shrimp), having exported 125 tonnes in 1984/85. Given the degree of overcapacity in the shrimp packing industry as a whole, BFDC's involvement in this activity does not appear to have any developmental objective, but to be simply a profitable sideline compensating other less profitable activities. Another public corporation, Bangladesh Sugar and Food Industry Corporation (BSFIC), also packs and exports shrimp, having 5 plants, 2 in Khulna and 3 in Chittagong.

3.7.2 Marketing achievements

BFDC has sought to influence the marketing of fish in two ways.

On the one hand, it has adopted a developmental role by providing facilities for use by the private sector with a view to enhancing market efficiency. The facilities which are hygienic and comparatively well designed, now handle upward of 12,000 tonnes of fish per annum. This is a small part of the national catch, but it represents a major improvement in those places where the facilities are located.

On the other hand, BFDC has adopted a commercial role by marketing fish in its own right, in competition with the private trade. However the quantity marketed

in this way (less than 1,000 tonnes per annum) is too small to influence general price levels in the country, and experience to date suggests that it is difficult to compete with the private sector. This experience parallels that of parastatal companies elsewhere in Asia.

Nevertheless, it is likely that some of BFDC's commercial activities have brought benefits by virtue of their innovatory aspects, as follows: (a) by teaching people to consume more fish; and, (b) by storing fish caught in periods of glut and then releasing it onto the market in the lean period. As indicated in Section 3.4.4, some private traders are beginning to follow this example.

BFDC's innovatory role is also shown by the development of new products from minced fish. This kind of work would not have been done by the private sector acting alone, although there may indeed be scope for private companies to participate in commercial implementation once viability has been demonstrated.

3.8 THE ROLE OF CO-OPERATIVES IN FISH MARKETING

Fishermen's co-operatives are often seen as ways of improving marketing, involving bottom-up pressure by those who most stand to benefit from the improvements. Fishermen who pool their resources can improve local storage facilities, acquire collector boats and mini ice-plants. They can greatly improve the physical handling of fish in the catching-assembly phase, where the greatest handling problems have been demonstrated to exist (see Section 3.6). They can greatly increase their share of the wholesale value of the catch at the expense of middlemen.

There are in Bangladesh 4,234 primary co-operative societies of fishermen, mainly in marine areas, with a total of 537,224 members (FAO Bay of Bengal Programme, 1985). There are 88 intermediary area societies, and these are organised into a single national apex organisation called Bangladesh Jatiya Matshyajibi Samabaya Samity Ltd. (BJMSS). The co-operatives' main source of funding has been Government loans, a total of Tk 85 million being provided between 1961/62 and 1982/83, and credits from Japan and Denmark. These funds have been primarily used for the mechanisation of boats and acquisition of gear.

One might expect that such a large co-operative movement would have a major role in fisheries marketing, but this is not the case. Shrimp is frozen for export by BJMSS, but there is practically no involvement in the marketing of finfish which constitutes the bulk of fishermen's catches.

In 1973, the International Cooperative Alliance reviewed the state of the fishery co-operative movement in Bangladesh (Ponnuthurai, 1973), and pointed out several organisational problems including the following: a lack of awareness of the true significance of co-operation; illiteracy and the inability of committees to manage the societies' affairs; admission of non-fishermen into the societies, including many middlemen; the general exclusion of genuine fishermen from the management committees. There was no organised marketing for the co-operative members' produce and these had simply to sell their catch to middlemen, some of whom sat on the committees. While an up-to-date report is not available, this situation still prevailed in the early 1980s (see Ahmed, 1983).

While co-operatives have not been very active in marketing fishermen's catches, it should nevertheless be remembered that by channelling funds for the acquisition of mechanised boats they have in fact allowed many marine fishermen to gain more direct access to the major wholesale markets. There are moreover socio-cultural factors which discourage the poorer fishermen from engaging in marketing activities. Traditionally fishing has been the preserve of a particular caste of Hindus who have been reluctant to engage in activities outside their normal sphere of activity. Though Muslims are now heavily involved in fishing, Hindus still account for a greater percentage of fishermen than of the population at large.

Despite this background, the idea of co-operation is being encouraged by non-governmental organisations assisting marine fishermen in the Bay of Bengal, an example being the organisation Dwip Unnayan Sangstha (DUS) in Hatiya Island. DUS is working with 35 groups of 10-15 fishermen who at present own neither the gear nor the vessels they use. The approach adopted emphasises the raising of consciousness and the development of organisational skills among the fishermen. Small loans are provided to the groups to be invested in projects (e.g. purchase of nets), with the fishermen covering a large percentage of the cost from their own savings. Ultimately the groups intend to acquire all their own fishing boats and gear, as well as motorised collector boats to transport the catch to wholesale markets.

The approach adopted may overcome some of the shortcomings of the legally constituted co-operatives referred to above (lack of awareness of the true meaning of co-operation, lack of management capability, etc.), and the emphasis on saving should encourage greater grassroots participation, as members will have a personal stake in their groups. However it is too early to determine if the groups will prove successful and the possible pitfalls should not be underestimated.

3.9 CONCLUSIONS: MARKET EFFICIENCY

On the basis of analyses by Sabur and Rahman (1979) and Ahmed (1983), and the authors' own observations, the following conclusions can be reached concerning the efficiency of fish marketing in Bangladesh:

(a) There is a widespread belief that middlemen are only exploiting fishermen and that they should be 'eliminated' from the marketing system. However it is found that the profits of fish traders are not extraordinarily high considering the perishable nature of the product. At the same time it does not appear that either parastatals or the co-operative movement can perform the same service at lower costs.

(b) Notwithstanding this general comment, there is scope for increased competition in marketing, particularly at the assembly phase, where the bargaining position between fishermen and middlemen is often very unequal due to financial dependency, poor communications with markets, lack of ice, etc. The existence of a closed shop among aratdars in some major wholesale markets is also indicative of lack of competition.

