POST-HARVEST FISHERIES OVERVIEW

SRI LANKA

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POST-HARVEST FISHERIES OVERVIEW OF SRI LANKA

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

This information bulletin was produced by the Department For International Development's Bay of Bengal Post-Harvest Fisheries Project (DFID-PHFP), prepared by R J Campbell of Integrated Marine Management Ltd., UK.. and updated by the project's partner organisations and local staff.

This Overview Study provides a working document and framework which will serve as a planning toot and reference for directing interventions at specific problems by organisations active in the post-harvest fisheries sector. The Overview will have application to policy-makers, government and non-government organisations, private sector and other agencies and informs them of the constraints and options within this sector. This bulletin will be periodically updated. as more information becomes available, to enhance its accurancy.

The Project is working with small—scale artisanal fishing communities to reduce post-harvest losses of fish by developing low-cost improvements in handling, processing and marketing and providing technical support, advice and training to government and non-government organisations, fisherfolk associations and wonien's groups. The Project is funded by the Govemment of the United Kingdom and covers three countries within the Bay of Bengal region, namely India, Bangladesh and Sri Lanka.

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ABBREVIATIONS AND ACRONYMS

ADB	–	Asian Development Bank
AIGOs	–	Alternative Income-Generating Opportunities
BOBP	–	Bay of Bengal Programme
CFC	–	Ceylon Fisheries Corporation
CFHC		Ceylon Fishery Harbours Corporation
DFAR	–	Department of Fisheries and Aquatic Resources
DFID	–	Department for international Development (UK) formerly the ODA (Overseas Development Administration)
EC		European Community
EDB	–	Export Development Board
EU		European Union
GSSC		Grassroots Support Service Centre (formerly IRED)
tIED	–	International Institute for Environment and Development
IRED	–	Development Innovations and Networks
LMRB		Lanka Market Research Bureau
MT	–	metric tonnes
NARA		National Aquatic Resources Agency
NDB		National Development Bank
NGOs	–	Non-Governmental Organisations
ODA	–	Overseas Development Administration
Rs	–	Sri Lankan rupees
SAFCOL	–	South Australian Fishermen's Co-operative Ltd.
SMIL		Small and Medium Industrial Loans Scheme

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1. INTRODUCTION AND REPORT STRUCTURE

1.1 INTRODUCTION

1.1. I Background to the Project

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

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

The Project focusses on working with small-scale fishing communities in the marine artisanal fisheries sector. These communities traditionally suffer from natural disasters. environmental degradation, over-fishing and population pressures. Climatic changes and rising sea levels associated with global warming will also lead to an increasing instability in the coastal areas. Fishery capture and production-oriented practices have been instrumental in placing more strain on the common pool of resources in the sea. Therefore. it is essential that the use of these resources is sustainably managed and the usage of such resources maximised. The Project has worked towards this aim through improving the efficiency of post-harvest handling, processing and marketing of sustainably produced products. However. the Project has always taken a much broader approach in working with coastal communities, addressing issues that affect their lives. and has, thus, been working towards sustainable livelihood strategies.

The Project has always followed a process approach through developing, demonstrating and promoting new techniques. technologies or ideas to help improve the condition of small-scale fisherfolk communities. The Project has limited its fieldwork to the areas where post-harvest practices were considered particular priorities by the member states at that time. that is in India. Bangladesh and Sri Lanka. In India, only the east coast states were involved. The approach adopted by the Project has been tlexible. reactive and catalytic. *Flexible* in the sense that it was very openly defined at the design stage, allowing the Project to adopt a process approach to activity planning. The Project had the scope to identify, design and appraise a series of sub-projects within a broad Project framework. Reactive in that its function was to respond to the needs of the coastal communities, or to the needs expressed by other agencies as and when post-harvest problems became apparent. *Catalytic* in that the Project aimed to find solutions to problems, develop methodologies for resolving them, and then to mobilise local institutions to carry out the implementation and dissemination of ideas. The Project then took the essential lessons and methodologies from the localised situation and made them regionally available. In that way, the benefits from the Project's activities could reach a wider audience across the region.

The Project started in 1987, and is currently in its Third Phase, which will finish by March 3 1, 1998. The Project always worked on the principle that it was at best a temporary mechanism to raise awareness on post-harvest, but ultimately the local institutions will have to take on the role of the Project. The Project has operated over a large geographical area in trying to address a wide diversity of development problems. An important element of the Project has been the strong partnerships formed between the Project, other donor projects. government departments and non-government organisations in the three countries. Government staff have played a vital role in identifying key problem areas to be addressed and in facilitating the evolution of solutions.

The partnerships with NGOs have also been crucial to the Project's success and they have provided a vital mechanism for close interaction with the communities, especially those NGOs which have their origins in the fishing communities themselves. The Project has placed considerable emphasis in recent years on forging strong partnerships between NGOs and Government and this is seen as an important function

for the sustainability of work with coastal communities once the Project closes.

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

— To provide a working document which will serve as a planning tool and as a reference for directing interventions at key problems in the post-harvest subsector.

— To assist in disseminating outputs to those institutions that can most effectively use them.

— To be of benefit as a planning tool to other organisations active in the post-harvest fisheries sector in the region.

The report has taken as wide a perspective of the post-harvest sub-sector as possible. not limiting its concerns to those areas within the specific mandate of the Project. This would enable all post-harvest issues to be addressed and has allowed the Project to support a wider process of development through other institutions within the post-harvest sub-sector.

1.1.2 The scope of the overview

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

1.1.3 The intended audience of the overview

The Overview will he distributed as widely within the industry as possible. at the government, private sector. NGO and community organisation levels.

1.2 THE STRUCTURE OF THE OVERVIEW

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

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

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

The Overview is. thus, arranged in three distinct sections related to:

- Demand

. Supply

Transformation

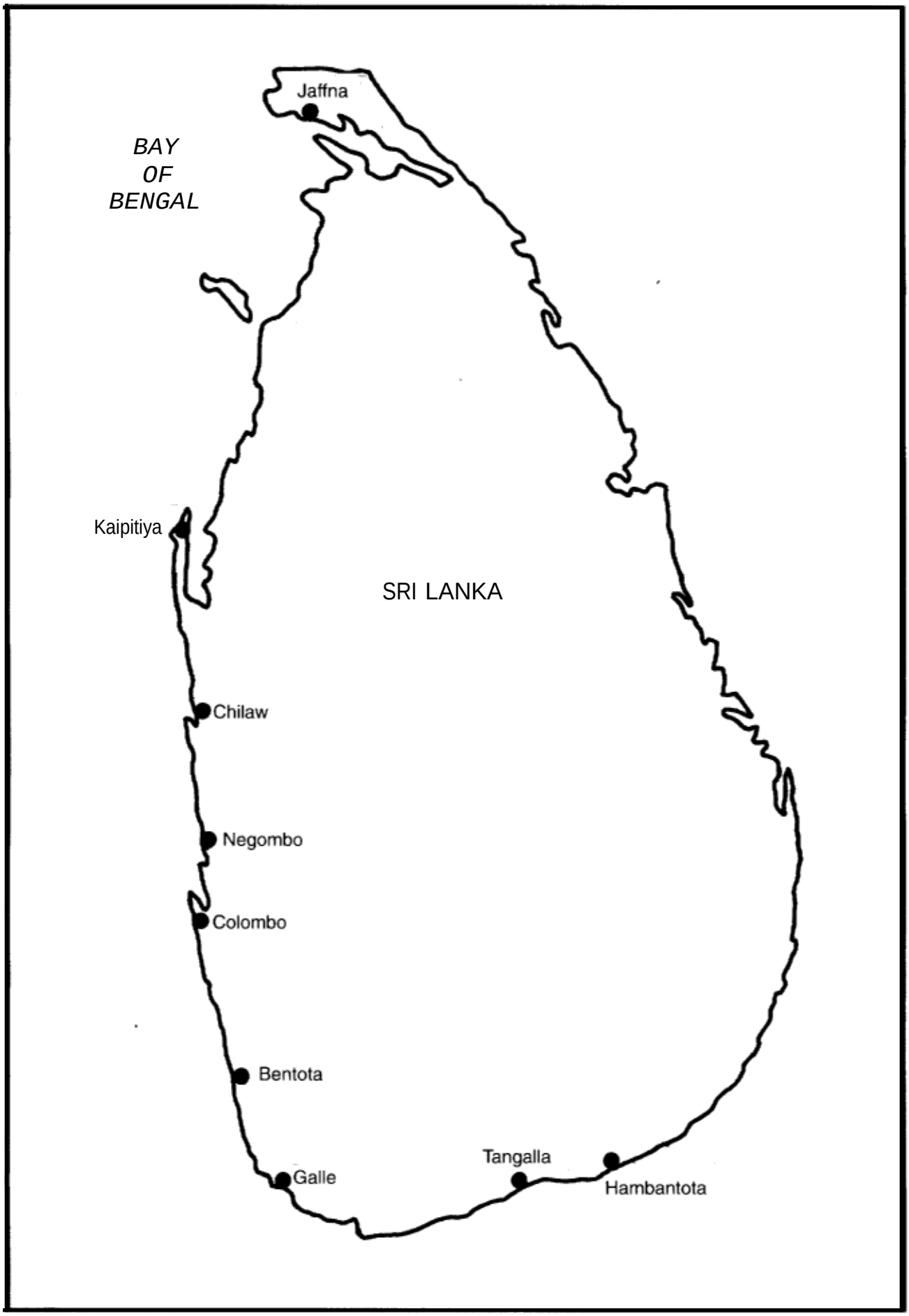
Each of these sections considers the characteristics. source and factors affecting

-- the key problem areas associated with each;

— current interventions in the sector; and

— any further action which is immediately apparent.

MAP OF SRI LANKA



2. FISHERIES AND THE ECONOMY

2.1 SRI LANKAN FISHERIES

Sri Lanka's land area is 64,000 sq km and its sea area is roughly 23 times the land area. It comprises a territorial sea extending upto 12 - 24 nautical miles and an exclusive economic zone extending upto 200 miles from the shore, covering an area of approximately 230,000 sq km, The coastline, 1800 km long, comprises a vast range of marine habitats, i.e., sandy beachs, extensive lagoons, mangroves and coastal marshes. Over SO per cent of the population resides in the coastal areas of the country.

The fisheries sector contributes about 2% of the Gross Domestic Product of Sri Lanka, but its main importance lies in its contribution to employment, domestic food security and foreign exchange earnings. It is estimated that the total number of fishermen employed by the sector is over 120,000, for 93% of whom fishing is the main or sole source of income. In addition, there are many people engaged in fish processing and distribution about whom very little is known.

According to the Food Balance Sheet of the Department of Census and Statistics in 1989, fish makes up 65% of all animal protein consumed and 13% of the total protein intake. The present per capita consumption of fish is about 16 kg. This not only constitutes a secure source of locally available protein for the population, but also a source of protein which is nutritionally very beneficial for the consumer.

Since 1950, the fisheries sector has undergone a transformation from entirely artisanal to more semi-industrial fisheries as a consequence of motorisation of traditional craft and the introduction of mechanised craft capable of long voyages. It is estimated that there are 28.000 craft (15,000 motorised craft) which bring in a yearly marine catch of 220,900 tonnes (1995). There was. however a decline in production when conflict erupted in the northern and eastern parts of the country in 1983. This resulted in overfishing along the northwestern coast off the districts of Negombo and Chilaw. A major proportion of the catches by the marine sector is from the continental shelf. An increasing need for better fisheries management will be dealt with in more detail later in this section.

Exports of fish products steadily rose to a peak of Rs I, 137 million in 1989 (3.56% of total export eamings) and then declined to Rs 855 million in 1991, mainly due to the security problems in the country. The potential for expansion in exports is considerable.

The sector contributes significantly to the health. wealth and development of the country.

2.2 THE POST-HARVEST SUB-SECTOR IN SRI LANKAN FISHERIES

The post-harvest sub-sector of fisheries covers those activities from the time the fish caught is taken on board until it reaches the consumer. It is. thus. a major segment of the total activity of the sector as a whole.

Post-harvest activities can be considered under three headings:

- Demand
- Supply
- Transformation

There are a large number of institutions involved in the Post Harvest sub-sector in Sri Lanka.

The government agencies involved in the post-harvest sub-sector are many. By far the most important agency is the Department of Fisheries and Aquatic Resources (DFAR). Through a large network of primary co-operatives, the DFAR is in a position to extend management- and technology-related information to almost all villages along the Sri Lankan coast. The extension of ice boxes for use by cycle traders and operators of 18-22 foot craft was through the co-operative network. One of the advantages of this strategy has been that reaching out to the community, dissemination of information, and gaining access to state financial resources was relatively easy. The problem is that some of the co-operatives are not very active and at these locations extension activities are seldom undertaken.

The National Institute of Fisheries Training conducts training courses to educate fishermen and fisheries officials. This institute has centres at Negombo, Tangalla, Batticaloa, Jaffna and Trincomalee.

The other large agency is the Ceylon Fisheries Corporation. Established in 1964, the Corporation was set up to ensure fishermen got the highest prices for fish they landed and the consumer obtained good quality fish at a reasonable cost. The Corporation established a series of purchasing centres at various points along the coast, ice plants, transportation networks and retail outlets. However, with changes in government policy and liberalisation of the economy, a large segment of the Corporation's assets, mainly ice plants and certain landing facilities, have been given on lease to private parties. The Corporation has, nevertheless, managed to retain some presence in the retailing of fish.

The Ceylon Fishery Harbours Corporation (CFHC) provides infrastructure facilities for the fisheries sector. This includes construction and maintenance of fishery harbours and anchorages.

The National Aquatic Resources Research and Development Agency (NARA) was established in 198 1 to provide research and development inputs for the development of the fisheries sector in the country. The agency has a post-harvest division which caters to the requirements of the government and private sectors. Research activities include assessment of fish resources, development of fisheries products, culture of ornamental fish and oceanograpic studies.

The National Development Bank (NDB) is the primary source of funding. Funding from multilateral banks, such as the World Bank, International Monetary Fund and Asian Development Bank (ADB). are routed through the NDB. Among the multilateral banks. the ADB is the biggest source of funding. For artisanal fisherfolk, funding is provided under the Small and Medium Industrial Loans scheme (SMIL). The ADB Sri Lanka Fisheries Sector Community Development Project seeks to open up alternate sources of income for fisherfolk. Ice boxes for cycle traders have been provided under this Project. Funds from the NDB are generally routed through commercial banks.

The Bank of Ceylon, People's Bank and Hatton National Bank are some of the commercial banks who have come forward to provide loans to fishermen and cycle traders for the procurement of ice boxes. These banks have similar criteria for deciding the provision of funds and have a fairly long history of interventions in the fisheries sector.

The Hambantota Integrated Rural Development Project funded by the Norwegian bilateral aid agency NORAD, has been undertaking development activities amongst artisanal fisherfolk in Hambantota district. The activities undertaken include provision of houses for fishing families. provision of craft and gear, technical training programmes, funds for fishermen's co-ops and provision of bicycles and motorcycles.

A Fisheries Management Project funded by the United Nations Development Programme has been operational in the country for the last few years. The Project seeks to establish a system of stock management of marine resources. To this end. it recently completed a fisheries census. The Project has also conducted a study of craft and gear combinations used along the coasts of Sri Lanka.

Amongst non-governmental organisations, Grassroots Support Service Centre (GSSC). is one organisation with considerable experience of working among artisanal fishing communities. Formerly known as IRED, GSSC has helped the Project organise the cycle traders who operate out of St John's Fish Market, Colombo. During the course of its interaction with the Project. GSSC has acquired the skills to impart training in community organisation and participatory appraisal.

3. DEMAND FOR FISHERIES PRODUCTS

3.1 DEMAND CHARACTERISTICS

The characteristics of the demand for seafood can be looked at in terms of:

- Quantities demanded.
- Species demanded.
- Quality.
- Demand variability.

3.1.1 Current quantitative demand

The total demand for fish and fisheries products in Sri Lanka is unknown. The Department of Fisheries and Aquatic Resources has, however, estimated total demand at 313,654 mt, although this will clearly depend on the price of the product relative to available alternatives, It is accepted by all concerned that supply has always fallen short of demand.