(c) Lack of adequate marketing infrastructure, lack of ice and other major deficiencies in the system of physical handling give rise to serious qualitative deterioration, demonstrated both by the downgrading of fresh fish and conversion of the same into cured products. Such problems are most serious in remote fishing communities.

Section 4

THE SHRIMP INDUSTRY

4.1 TRADE FLOWS AND INTERMEDIARIES

4.1.1 Shrimp caught by artisanal methods or by farming

Shrimp caught at sea by trawlers constitutes less than 20% of Bangladesh's total catch. Most shrimp is caught by artisanal methods or is produced by farming, and is landed at a large number of widely scattered landing places and farm sites. The quantities caught by individual fishermen are often very small.

From the landing places, shrimp is transported to collection centres and held there until a sufficient quantity is available. It is then transported by water, road or rail to processing plants which are concentrated in and around Chittagong, Cox's Bazar, Khulna and Satkira. The shrimp is often not iced until it reaches the collection centres, but may be re-iced before reaching the processing plants, depending upon the time required for shipment. This varies greatly, but may be up to 60 hours.

Processing plants clean, process, grade, freeze and pack the shrimp which is then exported via Chittagong or Chalna. Shrimp processed in Khulna has to be shipped down the rivers in small reefer vessels to Chalna to be loaded into cargo vessels lying offshore. The lack of a deep-water port at Khulna is a disadvantage to processors in that city, but their proximity to the sources of production places them at an advantage to processors in Chittagong. Indeed the increasing number of processing plants at Khulna has deprived Chittagong packers of much raw material which they formerly obtained from the Khulna area.

Plants buy most of their material through agents, who may in turn buy from sub-agents or traders dealing directly with the fishermen and farmers. Agents may finance sub-agents and may also give credit to the processing plants, receiving payment only after the processor has shipped to his overseas customer. The shrimp is usually decapitated before reaching the plant and grading is likely to be carried out each time the shrimp is sold, with increasing precision at each stage. Industry sources estimate that the fisherman or farmer receives 75-80% of the price paid by the processor. Except in some more remote areas, fishermen and farmers are thought to be well informed about prices the plants are paying (Aquatic Farms Ltd., 1986).

4.1.2 Shrimp from trawls

Almost all shrimp caught at sea is processed on board the trawlers and transferred directly to reefer vessels for export to Japan. Most of the shrimp trawling companies operate joint ventures with their Japanese customers and processing is carried out under Japanese supervision.

4.2 MARKETING INFRASTRUCTURE

In 1983-1984, there were 44 processing plants operating with a freezing capacity of 308 tonnes per 24 hours and cold storage capacity of 8,670 tonnes (Aquatic Farms

Ltd., 1986). Shrimp accounted for most of the product processed, but frogs' legs and fish were also handled. Two of the plants belonged to Government corporations: BFDC and BSIFC.

The degree of capacity utilisation was very low — only 16% according to one source (Marr, 1985). Such overcapacity has not led to a curtailment of the building of new plants and there are now about 70 in existence. It has however caused intense competition for shrimp between packers, forcing up their buying prices, eroding profit margins and making it difficult for them to insist on good quality raw material. To make ends meet some processors lower the quality standards of the finished product by packing short weights, inaccurate counts and defective product. Another consequence of the overcapacity is that processors are trying to export cheaper types of seafood (e.g. hilsa) and in some cases are freezing fish for the domestic market, as discussed in Section 3.4.4.

Most processing plants are well designed, well constructed and adequately laid out. However, some improvements can be made, generally requiring only minor expenditure or a tightening of operating procedures, e.g. screening of doors and windows, wooden slats to ensure adequate air circulation between cartons and walls in cold stores, plastic strips across storage doors, lights recessed into the ceiling to prevent collection of dust, adequate foot baths and washing facilities.

Many plants have special areas set aside for peeling shrimp, but here facilities and practices are worse than in other areas of the plant.

A survey of 17 packers (Rapport Bangladesh Ltd., 1986) found that port facilities and shipping presented some problems. As regards port facilities, the following difficulties were reported: cranes not available in a timely manner, inadequate jetty facilities at Chalna, absence of cold storage and generator in port areas, absence of plug points for refrigerated containers and occasional labour troubles. Shipping presented more serious problems. Sixteen out of the 17 firms interviewed expressed serious concern about the shortage of reefer space and the inadequacy of refrigerated containers.

4.3 HANDLING AND PROCESSING

With shrimp caught by trawlers at sea there are virtually no handling or quality problems, given the speed with which it is processed and the high quality of supervision enforced by the Japanese buyers. This is not the case with farmed shrimp, where there are problems both prior to arrival at processing plants and during processing.

Pre-plant problems are by far the most serious. Ice is often insufficient and there is a general lack of hygiene. Shrimp is decapitated and sometimes peeled in agents' stores or peeling sheds before reaching the processing plants. These sheds are apparently not registered or under any form of control and, in most cases, conditions are quite inadequate: there is no fly screening, ice is rarely used, utensils and water are dirty, shrimp to be peeled is generally piled on a dirty floor and personal hygiene is non-existent.

For transportation, the shrimp is often packed under pressure, causing damage to the product. It is usually packed in bamboo baskets or in wooden boxes covered with jute cloths, all these materials being dirty and not capable of being thoroughly cleaned.

Deficiencies in the processing plants add to quality defects of incoming shrimp. Although processors have recognised the needs for high standards and have invested in high quality plants, standards of hygiene tend to be deficient. Cann (1985) quotes the following examples: incorrect dress of workers and non-use of protective clothing or headgear, lack of handwashing facilities and poor toilets, stacking of uniced shrimp directly on the factory floor and the use of child labour for shrimp

peeling as well as women (both sit bare-footed and dirty clothed amongst the products). Such practices stem from a general lack of knowledge among supervisory staff, there being few qualified people in these positions. There is clearly a need for training at this level.

Processing is sometimes hindered by external causes such as disruption of power supply and the shortage of imported supplies like bleaching powder and master carton bands.

4.4 PACKAGING

Shrimp is exported chiefly in raw headless shell-on form. Some raw peeled shrimp, mostly of the smaller sizes, is also exported.

Shrimp is normally packed in 2 kg inner cartons, but some, especially that for the United States market, is packed in 5 lb cartons. The use of different carton sizes for different markets is a good policy, given that users such as retailers and restaurants find it a nuisance to have to handle non-standard packs. Headless shrimp is usually finger packed for attractive presentation and, in order to ensure correct weights when thawed, processors put 2-3 oz overweight in each inner carton. For peeled shrimp, 8 oz overweight is normal.

The quality of inner cartons is poor. The board and waxing used are not of good quality and staples are required. Cartons should be designed so that staples are not required.

Inner cartons are packed in master cartons according to market requirements, usually 10 inner cartons per outer carton. Since the import of unprinted cartons has been banned, some problems have also been encountered with the domestically manufactured outer cartons. According to the 1986 survey (Rapport Bangladesh Ltd., 1986), 20-30% of the domestically made cartons were estimated to have been lost due to early breakage, requiring importers to re-pack the product.

4.5 LOSSES

It is almost impossible to estimate the financial losses to Bangladesh caused by questionable quality, because there is not a precise and measureable relationship between quality and price in international markets. An exporter who improves his quality will not immediately obtain higher prices. However he will gradually increase the confidence of his customers, reduce the risk of rejections and improve his long-term market opportunities. He may indeed be able to find new customers who would not previously handle his product.

Table II

Prices of peeled and deveined shrimp IQF, ex-warehouse New York

Count	US\$ per lb	
	Origin	
	Hong Kong	Mexico
16/20	7.50	9.45
26/30	6.50	8.25

Source: *Infofish Trade News*, 2 March 1987

The price that an individual shipper can obtain for good quality product is also constrained by the reputation of the country and of Asian suppliers in general. At present peeled shrimp from Asia sells at lower prices than Mexican shrimp of this type, as the example in Table 11 shows.

For a country or for an entire region to improve its relative price level may require a sustained effort over a long period of time to improve quality, in order to change buyers' perceptions of particular origins.

In spite of difficulties in appraising Bangladesh's losses there is plenty of evidence of the harm done by poor quality shipments. Bangladesh shrimp was 'blocklisted' in the United States in 1979, i.e. every shipment of shrimp from Bangladesh was automatically detained until the importer could prove that it met United States requirements. Saudi Arabia and Italy have stopped buying from Bangladesh, and United Kingdom buyers rejected six full containers of peeled shrimp during the first 7 months of 1987 (approximate value £300,000).

The method used to overcome United States objections has not been to improve handling and transportation but to wash the shrimp repeatedly. Shrimp is washed during processing at least three times and sometimes five times, with one wash under pressure, using 50 parts per million of chlorine (compared to a recommended maximum of 10 ppm). Although this reduces the bacteria load, it causes a weight loss of at least 2%, makes the product unnaturally white and is believed to adversely affect taste. If it is assumed that 2% of Bangladesh's shrimp exports are lost through this form of processing, the resulting quantitative loss for 1985/86 would be approximately 280 tonnes worth US\$ 2 million.

Some indication of qualitative loss incurred can be gained by comparing prices for sea-caught shrimp, sold through Japanese joint-ventures, and other shrimp of the same species sold to Japan. The difference is about US\$ 1 per kg according to an informed source, which if applied over 50% of Bangladesh's entire exports for 1985-86 (this excludes sea-caught shrimp and freshwater shrimp) suggests that Bangladesh was then losing about US\$ 7 million. However, for reasons stated above and in view of the special trading channels enjoyed by the joint-venture companies, it is not expected that such gains from quality improvement would arise immediately, but would materialise gradually as a result of the improved reputation of Bangladesh shrimp against competitors.

Qualitative losses of freshwater shrimp are probably less important than for marine shrimp. Bangladesh already has a good reputation compared to other supplying countries and the product is destined to price-conscious, but less quality-conscious, markets.

The record in international markets indicates that Bangladesh is already experiencing heavy losses and runs the risk of further exclusions/blocklisting, etc., in major markets. The risk is greater if an oversupply develops in the 1990s resulting from the development of aquaculture around the world. Under conditions of oversupply, importing countries are likely to apply stricter quality standards. For these reasons Bangladesh urgently needs to introduce improved quality control measures (see next section).

4.6 QUALITY CONTROL

The situation described above has resulted in a series of missions by international experts and exhortations to establish an effective quality inspection and control service. DOF is responsible for this function through the Fish Inspection and Quality Control Service (IQCS) which issues certificates enabling processors to obtain export licences. It has two laboratories in Chittagong and Khulna, of which only the latter is presently operational. Where IQCS laboratories are not available, products are tested at Amin Agencies (in Chittagong), the Bangladesh Council for Scientific and

Industrial Research (BCSIR, in Dhaka) and in private laboratories. Inspection consists mainly of microbiological analysis of end-products. Plant inspection is not presently carried out and IQCS has no responsibility for landing places, ice plants or peeling/decapitating establishments outside processing plants. There is also a lack of transport to enable inspections and sampling to be undertaken opportunely.

This system is not really effective, and the Service needs to be expanded in facilities, personnel, training and budget. An international programme of technical assistance has been proposed by FAO. It is expected to be operational by January 1988.