Most of the fish is consumed in a fresh condition. Fish that is landed in a spoilt condition is usually turned into cured products. This, however, does not meet demand. Consequently shortfalls are met through imports, principally from Thailand, the Maldives and India. (More details in section 4.2.)

Fish and fisheries products are in high demand, judging by the quantities consumed, prices which consumers are willing to pay, and the speed with which the product is sold. Fish is considered highly as a source of animal protein by all sections of the community.

The current population stands at over 18 million. Fish consumption is in the order of 16 kg/person/year, giving a current consumption of around 270,000 mt.

3.1.2 Species composition of demand

Traditionally, the demand for fish has focussed on those species readily available locally. This was mainly the inshore species. When pelagics became available, they were in high demand, although the majority of the population traditionally ate demersals from inshore fisheries or dried fish from overseas.

The expansion of fishing technology and the growth in demand has allowed the greater exploitation of offshore pelagics and these have increased significantly in popularity. Although preferences exist, most species of fish landed find a market, except perhaps jellyfish.

In the higher income brackets, particularly in Colombo, seer, prawns and bloodfish (tunas) are the preferred types. In the areas south of Colombo, there is a marked preference for bloodfish. In the areas north of Colombo, bloodfish are not generally preferred. In the Mannar and Jaffna Districts, the preference is for rock fish and shark.

3.1.3 Quality considerations in demand

Traditionally, the demand for fish was governed by the limitations of the transformation system. In the past, a lack of ice and good transport made dried fish the only option for the rural communities. The main urban centres, however, have always tended to prefer fresh fish. As early as the beginning of this century ice was used in Sri Lanka for the preservation of fish. The development of the train and road system combined with the growth of ice plants meant that good quality fish could be distributed more widely and was available in Colombo even when the fishermen migrated north during the Southwest Monsoon.

The variation in demand for quality in the market is not pronounced, although there is a price premium paid for the higher quality product. This manifests itself at the landing sites by fish being graded by quality and the price being agreed accordingly. The mixing of good and poor quality fish in one sale lot, for instance, depresses the price. The landings of purse-seine-caught sardines in the south of Sri Lanka receive higher prices than the lower quality gillnet-caught fish.

The degree to which quality preferences influence demand at the consumer level is poorly understood. Amongst the poorer consumers, quality is probably a much less important consideration than price. Amongst wealthier consumers, there is a preference for quality-as demonstrated by the high prices paid for well-presented fish in shops and supermarkets in Colombo.

3.1.4 Variability in demand

Fish is consumed all the year round by all groups and there is no record of seasonal fluctuations in demand. The extent to which the seasonal availability of other sources of protein, or the occurrence of religious festivities, affects demand is also undocumented, although this may well occur.

3.2 SOURCES OF DEMAND

The composition and characteristics of demand vary between different groups of consumers. Understanding

these groups and how they differ is called demand segmentation.

3.2.1 Demand segmentation

In trying to define segments of the Sri Lankan fish market, it is necessary to define groups which have sufficiently significant differences in their demand characteristics. But to be meaningful, members of each segment have to be sufficiently similar in their demand characteristics to allow generalisation.

The segmentation of demand in Sri Lanka is dependent to a large extent on income distribution. This does, however, relate in the main to the segmentation of customers (i.e., those who buy the fish) rather than segmentation of consumers. The buying patterns of the customers are ultimately influenced by the demands of the consumers they serve.

The method of segmentation is also dependent, to some degree, on whose perspectives the segmentation is carried out. In this case, our primary concern is for the small-scale traders and thus our segmentation should reflect that group. Segmentation of demand should not, however, reflect only those segments of the market supplied by the small-scale trader; rather, it should reflect those segments which influence their operations.

The segments which appear most obvious are:

- Rural customers
- Urban customers
- Estate customers
- Subsistence /part-time fishermen
- Institutional customers
- Industrial
- Export

The first three are the main customers of the small-scale traders. The last three are the target of larger-scale traders who compete directly with the small-scale traders for the available supply of fish in the market. The subsistence fishermen are sometimes buyers from the small-scale traders and sometimes competitors. The last three segments are also, in the main, more distant from their consumers than the first four and represent large, widely defined, groups of consumers. Those consumers are, however, sufficiently displaced from the market which the small-scale trader uses to justify being grouped together in segments.

The characteristics of the different segments are not well-documented and the points discussed below under each of the headings are very speculative. Karunanayake (1988) presents data computed from the 198 l/82 Consumer Finances and Socioeconomic Survey of the Central Bank on fish consumption of the rural, urban and estate segments. This is shown in Table 1 (Appendix 2).

3.2.2 Urban

2 1% of the population of Sri Lanka live in urban centres. This category is a wide income group, which may have a wide range of quality, species and quantity needs. They are united, however, by their close proximity to one another, their predominance in Colombo and the high level of marine fresh fish consumed in their households (see Table 1). There is a high incidence of women in urban homes who go out to work. This reduces the time available for shopping and thus increases the dependence on regular supplies from vendors.

A study by the Lanka Market Research Bureau (LMRB) divided urban consumers in Colombo into three categories. The poor, who were classified as those who earned Rs 1500 and below, the middle class being those earning between Rs 3000 and Rs 4.500, and the rich being those who earned Rs 6000 and above a month. The results of the study show that fish is the preferred source of animal protein by all three sections. However, species and quality varied across classes. The poor usually consumed small pelagic species of indifferent quality at least three times a week. The middle income consumed small pelagics on most days of the week, while preferred species such as tuna and seer were consumed on festive occasions. Another difference between the poor and middle classes was that the latter placed greater emphasis on quality when making a purchase decision. The rich went in for preferred species like tuna. seer and prawns on a daily basis. They were also particular about quality, presentation and the ambience in which the fish was marketed. Small-scale traders often cater to the needs of the first two categories, often providing fish on credit. Since they do possess freezers, they tend to purchase fish in small quantities on a daily basis. On rare occasions when small-scale traders meet requirements of high-income households, they purchase relatively large quantities of high-value species at prices which they (the urban consumer) consider low.

67% of the active workforce in urban centres are engaged as regular employees and 2.5% are self-employed. Regularity of income in urban homes may. thus. have implications for debt relationships with vendors. The urban sector spends about 40% of the family budget on food, of which 12.2% goes on fish. Its calorific intake from meat and fish constitutes about 6.3% of total intake.

The degree of urban electrification is much higher than in the rural environment and the ownership of refrigerators amongst urban dwellers is likely to influence the purchasing patterns of this group.

3.2.3 Rural

Rural customers are widely dispersed. are less exposed to strangers and, thus, have different expectations of the people with whom they deal. They tend towards closer and longer-term trading links. They are also likely to experience different, and possibly less stable. income sources when compared with urban customers, particularly as only 50% of the active workforce are employees and 35% are self-employed. The rural sector eats a higher proportion of freshwater fish and more dried fish than both the urban and estate consumers. Their consumption of fish is less than urban consumers but much higher than estate workers. The rural sector has lower average wages than the urban sector but spends a greater proportion of its income on food (56%) than the urban sector. Of the family food budget, approximately 9.2% goes on fish. The calorific intake from meat and fish constitutes about 3.1% of total intake.

3.2.4 Estate

The estate market is rural and predominantly wage labour (97%). There is a lower variation in the wage structure, with most earnings falling within a fairly narrow band. The estate consumer eats very little fresh fish. relying much more on both the dried and tinned product. Estate workers spend a very high proportion (68%) of their income on food. Of the food budget. 5.2% goes on fish. The calorific intake from meat and fish constitutes about 2.4% of total intake.

3.2.5 Subsistence/part-time fishermen

Subsistence or part-time fishermen are a segment of the market which has very low demand. In the main, the subsistence fisherman will provide for his family's needs and thus will represent a lost opportunity to the trader. At some times of the year or month, they may need to buy fish and thus provide an opportunity for the trader. At other times. they may have a surplus to sell and thus compete directly with the trader. They therefore represent a level of uncertainty in the marketplace.