Self-regulation by an industrial body has also been proposed as a means of achieving effective quality control in Bangladesh. In support of this proposal it has been noted that companies' attitudes have evolved greatly since United States blocklisting in 1979, and they are now acutely aware of the importance of quality. However, it may be objected that, in Bangladesh as elsewhere, industry will lack the unity of purpose to work a satisfactorily effective system, in view of which the Government must continue to take primary responsibility for this function. However, were self-regulation to be wholeheartedly supported by the private sector, it would be the better system to adopt.

Section 5

CONCLUSIONS

5.1 PROBLEMS OF THE EXISTING SYSTEM OF MARKETING

The main problems affecting the marketing of fish in Bangladesh are as follows:

- (a) The isolation of many fishing communities from their wholesale landing facilities, coupled with poor transport and lack of ice.
- (b) Poor physical facilities for marketing of fish (i.e. landing centres, wholesale and retail markets).
- (c) Widespread ignorance of the factors affecting fish quality and ways of overcoming them.

These problems give rise to substantial losses to the economy of Bangladesh. Quantification of such losses is very difficult without a series of detailed investigations, but the following estimates provide an indication of the order of magnitude of the problem:

	Quantity/value	Type
Internally consumed:		
Quantitative losses	at least 35,200 tonnes (4.6% of the catch)	discarded by-catch and dried fish loss
Qualitative losses	US\$ 96 million	downgraded fish
Shrimp exports:		
Quantitative losses	US\$ 2 million	excessive washing
Qualitative losses	US\$ 7 million +	downgrading

It should be noted that the quantitative loss is equivalent to 340 grams per annum per head of population in Bangladesh; elimination of such a loss would allow consumption per head to be raised from the present 7.6 kg per capita to nearly 8.0 kg per capita.

This picture of quantitative and qualitative losses contrasts with the conclusion of a recent ADB report (Aquatic Farms Ltd., 1986) according to which prices vary little with quality and losses are not large. It should however be noted that the growing importance of fish culture will ease post-harvest problems rather than exacerbate them. Cultured fish can be harvested as and when required, avoiding the accumulation of unmarketable gluts, while arrangements for icing and packaging can be planned in advance of harvesting. All this tends to minimise post-harvest losses.

As discussed in Section 3.9, fish marketing is almost exclusively in the hands of the private sector, which is considered efficient compared to alternative systems which might be established. Nevertheless there is scope for increased competition in distribution, particularly at the assembly phase of the marketing chain.

5.2 POSSIBLE MEASURES TO IMPROVE THE MARKETING SYSTEM

The scale of the losses and the scarcity of fish in Bangladesh make it particularly important to improve the way in which fish is marketed. As stated in Section 2.9, Bangladesh will have difficulty maintaining its present level of per capita fish supplies over the next two decades, let alone improving it, and this makes it all the more necessary to reduce physical losses and to increase the flow of fish from producing areas to consumers.

Measures of the following kind are needed:

(a) Assistance targetted specifically at remote fishing communities in the Bay of Bengal and the beel fishing areas. In some inland areas, the building of roads is necessary to improve market access. Fishermen should receive instruction on improved methods of handling and curing fish, there being simple preventative methods which will substantially reduce curing losses. Fishermen or fishing communities should also be helped to acquire motorised collector boats, mini ice-plants (where economically justified) and processing facilities. Of course the effective use of such plant and equipment by communities or groups of fishermen requires that they be suitably organised and managerially capable, for this reason careful attention should be paid to social development aspects.

(b) An improved system of mandatory inspection for seafood exports as discussed in Section 4.6.

(c) The building of a series of modern landing facilities and wholesale markets in all the major landing and trading centres throughout Bangladesh. These would be hygienic and require less physical handling of the fish.

(d) Training and extension in improved handling and processing addressed at all those involved in the handling of fish, including fishermen, traders, processors, export packers and municipal authorities. The first priority should be to improve the quality of exported fish, given its high unit value, but training should subsequently be given to those involved in the domestic trade. Training should be linked with research into improved handling which is discussed under the next sub-heading.

(e) Research. There is scope for considerable research in the post-harvest fishery sector. For example, reseach is required to better quantify the post-harvest losses described above. Another exercise is required to determine the optimal use of shrimp by-catch which is presently discarded at sea. A number of subjects need to be considered such as the design and operation of shrimp trawlers, the use of collector boats and alternative uses of the by-catch. Research is also appropriate for evaluating improved methods of handling and processing of fresh fish, e.g. new forms of packaging and insulation.

(f) Further suggestions arising from this report include: restrictions on the number of new seafood packing plants that may be built, together with a prohibition on exports by companies which do not own such plants; improvements in port facilities and reefer services (see comments in Section 4.2); improvements in the quality of packaging materials available to exporters.

For Bangladesh to undertake such a programme the Government, as well as co-operating private organisations, will need considerable technical and financial support from outside. Much of this support would consist of training Bangladeshis in fish quality, handling, processing techniques, etc. It was noted by the authors that there were a number of enthusiastic graduates who had already received some training in these areas, often overseas, but that they tended to lack sufficient practical experience. It is therefore preferable that most training be of the practical hands-on kind, which can best be provided by in-country courses. At the same time there is a need to improve the training capability of the universities and the fisheries training centre at Chandpur, which has recently come under the newly created Fisheries Training Institute.

5.3 BENEFITS FROM THE PROPOSED MEASURES

The main economic benefits from implementing measures of the kind listed above can be summed up as follows:

- Consumers benefit from a greater availability of fish, particularly fresh fish, better quality and lower prices. More fish is available because of a reduction in physical losses, and because the more efficient marketing system increases incentives to producers. At the same time less fish is downgraded into cured product, but instead reaches the consumer in its higher valued fresh form.
- Fishermen benefit by increased income from their traditional activity.
- Communities in the vicinity of modern landing/wholesale centres benefit from less pollution and congestion.
- All those involved in the export trade, including suppliers and intermediary processors, benefit from increased proceeds, with corresponding improvements occurring in the balance of payments and tax revenues.