3.2.6 Institutional

Institutional fish-buyers include:

- The Army
- The Navy
- . The Police
- Prisons
- Harbour authorities
- Hospitals
- Hotels/restaurants

They tend to be in urban areas and buy large quantities at one time. They generally fall outside the market of the small-scale trader, but could have a very significant impact on the trader by affecting overall demand and. thus, the availability and price of fish which the small-scale trader may wish to access.

3.2.7 Industrial'

There is limited industrial use of fish in Sri Lanka and this probably has only a very limited and localised effect. In the past, there was a commercial cannery and a fishmeal plant. There is now only a small cannery supplying part of the domestic market with value-added products. There are also small operations making fish sausages, fish fingers and fish fillets, but these do not constitute a large area of product demand.

3.2.8 Export

The demand for fish for export is increasing. This is an area where there is considerable pressure from Government for expansion and this has the potential to remove supplies from the domestic market. The stature of the Sri Lankan exporters in the international markets has grown, with markets being opened in Japan and West Asia.

3.3 FACTORS AFFECTING DEMAND

There are a wide range of factors which can affect demand. including:

- Macro-economic policies
- Sectoral policy and legislation
- Environmental factors/health concerns
- Micro-economic factors
- Institutional influences
- Political influences
- Technological influences
- Social, cultural and demographic factors

These are outlined below.

3.3.1 Macro-economic policies

Demand is. in large part, determined by income levels. population and fish price. The macro-economy can influence all of these areas. Sri Lanka's recent macro-economic policies have been focussed, in part, towards

correcting large fiscal imbalances and promoting the development of the private sector. Fiscal measures may influence disposable incomes and redistribute wealth. Recent changes in personal income tax (lowering the maximum tax rate to 35% and increasing the tax-free threshold) have doubtless increased disposable incomes for those employed within the formal sector. This will particularly affect the urban demand segment. Furthermore, improved social safety nets for the poorest members of society may also have increased demand from those groups.

Changes in taxes on fuel (petrol and diesel) or other transport-related inputs have doubtless also affected the cost of distributing products. although how this has affected price is unknown. Recent cuts in government budgets may affect fish consumption promotion programmes and retrenchment of government staff may reduce urban demand amongst the employed. Whilst these fiscal changes are well-documented, the effect of these factors on fish demand are not well-known in Sri Lanka.

Monetary policies have also been applied to the economy. These have been particularly concerned with reducing the availability of credit and this may have affected consumer investment in domestic freezers or reduced expenditure on food. Both may have affected demand.

Unemployment within the economy stands at about 15.5% of the workforce. The levels of unemployment are similar in rural and urban environments, but lower in the estate sector. One of the reasons for recent increases in unemployment is an expansion of the workforce due to more women taking up paid employment to supplement family incomes. This has probably had a substantial impact on the distribution of income between households, with some becoming wealthier and other becoming poorer. Increased unemployment may not necessarily reduce demand for fish, but it will certainly change the structure of demand.

The liberalisation of trade policy has had a significant influence on export trade as discussed below.

3.3.2 Sectoral policy and legislation

The Government actively promotes the consumption and export of fish. The National Fisheries Development Plan identities increased consumption of fish as important for the improved nutritional status of the population, increased employment, improved incomes of producers, and for generating export earnings. The consumption of fish is promoted through radio broadcasts. teaching in schools and through publications.

In the case of export earnings, Government has produced an export development plan to promote exports. This includes a wide range of support and financial incentives.

The reduction or elimination of taxes on exports of fish products and the provision of export incentives and foreign investment incentives in this industry are aimed at promoting increased export demand for Sri Lankan products by reducing export prices and increasing quality. Whilst increasing the attractiveness of exports, this has also reduced the availability of fish, albeit to a limited degree, on the domestic market and, thus, increased prices to consumers. This is further strengthened by a policy of limiting import of fresh fish through high import duties. Duties on tinned and dried products are, however. not so restrictive.

The restriction of imports has the potential to benefit the producer who can achieve good prices due to the high demand. The high consumer prices tend not, however. to be reflected in the prices paid to the producers to the extent that Government would wish. The price differentials between producer and consumer are distributed through the marketing chain and probably reflect reasonably the perceived transaction costs at each level.

Policies in support of the private sector and liberalisation of the economy since the late 1970s have improved the commercial performance of the sector and encouraged diversification of investment and commercial activity. Increased competition within the sector has also probably improved efficiency within the sector. This may well have reduced costs and encouraged demand.

3.3.3 Environment

At present there are no clearly apparent environmental factors affecting demand. This may change. however, as increased awareness of environmental pollution, habitat destruction and resource depletion influence demand both domestically and in export markets. Sri Lanka has a reputation for high quality products and every effort should be made to promote this quality in the future.

The European Community (EC) import regulations in relation to fish products may pose a threat to some exporting companies. but the Export Development Board. NARA and the Sri Lankan Standards Institutes are taking steps to ensure that local industries exceed these standards.

Fish is perceived as a healthy component of the diet. This perception is liable to increase as people become more educated and health-conscious. It is also likely that demand for improved quality in handling and preservation will also increase. The effect of this may, however, be countered by an ever-increasing gap between supply and demand caused by population increases.

3.3.4 Micro-economic factors

Although population size, fish price and income are the most important factors governing demand, the availability of alternative competitive supplies also plays a role.

Alternatives include poultry, beef. pork, mutton and vegetable protein. The attractiveness of each differs between social and economic groups and is in part determined by religious preference, income levels and location. The interaction of fish with other sources has been little studied.

3.3.5 Institutional influences

Institutional problems affecting demand are few. With the rising cost of fish, however, institutions find it more difficult to access sufficient produce within the constraints of their budgets. Among institutional sources of demand, the armed forces have emerged as the biggest source. With the expansion of the armed forces in response to the security situation that prevails in the country, the demand for fish by this segment has expanded considerably. This in many instances affects availability of fish, especially for the small traders, particularly when large-scale procurements are made on behalf of the armed forces.

3.3.6 Political influences

The current security situation, whilst not affecting overall demand, may have an effect on a change of location of demand with the increase in displaced persons in the west of the country and increased armed forces in the north.

3.3.7 Technological influences

The major technological influence on demand is that of electrification. The use of refrigerators in the home and local stores has increased. This has affected the distribution. It has probably also changed the market perception of the frozen product and increased its acceptability. It may have affected the frequency of purchase too.

3.3.8 Social, cultural and demographic factors

The rising population will be a major factor affecting demand in the future. Population growth rates are Projected to fall from 1992 onwards.

Assuming a 1 .0% growth rate in population. demand for fish will continue to rise at a similar level unless there is a radical change in consumer preference, particularly for alternatives.

There does not appear to be any major shift in the religious or wealth strata in society that would affect the structure of demand in the short-term.

The composition of the population by religious affiliation and ethnicity in 198 1 is shown in Table 4. The religious factors affecting demand are little understood. One of the few studies which touches on this is that of Fernando (1984) .

The standards of education in Sri Lanka are high for the region and internationally as well, as shown in Table 5. This will tend to encourage increased demand for fish as the awareness of the nutritional benefits become more accepted by the population. Rural electrification is also increasing access to television which will also lead to increased health and nutrition awareness. Newspapers are also widely available and read.

3.4 KEY PROBLEM AREAS

There are several key problem areas associated with demand.

3.4.1 Lack of information

Perhaps the most pervasive problem area concerned with the demand-side of the post-harvest sub-sector is the lack of information, either about demand or how changes in demand affect participants within the sector. This lack of information is of particular significance to the small-scale trader and processor. His role in the sub-sector appears particularly susceptible to changes in demand which may, in turn, affect the price and availability of product. As these participants appear to have limited scope for flexibility. they are particularly vulnerable to any demand-driven redistribution of access to the benefits from the sub-sector.

3.4.2 Increasing consumer prices

Another important problem is that demand is increasing relative to supply and high consumer prices are being maintained or increased. This means that the availability of produce at a reasonable price, particularly for the poorer consumer, is likely to be reduced

in the future, unless production increase is accelerated at a greater rate than the combined population and export growth rates. As prices rise, government institutions too will find it difficult to justify fish purchases within their limited budgets.