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APPENDIX A: SOURCE TABLES

Table A.1

Production of inland and marine fish

Year	'000 tonnes		
	Inland	Marine	Total
1965/66	720	81	801
1966/67	721	81	802
1967/68	723	81	804
1968/69	726	82	808
1969/70	727	83	810
1970/71	729	85	814
1971/72	729	85	814
1972/73	731	87	818
1973/74	732	88	820
1974/75	733	89	822
1975/76	545	95	640
1976/77	541	100	641
1977/78	533	110	643
1978/79	527	118	645
1979/80	524	122	646
1980/81	524	125	650
1981/82	556	130	686
1982/83	584	144	728
1983/84	589	165	754
1984/85	586	188	774
1985/86*	587	207	794

Source: DOF

Note: * Tentative figures

Table A.2

Fish production of Bangladesh, 1983/84-1985/86

Sector of fishery	Water area (^{'000} ha)	Production (^{'000} tonnes)			Percent change
		1983/84	1984/85	1985/86*	1983/84-1985/86
1. Inland fisheries					
(a) Capture					
- Rivers, estuaries and sundarbans	1,032	215.5	219.9	206.7	-4%
- Beels	114	51.4	45.9	45.3	-12%
- Captai Lake	69	4.1	2.7	2.4	-46%
- Flood plains	2,833	200.6	194.1	187.4	-7%
Total capture	4,047	471.6	462.6	441.8	-6%
(b) Culture					
- Ponds	147	107.9	111.6	123.8	+15%
- Baors	5	0.9	1.0	1.0	+12%
- Shrimp farms	52 (83/84) 87 (85/86)	8.2	11.3	20.0	+143%
Total culture	204 (83/84)	117.0	123.8	144.7	+24%
Total inland fisheries	4,252	588.6	586.4	586.5	—
2. Marine fisheries					
(a) Trawl fisheries		14.5	12.4	11.9	-18%
(b) Artisanal fisheries		150.4	175.1	195.5	+30%
Total marine fisheries		164.9	187.6	207.4	+26%
3. Country total					
		753.5	774.0	793.9	+5%

Source: Fisheries Resource Survey System, DOF

Note: * Tentative figures

Table A.3

Seasonal price variations for hilsa, rohu and katla in Dhaka Wholesale Market

Tk per kg

Species	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Percentage difference (Highest month over lowest month)
Hilsa	1985	22	19	20	25	28	28	30	22	17	16	20	28	88%
	1986	30	29	27	31	35	41	36	32	20	19	23	29	116%
Rohu	1985	38	39	38	45	49	56	59	60	63	51	54	50	66%
	1986	52	54	51	55	61	66	61	68	69	70	68	71	39%
Katla	1985	28	32	28	38	39	39	43	43	45	46	46	40	64%
	1986	42	40	43	45	51	59	56	63	56	62	61	59	55%

Source: Directorate of Agricultural Marketing, Ministry of Agriculture

Table A.4

Price list for selected species

Tk/kg, whole fish

Local name	English name	Scientific name	Price
Freshwater species			
Rui	Rohu	<i>Labeo rohita</i>	38
Katal	Catla	<i>Catla catla</i>	34*
Mrigal	Mrigal	<i>Cirrhinus mrigala</i>	32
Silver Carp	Silver Carp	<i>Hypophthalmichthys molitrix</i>	20
Grass Carp	Grass Carp	<i>Ctenopharyngodon idella</i>	26
Kalibaush	Calbasu	<i>Labeo calbasu</i>	18 †
Hilsa	River Shad	<i>Hilsa ilisha</i>	22
Chited	—	<i>Notopterus chitala</i>	32*
Boal	Catfish	<i>Wallago attu</i>	28*
Aur	Aur	<i>Mystus aor</i>	28*
Puti	Puntius Carp	<i>Puntius</i> spp.	16
Chapila	—	<i>Gudusia chapra</i>	12
Foli	Featherback	<i>Notopterus notopterus</i>	20
Shol/Gazar	Snakehead	<i>Ophicephalus</i> spp.	22-24*
Marine species			
Poa	Croaker	<i>Pama pama</i>	16-20*
Rupchanda	Pomfret	<i>Pampus chinensis</i>	35-40*
Chhuri	Hairtail	<i>Trichiurus</i> spp.	14
Bhekti	Giant Sea Perch	<i>Lates calcarifer</i>	30
Kala Datina	Black Jewfish	<i>Johnius diacanthus</i>	24

Source: BFDC, October 1985.
Quoted from ADB (1987)

Notes: * Large sizes
† Small sizes

Table A.5**Indicative prices in international markets of frozen finfish exported from Bangladesh**

US\$ per kg

Species	Product form	Indicative price	Price reference and market area
White pomfret <i>Stomateus argenteus</i>	Whole, IQF, 300-500 g/piece	2.60	C&F Middle East
	Whole, IQF, 500 g/piece	3.15	C&F Europe
Black pomfret	Whole, IQF, 300/500-500/800 g/piece	1.35	C&F Malaysia
Hilsa <i>Hilsa ilisha</i>	Whole, IQF, 500-800 g/piece	0.85	C&F Malaysia
	Whole, IQF, 800-1000 g/piece	0.90	C&F Malaysia
Rohu <i>Labeo rohita</i>	Whole, IQF, 3 kg per piece	3.20	C&F Europe
Katla <i>Probarous jullieni</i>	Whole, IQF, 1.6 kg per piece	3.00	C&F Europe
Chital <i>Notopterus chitala</i>	Whole, IQF, 6 kg per piece	2.80	C&F Europe

Source: *Infofish Trade News*, 2 March 1987**Table A.6****Indicative prices of frozen shrimps and frogs' legs from Bangladesh in international markets (in US\$ per kg)**

(a) Headless marine shrimp, block frozen, C&F Japan

Count (i.e. number of pieces) per lb	Black tiger	White
8/12	15.80	15.00
13/15	14.80	14.00
16/20	13.30	13.00
21/25	11.40	11.50
26/30	10.20	10.50
31/35	9.10	9.30
36/40	8.20	8.60
41/50		7.90
51/60		5.60
61/70		4.60
71/90		3.50

(b) Freshwater shrimp, headless, block frozen, C&F Germany

Count per lb	Price
5	15.87
7	15.54
10	13.23
11/15	13.23
16/20	12.46

(c) Marine shrimp, peeled and undeveined (pud), block frozen C&F United Kingdom

Count per lb	Price
100/200	8.16
200/300	7.72
300/500	6.72
Broken	4.41

(d) Frogs' legs, ex-warehouse, New York, United States

Size	Price
Jumbo	6.94
Large	7.16
Medium	7.16
Small	6.94
Very small	6.39

Source: *Infofish Trade News*, 2 March 1987

Table A.7

Producers' share and marketing margins in fish sold in Dhaka and Pabna in 1981

	Dhaka			Pabna	
	Hilsa	Rohu	Shingi	Hilsa	Rohu
Distance of supplying areas (miles)	80-180	85-220	85-190	160-300	50-70
Average consumer price (Tk/kg)	14.2	26.7	33.0	16.6	30.7
Fishermen's share in consumer price	58%	60%	61%	51%	63%
Middlemen's share in consumer price	42%	40%	39%	49%	37%
<i>of which:</i>					
Expenses*	16%	12%	15%	24%	13%
Net income after expenses †	26%	28%	24%	25%	24%
Share of assembler (malik, mahajan)	35%	30%	16%	22%	14%
Share of distributor (bepari)	—	—	16%	20%	18%
Share of retailer	7%	10%	7%	7%	5%

Source: Ahmed (1983)

Notes: * Main expenses are, in order of importance, aratdars' commissions, transport, ice, personal expenses and portage
 † Remuneration to middlemen for their own labour and capital employed

Table A.8

Average marketing margins for marine fish sold in Chittagong and Cox's Bazaar

	Delivered to truck	Delivered to launch
Fishermen's share	60.1%	63.4%
Middlemen's share	39.9%	36.6%
Share of different middlemen:		
— Farias	9.2%	—
— Beparis	19.4%	25.3%
— Retailers	9.7%	9.7%
— Physical losses	1.6%	1.6%
Breakdown of middlemen's margin:		
— Marketing costs	22.2%	21.7%
— Physical losses	1.6%	1.6%
— Net income*	16.1%	13.3%

Source: Sabur and Rahman (1979)

Note: Net income = remuneration to middlemen for their time and capital employed

Table A.9

Tentative calculation of post-harvest qualitative losses in domestic fish marketing

Total catch for domestic consumption	760,000 tonnes
15% cured	114,000 tonnes
85% not cured	646,000 tonnes
Locally canned as fresh fish 50%	323,000 tonnes
Marketed outside immediate localities 50%	323,000 tonnes
of which:	
Hilsa 60%	193,800 tonnes
Other 40%	129,200 tonnes
Estimation of losses for year 1986:	
(1) Cured fish:	
Est. for 1981 (Ahmed 1983) — Tk 1,115 million x adjustment factor 0.75 (see text)	
x adjustment for cost of living index (1.67)	Tk 1,397 million
(2) Hilsa	
193,800 tonnes at retail price of Tk 35,000/tonne x 7% loss	Tk 475 million
(3) Other fish	
129,200 tonnes at retail price of Tk 40,000/tonne x 20% loss	Tk 1,034 million
Total losses per annum	Tk 2,906 million
Total in US\$ (at Tk 30.4 per US\$)	US\$ 96 million