3.4.3 Export demand quality

The key problem area facing demand from the export sector will be quality perceptions and compliance with ever more stringent overseas import requirements. Rising prices on the domestic market will also encourage export demand to look towards cheaper sources elsewhere.

3.5 CURRENT INTERVENTION

Current intervention takes the form of promotion of demand and understanding demand. These are discussed below according to the type of intervention:

3.5.1 Non-Governmental sector

There is very little NGO involvement in the promotion or changing of demand. There is. however, some involvement from the Post-Harvest Fisheries Project in understanding the characteristics of demand for its intervention with the cycle traders. In the past, some market analysis has been carried out the MARGA Institute through a regional Project sponsored by the International Development Research Centre of Canada.

3.5.2 Private sector

The benefits to be derived from increasing the demand for domestically produced fish are few, given the current high demand levels. As a consequence, there is little commercial involvement in the promotion of fresh fish per se. There is benefit to be had. however, from the promotion of speciality products such as high quality products, highly processed products and imports, where additional margins have to be achieved to cover additional processing or import costs. There are benefits to be derived from promoting exports, and the private sector is active in this area.

There are several private sector marketing organisations who have been involved in assessing market demand for fisheries produce including the Lanka Market Research Bureau (LMRB) which carried out some studies for the Project.

3.5.3 Government

Government (see section 5.5.3 for a discussion on the different government departments involved) actively promotes the demand for fish as part of its campaign for improved nutritional standards. It has also attempted to sustain the demand of the poorer communities and institutions by providing cheaper supplies of fish through the Ceylon Fisheries Corporation (CFC).

Government also promotes exports through the Ministry of Fisheries and Aquatic Resources and the Export Development Board (EDB). It has a range of export promotion centres within its overseas representative agencies. The EDB actively promotes demand for Sri Lankan fisheries products through international trade fairs and through its publications.

NARA has also carried out some wider market research and has done some research on the potential demand for value-added products.

The Sri Lankan Institute of Standards aims to ensure that export demand standards are maintained to comply with international import regulations.

3.6 FURTHER ACTION

There is clearly a need to understand the current structure of demand, the factors causing demand change, and how changes in demand may be used for the benefit of the small-scale producer and distributor. There is also a need to more fully understand the potential demand for highly processed value-added products for the domestic market. It may be possible to make such products from low-value species at the village level (e.g., as *jaadi** or as the high value anchovy product made in South India). There are currently some aquatic resources products which are not used to any great extent, such as seaweed products. There is a need for improved consumer awareness of the potential of such products.

The quality of fish on the market is a reflection of demand. At present there appears to be only limited consumer awareness of the loss of quality experienced by the fish due to poor handling practices through the many phases of its distribution. There is a need to improve this consumer-awareness if the health and hygiene standards are to be raised.

The changing, and ever more strict, requirements of the export trade need to be closely monitored and translated into practical action so that suppliers can sustain and expand the demand for Sri Lankan products.

* A pickled fish

4. SUPPLY OF FISHERIES PRODUCTS

4.1 SUPPLY CHARACTERISTICS

The supply of fish can be characterised by the following:

- Availability of fish.
- Species composition of supply.
- Quality of supply.
- Variability of supply.

These are discussed below.

4.1.1 Availability of fish

The total supply of fish to the Sri Lankan market in 1997 was 2 11,520 mt (wet weight equivalent). Over 90% of the total supply was from the marine sector.

Changes in the quantity of fish caught locally over recent years is shown in Table 7. The figures of production are estimates based on sample surveys. They are not the result of a regular programme of monitoring landings.

4.1.2 Species composition of supply

The main groups of fish which make up the supply in Sri Lanka are shown in Table 8 with English, Latin and Sinhalese names provided. The estimated relative quantities of each variety of fish is shown in Table 9. Since the 1950's, changes in catch technology have had an impact on supply. In the past, when shore seines contributed a major proportion of the landings, small pelagics dominated. However, with the type of fishery changing to motorised and semi-industrial fishery, tunas have become the predominant species handled.

4.1.3 Quality of supply

The quality of the fish supplied to the market is variable. Fish caught by the traditional inshore craft is generally landed in good condition as it is not on board for more than a few hours.

The same cannot be said of the 18 - 22 foot craft which go further out to sea. Voyage times are generally over 18 hours and this very often results in spoilage, especially when the craft don't carry an ice box on board.

The multi-day boats often go to sea for periods in excess of 14 days and although ice is carried, the resultant landings are of variable quality. It has been observed that fish caught in the first few days end up at the bottom of the ice hold. In the absence of a system of partitions. the first catches tend to get crushed under the weight of later hauls .

The quality of aquaculture products is generally very good and has a high international reputation.

Aquarium fish often enter the market in poor condition due to inappropriate catching and handling techniques. Training programmes have been conducted by NARA to provide the necessary skills to the fisherfolk involved in this form of fishery, under the FAO-BOBP's ornamental fisheries programme.

Imports of dried fish are reported to be of variable quality. The best quality products are said to come from Thailand which supplies a large proportion of the dried anchovies. Maldives supplies products such as *masmeen,* while India comes at the bottom of the scale providing poor-quality fish products. The product from India is often used to adulterate products that arrive from other parts of the world.

4.1.4 Variability of supply

There is both a seasonal and geographical variation of supply. The statistics on this variability are of limited accuracy and should be treated with caution.

The supply of fish is also affected by weather conditions. From April to late October, the Southwest Monsoon is dominant and results in strong onshore winds and rough seas along the south and west coasts. For the rest of the year, the wind blows from the northeast. These wind changes affect the location and type of fishing and the subsequent supplies. Before the current security problems, many of the fishermen migrated during the monsoons to areas where the weather was calmer. This was only partly weather-related; it also reflected the economic needs of the fishermen. Detailed data on the seasonal variation in quantity, location and species do not exist. Some indication of this could possibly be gained, however, from the price statistics collected from St John's Fish Market in Colombo.

4.2 SOURCES OF SUPPLY

Approximately 30% of the fish in the Sri Lanka domestic market, wet weight equivalent, is imported. Much of this comes from the Maldives, South Africa, Thailand and Japan. This takes the form of Maldive fish, dried fish and canned fish.

The domestic supply of fish comes from all around the coast and inland. The bulk (88%), however, is

produced from the marine environment. While the bulk of the fresh fish comes from the coastal districts located on the south and southwestern coasts of the country, a significant quantity of fish products, mostly dried and wet salted, have begun arriving in the Colombo market since the government forces regained control of parts of the northern and eastern districts.

4.3 FACTORS AFFECTING SUPPLY

There are a wide range of factors affecting the supply of fish and these are outlined below.

4.3 1 Macro-economic policies

Liberalisation of the economy since the late 1970s has doubtless done much to encourage investment in all forms of production. The fisheries sector, which is dependent on the import of many of its inputs, would have benefitted from this.

Fiscal policies which promoted subsidies for investment in productive capacity have benefitted the sector's development. Likewise, a strong monetary policy towards lending for investment has also assisted.

4.3.2 Sectoral policy and legislation

The principle objective of the Ministry of Fisheries and Aquatic Resources is as follows:

> *To improve the fish production in Sri Lanka by use of scientific and modern technological methods for exploitation of fish resources. Whilst by encouraging the fishermen to use these techniques in fishing, to develop the fishing industry through a process qfproper management techniques, to bring foreign exchange into Sri Lanka through exportation of fisheries and aquatic resources, to create fisheries-related industries through welfare measures and training in the field and to improve the living standards and socioeconomic conditions of the fisheries community through various projects.*

This clearly indicates Government's intention to increase production within sustainable limits. In so doing, it provides support to fishermen in all categories to increase production, though the current focus is on offshore production where the greatest potential for increase lies.

The recent reduction in focus away from the increased support for production inland has clear implications for future supplies from these areas.

4.3.3 Environment

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

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

From the perspective of supply, depletion of resources results in fewer fish reaching the market. Loss of biodiversity results in fewer species available. Destruction of habitats results in a change in both species and quantity landed. Pollution results in a reduction in the carrying capacity of the environment and, thus, resource depletion. And loss of amenity poses a threat to the fishing communities themselves and the important tourist industry which relates closely to the fisheries sector.