APPENDIX B: LIST OF SCIENTIFIC, BANGLADESHI AND ENGLISH NAMES OF FISH, MOLLUSCS AND CRUSTACEANS

FISH

<i>Acanthopagrus datina</i>	Datina	Sea bream
<i>Actobatus narinari</i>	Narinari	Eagle ray
<i>Actomyelus nichofii</i>	Sankachil	Eagle ray
<i>Agyrops spinifer</i>	Lal datina	Red bream
<i>Alia coila</i>	Banspala, Kanjuli	
<i>Amblypharyngodon mola</i>	Mola	
<i>Anabas testudineus</i>	Koi	
<i>Anguilla nebulosa</i>	---	Eel
<i>Anadontostoma chacunda</i>	Koi puti	Shad
<i>Aristichthys nobilis</i>	---	Bighead carp
<i>Atrapus atrapus</i>	Kanwa	Torredo trevally
<i>Bagarius bagarius</i>	Baghair	
<i>Barbus sarana</i>	Swar puti	Barb
<i>Catla catla</i>	Katla	Catla
<i>Channa</i> spp. — see <i>Ophicephalus</i>		
<i>Charcharinhus melanopterus</i>	Kala hangor	Black finned shark
<i>Chirocentrus dorab</i>	Karti	Wolf herring
<i>Chorimemus</i> spp	Chapa	Green fish
<i>Cirrhina mrigala</i>	Mrigal	Mrigal
<i>Cirrhina molitorella</i>	---	Bottom carp
<i>Cirrhina reba</i>	Vagna	
<i>Clarius batrarchus</i>	Magur	Walking catfish
<i>Coilia dussumieri</i>	Alua, Kariali	Pointed tailed anchovy
<i>Ctenopharyngodon idella</i>	---	Grass carp
<i>Cynoglossus</i> spp.	Kokorajib	Tongue sole
<i>Cyprinus carpio</i>	---	Common carp
<i>Decapterus maruadsi</i>	Nilambari	Round scad
<i>Decapterus russelli</i>	Nilambari	Mackerel scad
<i>Dussumieri acuta</i>	Nailla	Shark
<i>Eleutheronema tetradactylus</i>	Tailya	Four threaded tassel fish
<i>Elops machnata</i>	Kundra	Lady fish
<i>Epinephalus lanceolatus</i>	Bole, Koral	Grouper
<i>Euthynnus affinis</i>	Bom maityya	Tuna
<i>Eutropichthys vacha</i>	Bacha	
<i>Gadusia chapra</i>	Chapila	
<i>Glossogobius giuris</i>	Bela	
<i>Harpodon nehereus</i>	Nihari lottya	Bombay duck, Lizzard fish
<i>Heteropneustes fossilis</i>	Shingri	
<i>Hilsa ilisha</i>	Ilish (Hilsa)	River shad, Hilsa
<i>Hilsa kanagurta</i>	Chandona	Sea shad
<i>Hilsa toli</i>	Chandan ilish	
<i>Himantura uarnak</i>	Haush, Sankush	Sting ray
<i>Hypophthalmichthys molitrix</i>	---	Silver carp
<i>Ilisha filigera</i>	Choukya	Jewelled shad
<i>Johnius (Otolithes) argentatus</i>	Lalpoa	Silver jewfish
<i>Johnius diacanthus</i>	Kala datina	Black jewfish
<i>Kurtus indicus</i>	Shangrai	Hump head
<i>Labeo calbasu</i>	Kalibaush	
<i>Labeo gonius</i>	Ghonia	
<i>Labeo nandina</i>	Nandail	
<i>Labeo rohita</i>	Rui, Rohi	Rohu
<i>Lactarius lactarius</i>	Shadha machh	White fish
<i>Lagocephalus</i> spp.	Photka	Blow fish
<i>Lates calcarifer</i>	Vetki, Koral	Sea bass, Cock-up, Giant sea perch, Barramundi
<i>Leiognathus equulus</i>	Tak chandra	Silver belly
<i>Leiognathus</i> spp.	Tak machh	Slip mouth
<i>Lobotis surinamensis</i>	Samudra koi	Triple tail
<i>Lutjanus johnii</i>	Ranga choukya	Red snapper
<i>Lutjanus malabaricus</i>	Ranga choukya	Red snapper
<i>Mastacembalus armatus</i>	Baim	
<i>Mastacembalus paneales</i>	Guchi baim	
<i>Megalaspis cordyla</i>	Kauwa	Hard tail
<i>Megalops cyprinoides</i>	---	Tarpon
<i>Mene maculata</i> Chan chandra Moon fish		
<i>Mugil</i> spp.	Bata, Parse	Mullets

<i>Muraenesox</i> spp.	Kamila, Kaila	Conger eel
<i>Mylopharyngodon piceus</i>	---	Black or Snail carp
<i>Mystus (Osteopagrus) aor</i>	Aur	
<i>Mystus vittatus</i>	Tangra	
<i>Nemipterus japonicus</i>	Rupban	Japanese threadfin bream
<i>Notopterus chitala</i>	Chital	
<i>Notopterus notopterus</i>	Foli	Featherback
<i>Ompok pabda</i>	Pabda	
<i>Ophicephalus</i> spp.	Gazar, Pipla, Taki	
<i>Ophicephalus (Channa) striatus</i>	Shoal	Snakehead fish, Murrel
<i>Otholithoides brunneus</i>	Lambu	Long jewfish
<i>Otholithoides microdon</i>	---	Jewfish
<i>Pama pama</i>	Poa	
<i>Pampus (Stromatues) argenteus</i>	Foli chanda	Silver pomfret
<i>Pampus chinensis</i>	Rup chanda	Chinese pomfret
<i>Pangasius pangasius</i>	Pangas	Catfish
<i>Paraplagusia</i> spp.	Kokorajib	Tongue sole
<i>Parastomateus niger</i>	Hail chanda	Brown pomfret
<i>Polynemus indicus</i>	Lakya	Indian salmon
<i>Polynemus paradiseus</i>	Topshi, Muni, Rissi	Long thread tassel fish
<i>Pomadasys hasta</i>	Shadha datina	White grunter
<i>Priacanthus</i> spp.	Pari	Saw fish
<i>Pristis</i> spp.	Aishya	Saw fish
<i>Psenes indicus</i>	Makkon chanda	Butterfish
<i>Psettodes erunei</i>	Samudra, Serboti	Indian halibut
<i>Puntius</i> spp.	Puti	Puntius carp
<i>Rastrelliger kanagunta</i>	Champa	Indian mackerel
<i>Recunda russellana</i>	Phatra	Smooth herring
<i>Rhinomugil sorsula</i>	Khorsula	
<i>Rita rita</i>	Rita	
<i>Rynchobatus diiddensis</i>	Pitambari	Skate
<i>Sardinella longiceps</i>	Takhya	Sardine
<i>Sarotherodon mossambica</i>	Tilapia	Tilapia
<i>Sarotherodon nilotica</i>	Nilotica	Tilapia
<i>Saurida undosquamis</i>	Achila	Lizard fish
<i>Scatophagus argus</i>	Chitra, Bishtara	Spade fish
<i>Scoliodon sarrakawah</i>	Hanga	Dog fish
<i>Scomberoides commersonianus</i>	Chapa	Queen fish
<i>Scomberomorus guttatum</i>	Maittya	Spanish mackerel
<i>Sillago domina</i>	Hundra tulordandi	Lady fish
<i>Silonia silondia</i>	Shilong	
<i>Sphyrna</i> spp.	Dharkuta	Barracuda
<i>Sphyrna blockii</i>	Moishja hanga	Hammerhead shark
<i>Tachysaurus</i> spp.	Gongra guizza	Sea catfish
<i>Therapon</i> spp.	Barguni, Girpai	Therapon, Perch
<i>Triacanthus brevirostris</i>	Sukura	Tripod fish
<i>Trichiurus</i> spp.	Chhuri	Ribbon fish
<i>Trichogaster pectoralis</i>	---	Sepat Siam, Siamese Gourami
<i>Upeneus sulphureus</i>	Sonali bata	Red mullet, goatfish
<i>Wallago atu</i>	Boal	Catfish
MOLLUSCS		
<i>Anadara granosa</i>		Blood clam, Cockle
<i>Crassostrea</i> spp.		Oyster
<i>Mytilus smaragdinus (viridis)</i>		Green mussel
CRUSTACEANS		
<i>Macrobrachium lancesteri</i>	---	Rice prawn
<i>Macrobrachium malcomsonii</i>	Chatka chingri	
<i>Macrobrachium rosenbergii</i>	Golda chingri	Giant freshwater prawn
<i>Metapenaeus affinis</i>	Hani chingri	Endeavour shrimp
<i>Metapenaeus brevicornis</i>	Kachu chingri	Short-horned shrimp, Brown shrimp
<i>Metapenaeus monoceros</i>	Hainna chingri	Sand or brown shrimp
<i>Parapenaeopsis stylifera</i>	Ruda chingri	