Resource depletion is a direct result of both fishing pressure and pollution. The majority of the landings in Sri Lanka comes from the coastal waters (O-40 km). In this zone, the large pelagics are believed to be fully exploited as are the sardine stocks on the west coast and the lobster stocks in the South. Increased expansion of effort appears possible for small coastal pelagics, large offshore pelagics, and sardine stocks in the South and Southwest.

The biodiversity of fish resources offers potential for the future expansion of the live fish aquarium trade. The world market is mainly focussed on freshwater species, but exports from Sri Lanka focus on marine species. Biodiversity changes have mainly arisen from the introduction of exotic species such as tilapia, carp and gourami into the freshwater environment. This has affected the composition of fish supply to the market and should be monitored to ensure that adverse biodiversity changes do not disturb future aquarium fish supplies.

In some cases, changes in the composition of the resource can adversely affect specific groups of suppliers (e.g., subsistence fishermen may direct their efforts at a particular species accessible to their fishing methods. If these are selectively removed by overfishing, that group of people will suffer to a much greater extent than the general harvesting community.)

Destruction of habitats comes from a variety of sources. In many parts of the world the cutting of mangroves for fish smoking is a major cause of coastal

destruction. This is not the case in Sri Lanka where little of the fish is smoked. The cutting of mangroves for fuelwood and brushpile fishing has, however, seriously degraded this environment which provides the nursery grounds for some of the most important species traded by Sri Lanka, including prawns. The mangrove cover in the area from Thambalagam Bay to Valaichchenai, for example, has reportedly declined by 25%.

Aquaculture can damage the aquatic environment through habitat destruction (land drainage and clearing), the introduction of genetic changes in the wild stocks; pollution, and introduced disease. This is clearly an area which will require careful monitoring in the future.

Other sectors can also have a very negative impact on the aquatic environment. Agriculture and forestry practices generate soil erosion, which reduces light penetration in rivers, lakes and coastal areas, chokes lagoons and rivers, and affects filter feeders, sea grasses and coral reefs. Deforestation in Sri Lanka is, in some areas, severe. As a result, soil erosion has become a major environmental problem, particularly in the wetter southwest of the country. Agriculture poses problems through the use of fertilisers and pesticides, which are washed into the aquatic environment and adversely affect fish species, and through irrigation which affects water flow systems.

Dam construction is considerable in Sri Lanka and little is known about the possible impact on the migration of fish species or on breeding cycles brought about by changes in water flow.

Coral mining has been extensive in Sri Lanka, although recent legislation has aimed at reducing this. The extent of enforcement is believed, however, to be low.

Natural forces are also causing considerable erosion within the coastal zone in the south of the country. This occurs mainly during the Southwest Monsoon.

Industrial pollution around Colombo is becoming of increasing significance to fisheries, resulting in fish kills in some of the waterbodies. The build-up of heavy metals in fish flesh is a possibility for the future. This is compounded by sewage outflows, which are also adversely affecting the quantity and quality of fish caught in some areas near urban centres. Paper mills are also believed to have been responsible for fish kills in associated rivers and lagoons.

All these environmental factors have the capability of affecting the quantity, quality and diversity of the products placed on the market and, thus, are of importance in post-harvest considerations.

4.3.4 Micro-economic factors

There are many micro-economic factors which can affect supply. Market conditions can encourage or deter production and the influence of the large-scale traders has clearly played a significant role in this in the past. The past migrations of fishermen during monsoon changes are directly linked to the degree and type of support provided by these traders. In more recent times, the CFC and the co-operative systems have attempted to improve outlets and prices for the product and, thus, promote production.

Physical access to the market has limited the quantity and location of supplies in the past. Government has done much to improve landing and road infrastructure to allow the expansion of supplies.

Subsidies, flexible loans and training in loans management by the banks and the co-operatives have also helped fishermen to expand their catching capacity. The emphasis on providing loans and subsidies for larger multi-day boats has encouraged more offshore fishing and this has had a direct impact on both the species composition and quality of fish entering the market.

Improved organisation of fishermen in co-operatives has also improved their access to services and the economies of scale which have assisted in expanding their production base. They have also encouraged support from Government for the provision of latrines and other health and hygiene inputs, which can benefit the quality of the landing sites and, thus, the quality of the product.

In areas where it is realised that the expanding fishing population threatens the sustainability of the resource, both Government and NGOs have attempted to stimulate alternate income-generations (AIGOs). Much of this effort has been done through the ADB Fisheries Sector Community Development Project. A total of 1320 micro-enterprises were extended assistance. A large proportion of these activities were in occupations that were indirectly related to the fisheries sector. It is expected that through demonstration, these enterprises will eventually cater to other sectors of the economy.

4.3.5 Institutional influences

The links between MFAR, co-operatives and the banks have been strengthened over the past few years. The result is that the availability of credit for the purchase

and replacement of craft and gear is not as big a constraint as it used to be in the past. For the most part, membership in a fisheries co-operative ensures a reasonable chance of accessing funds for such purposes.

4.3.6 Political influences

The security situation in the north of the country has limited produce from those areas entering the wider market. In some ways this may be beneficial for the inshore resources which may have the opportunity to replenish themselves.

4.3.7 Technological influences

There have been considerable changes in the craft and gear combinations used. With the depletion of inshore resources, emphasis has shifted to harvesting offshore. The result has been more emphasis being placed on exploiting offshore large pelagics.

4.3.8 Social, cultural and demographic factors

The production of fish in Sri Lanka was traditionally limited to a few castes and racial groups, with over 75% of the fishers coming from two groups, the Sinhala Karava and the Tamil Karaya. This has acted as a mechanism for limiting entry to the fishery and may have reduced the rate of expansion of production beyond sustainable limits. This situation is less prevalent now, as labour demands have attracted new entrants to the fishery. However, those individuals involved in fishery occupy a low position in society, as catching of fish involves killing, which is looked down upon.

The fact that Buddhism is the prevalent religion in Sri Lanka is not a barrier to the harvesting of fish.

4.4 KEY PROBLEM AREAS

There are four key problem areas affecting supply.

4.4.1 Weather conditions

The key problem area affecting the supply-side of the post-harvest sub-sector is the seasonal shortage of the product due to weather conditions. This will require improved technologies to allow harvesting all the year around.

4.4.2 Environmental concerns

Environmental concerns have come to the fore, especially with respect to fishing in the inshore waters of Sri Lanka. In the past, fisheries resources were sought to be managed through a variety of acts and ordinances, such as the Fisheries Ordinance. the Chank Fisheries Act. the Whaling Ordinance. The salient features of each of these acts and ordinances were brought together in the Fisheries and Aquatic Resources Act of 1996. The Act vests much greater powers in management and enforcement in MFAR. It is expected that this will halt the decline in supply over the long term.

4.4.3 Improved technology

The redirection of harvesting towards under-exploited resources must be increased if supplies are to be sustained. Improved technology, skills and access to finance will also be necessary to encourage the exploitation of these resources.

4.4.4 Unfavourable import restrictions

Import taxes currently deter increased imports of fresh fish.

4.5 CURRENT INTERVENTION

4.5.1 Non-Governmental sector

FAO-BOBP carried out a review of NGOs involved in fisheries and identified 24 who were active. Some of these NGOs have been active in promoting expansion of the fishing effort and, thus. catch for the supply side of the fishery. These efforts have mainly revolved around the provision of credit.

There is some involvement of NGOs in developing AIGOs to remove the excess harvesting pressure from the resource. Considerable effort has gone into the organisation of the fisherfolk into savings and credit groups. This has eased dependence on informal sources.

The biggest NGO involvement within the post-harvest sub-sector is the co-operative movement. The co-operative movement is arranged on the three-tier system. The primary co-operatives are of two types: the large fishermen's societies which were formed after the old co-operatives were restructured in the early 1970s. and the newer co-operatives arranged at the Grama Seva level. There are about 700 registered primary fisheries co-operatives. most of the newer small type, which include some 89,000 people. A fairly large proportion of the membership are operators of 18 - 22 foot craft. These boats currently operate without an ice box on board. A box designed for the purpose has been developed by the Project and its use is being extended through the provision of credit. About 2% of the membership consists of bicycle and

motorcycle traders. These traders are now being provided with ice boxes to reduce spoilage and increase their area of operation.