<i>Penaeus indicus</i>	Chapda chingri	Indian or white shrimp
<i>Penaeus japonicus</i>	Bagda chingri	Banded or Kuruma shrimp
<i>Penaeus merguensis</i>	Bara chingri	Banana or blue tail shrimp
<i>Penaeus monodon</i>	Bagda chingri	Giant tiger shrimp, Grass shrimp
<i>Penaeus penicillatus</i>	Baro chana	White shrimp
<i>Penaeus semisulcatus</i>	Bagda chingri	Red-legged shrimp

APPENDIX C: FUNCTIONS OF BFDC

1. To take measures for the development of fisheries and fishing industries.
2. To establish a fishing industry.
3. To establish units for capture of fish and promote a better organisation for exploitation of fish wealth.
4. To acquire, hold or dispose of fishing boats, fish carriers, road and river transports and all equipment and accessories necessary in connection with the development of a fishing industry.
5. To establish units for the preservation, processing, distribution and marketing of fish and fish products.
6. To advance loans to fish industries and to fishermen's co-operative societies.
7. To encourage establishment of fishermen's co-operative societies.
8. To undertake survey and investigation of the fish resources.
9. To establish, institute or make arrangements for training and research in the methods of catching, processing, transportation, preservation and marketing of fish.
10. To set-up an organisation for the export of fish and fish products.
11. To acquire, hold and dispose of such other properties as are required for carrying out all or any of the above mentioned purposes.
12. To formulate a scheme or schemes for carrying out all or any of the functions specified above.

Source: BFDC (?1986a)

APPENDIX D: PHYSICAL FACILITIES BELONGING TO BFDC

Name of the project	Address	Plant/Products	
1. FISH HARBOUR COMPLEX	CHITTAGONG	a) Block ice	30 tons
		b) Flake ice	50 tons
		c) Fish meal	4.5 tons
		d) Cold storage	105 tons
		e) Freezing plant	15 tons
		f) Warehouse	2
		g) Frozen storage	350 tons
		h) Ice storage	250 tons
		i) Marine workshop	1
		j) Slipway	1
		2. WHOLESALE FISH MARKET	COX's BAZAAR
b) Ice plant: flake block	5 tons 15 tons		
c) Ice and cold storage	20 + 10 tons		
d) Workshop	1		
3. FISH AND FISH BY-PRODUCT PROCESSING UNIT	COX's BAZAAR	a) Ice plant: flake	15 tons
		b) Freezing plant	2 tons
		c) Frozen storage	20 tons
		d) Fish meal grinder	1 ton
4. DEVELOPMENT AND MARKETING OF KARNAFULI RESERVOIR FISHES	RANGAMATI CHITTAGONG HILL TRACTS	a) Ice plant: block	15 tons
		b) Cold storage	10 tons
		c) Workshop	1
		d) Fish landing pontoon	5
5. MARKETING AND DISTRIBUTION OF FISHES	PAGLA, DHAKA	a) Ice plant: flake block	5 tons 30 tons
		b) Freezing plant	15 tons
		c) Frozen storage	500 tons
		d) Ice storage	200 tons
		e) Fish storage	200 tons
6. FISH PRESERVATION PLANT	MONGLA, KHULNA	a) Ice plant: block flake	35 tons 25 tons
		b) Frozen storage	500 tons
		c) Ice storage: flake block	75 tons 105 tons
		d) Iced fish storage	200 tons
		e) Blast Freezer	12 tons
7. NET FACTORY	COMILLA, MONGLA, CHITTAGONG	a) Comilla	6 looms
		b) Mongla	6 looms
		c) Chittagong	6 looms
8. MARKETING CENTRE	PATHARGHATA	a) Cold storage	30 tons
		b) Block ice plant	15 tons
		c) Fish landing jetty	1
		d) Workshop	1
9. MARKETING CENTRE	KHEPUPARA	a) Block ice plant	15 tons
		b) Cold storage	30 tons
		c) Fish landing jetty	1
		d) Workshop	1
10. WHOLESALE FISH MARKET	RAJSHAHI	a) Block ice	5 tons
		b) Cold storage	10 tons
11. WHOLESALE FISH MARKET	KHULNA	a) Fish storage	10 tons
		b) Auction hall	1
		c) Fish landing pontoon	1
12. MECHANISATION OF COUNTRY FISHING BOATS	BARISAL	a) Workshop	1
13. TRAWLER PROJECT	CHITTAGONG	a) Fishing trawler	5

Source: BFDC