The second layer of co-operatives are the District Unions, of which there are eight. These are coordinated by the apex body: the National Federation of Fisheries Co-operative Societies Ltd.

Support from Government is mainly through the primary co-operatives and through them loans have been made to increase the fleet size and to adopt new fishing techniques.

4.5.2 Private sector

The vast majority of vessels operating in the fleet are owned by private individuals or groups. They are financed by loans from Government and private banks. In this sense, the principal driving force behind supply expansion comes from the private sector.

4.5.3 Government

Government actively promotes supply expansion through its policies and development plans, as described above.

4.6 FURTHER ACTION

There is considerable further action which can be carried out to increase the quantity and quality of supply. This includes:

4.6.1 Improved catching technology

This is largely related to improving offshore catching technology which is environmentally and financially sustainable. This allows the harvesting of fish in all weather conditions and the capture of fish that are currently underexploited. This requires a sound knowledge of the factors affecting the future demand and, thus, price of fish in the market.

4.6.2 Improved environmental monitoring

The quantity and quality of fish being landed is related to the condition of the environment. There is clearly a need to monitor changes in the environment and in the quality of the fish being landed if standards are to be maintained.

4.6.3 Appropriate import controls

The impact of changes in the regulations governing import of fish is not well documented. There is a need to understand these issues in more detail and to adjust import restrictions as required.

5. TRANSFORMATION OF FISH PRODUCTS

5.1 TYPES OF TRANSFORMATION

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

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

Transformation occurs in four main ways:

- Product transformation
- Place transformation
- Image transformation
- Price transformation

These are outlined below.

51.1 Product transformation

Product transformation occurs mainly to add value to fish or to preserve it, and can take many forms. The most common in Sri Lanka include gutting, filleting, icing, freezing, salting, drying, canning, and pickling. Traditionally the most important method of preserving fish was to sun-dry it. This was particularly so in the North and the East of the country where the weather conditions were conducive to this processing technique. Preservation was necessary because transport links were poor. At the turn of the current century, there was an expansion of both road and rail facilities as well as of ice production. This meant that fish could be moved more quickly and could be preserved on ice with limited processing. This trend has continued over most of the last ninety years and was accelerated during the liberalisation of the economy in the late 1970s. This led to increased private sector investment in transport and ice production and to a much more efficient and effective distribution network.

Dried fish is most often dried on raised structures similar to racks. It may be either salted or brined before drying. Larger fish are gutted, split and the meat scored. Small fish are dried directly without the use of salt. Only spoilt or crushed fish are generally used for drying.

Maldive fish* production in Sri Lanka has greatly reduced in recent years due to the high cost of tuna. The pickling of fish, to make products such as jaadi (a wet, salted product made with the fruit goraka), was traditionally carried out, especially with fish which had spoiled. This has also reduced as improved distribution and icing have reduced spoilage and as demand has pushed up the price of fish.

Both beche-de-mer and dried shark fin are produced in limited quantities for the export market.

The greater part of the catch is now merely iced before consumption. Very few iced fish are also gutted or filleted, as the demand is for whole fish. There seems to be a consumer suspicion of gutted fish. Icing practices are generally poor, but as most fish reaches the consumer within a few hours of being caught this does not present a problem. Most of the inshore vessels do not use ice on board as they are only at sea for a few hours. The multi-day boats do carry ice, but fish handling and ice use are reported to be poor. This results in many of the fish being brought back to port in very poor condition, and prices reflect this quality loss.

Fish which is transported from landing sites to inland markets is generally iced in the trucks. Fish travelling to nearby wholesale markets may be lightly iced or not iced at all. Ice is used sparingly at markets, if at all. Some traders use ice boxes on motorbikes and bicycles.

Foreign vessels (Chinese and Taiwanese) operating under joint venture arrangements with Government target the fresh sashimi market in Japan. As such, the on-board handling of catch is extremely good. Shore handling is also of a high standard and carried out in association with the CFC in Colombo.

Very little filleting occurs, although some of the larger fish are cut into large steaks at the beach. This facilitates marketing of the product. Some of the supermarkets in urban centres also gut, fillet or steak fish for ease of selling.

Little in the way of freezing of fish occurs. The CFC does, however, buy up and freeze fish when prices are low in order to both sustain high producer prices and to cater for market shortages later.

In the past, several attempts have been made to can fish. The CFC was engaged in canning activities in the 1960s and the South Australia Fishermen's

* Smoked dried strips of tuna traditionally imported from the Maldives.

Co-operative Ltd. (SAFCOL) operated a commercial canning plant in the 1980s. Today, there is a small canning operation that offers value-added products to the local market.

One of the supermarket chains has invested in sophisticated value-added products such as fish fingers and fish sausage and some processors are filleting and freezing for convenience shoppers. This market is, however, embryonic.

Fish meal production has been carried out on a limited scale in the past and one operation is believed to still be active in the north of the country. There may also be a limited degree of small-scale chicken feed production from waste fish.

Some fish are landed live. These are destined for the export aquarium trade. Handling skills are reported to be poor and high mortalities ensue.

51.2 Place transformation

Most fish in Sri Lanka is landed at coastal beach sites. Some of the centres have developed landing sites, but most of the smaller vessels land fish directly on the beach. After fish is landed it is sold through either an auction or through direct haggling between owners and buyers. At some sites, the auctioning is handled by the co-operative. At others it is handled by private auctioneers.

From the beach, the fish is distributed by a wide range of methods. It is sold to local markets by beach/market retailers or distributed to local households by bicycle traders (with a range of some 15 km), headloaders or pingo carriers. Fish destined for further afield is carried by motorcycle, van, truck or train. Much of the fish travels to St John's Fish Market in Colombo. even fish from the east coast. Here it is wholesaled and retailed. Again, cycle traders, headloaders and pingo carriers distribute the fish to local households. Some of the fish from St. John's is transported to other inland rural or urban markets, where it is further distributed.

Fish from inland sources tend to have much shorter distribution chains and are generally sold to consumers nearby.

The CFC supplies much of the fish going to institutions.

Fish which is landed in a spoiled condition is not transported far but it is dried on the beach or converted to *jaadi* before distribution inland.

Live fish for the aquarium trade tends to go to Colombo where it is collected by large-scale exporters. Exports by air make use of an extensive air connection service which operates 123 international departures each week. The fresh sashimi market in Japan can be accessed twice weekly by direct flights.

Imported dried fish is handled by wholesalers based in Colombo who distribute the fish to the outer rural areas for consumption. Dried fish produced domestically is also handled by large-scale wholesalers after processing.

5.1.3 Image transformation

Little is done in the way of improving the image of fish in Sri Lanka. The Government promotes the health aspects of fish through schools and the media, and private sector operators promote value-added products through television and newspaper advertising. Exports are promoted through the efforts of the EDB.

Fish, at the wholesale level, is usually packed in wooden crates for transport from the landing centre to the market. An estimated 3 - 5% of the fish transported in this manner is damaged. Due to breakage of boxes when stacked during transport. MFAR has proposed introduction of plastic crates for transport. A few crates have been distributed for demonstration purposes.

5.1.4 Price transformation

Little accurate information exists on the price of fish over time to give a true reflection of the price changes along the different stages of processing and distribution. The Department of Fisheries and Aquatic Resources does collect data on fish prices in St. John's Fish Market and this can give some indication of changes over time. Average producer and retail prices for some species of fish are shown in Table 12. These indicate that retail fish prices are approximately 90-100% above producer prices. Given the complexity and efficiency of the distribution system, this is probably a reasonable reflection of transaction costs.

The increases in price are likely to vary also with the distance from the landing sites to retail points. Inland consumers are likely to pay much more for their fish than consumers in Colombo.

In general, the price of fish is high, reflecting the high demand in relation to the supply.

5.2 PARTICIPANTS IN TRANSFORMATION

There are many agents involved in the transformation process. These include preservation and processing agents, distributers and ancillary workers.

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5.2.1 Preservation and processing agents

The primary preservation and processing is carried out by the crew on board the multi-day boats. They stow the fish below decks in the ice-hold using ice to chill the fish. The fishermen on the smaller craft have taken to carrying ice on board. However, the practice is limited to a few locations where the fishing grounds are located far from shore.

Onshore. the drying of fish is generally carried out by men and women living in the fishing villages. The raw stock is fish which have been crushed and is got primarily from the multi-day boats. Given the quantities involved and the nature of the market, small processors find it difficult to access such fish. The small-scale processors are restricted to procuring crushed fish from small craft. Given the scale and instability in supply, these processors have little or no leverage in the market.

5.2.2 Distributors

The distribution of fish is a complex process involving many stages. The most prominent participants in this process are the large traders who buy at the beaches and transport either to St. John's Fish Market or to inland urban centres. These are generally not of the same caste as the fishermen but are traders who have moved into the fishing sector. In many cases these traders have long-standing relationships with specific vessel crews which allow them preferential access to fish. In the past. they have financed and provided transport for the coastal migrations of the fishermen during the monsoons. During these migrations, the buying system and lending patterns between the fishermen and traders was much more formalised and less variable. This, combined with the remote locations of the migration camps, meant that the fishermen were able to save their incomes for future investment in the business. The migrations are much less pronounced now due to the present security situation.

At St John's, the fish is transferred to commission agents who wholesale the fish to other wholesalers. These then transport the fish by truck or van to other urban centres, to retailers in the market itself and to the urban distributors. who consist of head-loaders. bicycle traders, motorcycle traders and pingo carriers. The commission agents aim to get the highest price they can, from which they take a commission for themselves and send the remainder back to the traders.

The small-scale traders distributing the fish by bicycle. head basket or pingo are generally fairly poor and come from the area in which they sell their fish, *i.e.,* they do not generally come from the fishing villages but from further inland. Many of them have been involved in the business of trading for many years and have established relationships with their customers. In some cases they buy their fish to orders placed by the customers.

5.2.3 Ancillary services

One ancillary service provided during the transformation process is that of auctioning. This is a growing activity of the co-operative movement which now controls some of the landing sites. It is the govemment intention to promote this role further. In the past, some of the auction halls have been operated by the church. This is less so today.

Some of the co-operatives are starting to provide other services, such as ice and cold storage. This has grown since the recent attempts to privatise certain functions of both the CFC and the Ceylon Fishery Harbours Corporation (CFHC). The co-operatives in some locations are taking over these roles. The private sector is also involved in the provision of ice and cold storage and this is an area where private sector involvement will expand in the future. One of the biggest problems faced is the availability of power. With over 75% of the pdwer generated in Sri Lanka coming from hydel sources, monsoon failures adversely affect power availability.

One of the most important ancillary services to the fisheries sector is that of credit. Much of the credit is internally generated, through deferred payments between the different stages in the distribution chain. Others are more formalised. as in the case of the large-scale traders lending to the fishermen during the migrations. The most important source of credit from formal sources for the post harvest sub-sector is the Small and Medium Industry Loan (SMIL) operated by the National Development Bank through commercial banks. The primary objective of the scheme is to enhance private sector participation as well as to re-orient lending operations of the commercial banks to Project-based lending in the fisheries sector. The Asian Development Bank is one of the sources of funding for SMIL. Small-scale traders and processors are also extended credit assistance under the New Enterprises Credit Scheme for self-employment. Both credit schemes are directed at meeting the fixed and working capital requirements of the traders and processors. The schemes are operated by the MFAR co-operatives in collaboration with the Bank of Ceylon and People's Bank. These co-operatives have become more inclusive in recent years. with membership being extended to cover those involved in the petty fish trade.

The informal sector meets much of the credit requirements of the fisheries sector. Within the wholesale markets, such as St John's, there are moneylenders who lend small or large amounts of money on a daily basis for fish transactions. Interest rates are generally very high (as much as 5% a day) but may well reflect the high transaction costs of such lending.

5.3 FACTORS AFFECTING TRANSFORMATION

There are a wide range of features affecting transformation.

53.1 Macro-economic policies

Liberalisation of the economy since the late 1970s has doubtless greatly increased the involvement of the private sector in the production of ice. Government policies to provide roads to all rural areas, especially along the coast, have improved the fish distribution network. This may also have been reinforced by a growth of the tourist industry which has been focussed on the coast. Economic liberalisation has also encouraged investment in improved transport and in capital-intensive aquaculture investments. Government's focus on increased exports from all sectors has also aided the development of a strong export industry within the fisheries.

Simplification and rationalisation of the taxation system has also aimed to encourage investment. This may have affected investment patterns between sectors which may, in turn, influence investment in cold store and ice plants.

5.3.2 Sectoral policy and legislation

Government's policy of promoting of fish landings has greatly increased the availability of fish entering the internal market. The increasing demand for fish and the improved distribution network has, however, meant that little in the way of processing occurs. In the past. Government had attempted to intervene in the marketing and distribution of fish through the CFC. This intervention did not lead to a redirection of the flow of the produce through the CFC as was expected. It may. however, have led to improvements in the distributions of benefits within the existing fish distribution system and to improved producer prices.

The liberalisation of the economy has had its impact on CFC operations. In the past, its operations covered a whole gamut of functions. However, with many of its activities right from capture to retailing being sold off to the private sector, its ability to influence the market has been largely curtailed. At present its operations are limited to the operation of a few auction halls and markets. ice plants and retail outlets at a few select locations on the island.

The current focus on the co-operatives as the principal medium through which support for the sector will be channelled also has important implications for the distribution of opportunities and benefits from growth within the sector. A growing focus on the importance of the role of the co-operatives in the marketing process may also have important implications for the relative roles of the existing participants. Lessons learnt from a greater analysis of the role of the CFC in the marketing and distribution of the produce in the past could be valuable in guiding this process.

The current focus on the export of fish has reaped benefits for the country through the increase in foreign exchange and in employment. There are, however. potential areas of conflict between export-oriented strategies and those aimed at the alleviation of poverty and improved domestic nutrition. These arise because the focus of export industries is, often of necessity, the larger-scale operators (thus being less accessible to poorer operators) and aimed indirectly at taking food resources away from the domestic market. There is clearly a need to harmonise these strategies to maximise the benefits to be derived from all three strategies.

5.3.3 Environment

Concerns for the quality of the environment expressed in Section 4.3.3 are also an area of concern for the transformation sub-sector.

Variations in the supply-side of the market due to environmental changes can result in seasonal shortages of produce. This may affect the degree of employment within the transformation side of the sub-sector. It is likely that supply shortages are most likely to affect the poorer members of the industry who target the lower-priced species and process-dried products.

The quality of produce aimed at the domestic market must be free from pollutants and pathogens if it is to maintain its status as a health-giving food source. Likewise, levels of histamine in tuna need to be controlled if the adverse effects of this are to be avoided by consumers. There is likely to be a growing awareness of the need for improved handling of fish as the tastes of the population become more sophisticated. This will have implications for the poorer participants in the transformation process who may not be in a position to adopt such new, and possibly more costly, practices.

The concerns for health and hygiene in the export area are an added dimension which places growing pressure on the sub-sector. Sri Lanka has continuously upgraded its monitoring of standards within the export industry but there is growing pressure to ensure that landing as well as processing and storage facilities meet international standards, particularly those laid down by the EC.

5.3.4 Micro-economic factors

The main micro-economic factor affecting the transformation process is the high domestic demand for fish relative to the supply, combined with a well-developed distribution network. This results in a rapid turnover of fish and little need for processing or preservation. The lack of demand for improved quality of fish at present also limits the degree to which fish handling is improved.

Credit within the sub-sector is widely available but appears to miss certain of the poorer participants because they do not fit neatly into the categories at which credit is targeted.

5.3.5 Institutional influences

Support from Government institutions in the area of post-harvest activities is limited by a lack of trained staff and resources. In the past, this has reduced the opportunities to overcome problems and to generate growth opportunities within the post-harvest area. It has also limited the feedback from the sub-sector to Government's policy formulation and planning processes. In spite of these problems, Government has developed a range of value-added products some of which have been taken up by the private sector.

Government departments have also co-operated in producing a comprehensive programme of support for the development of the export industry. which has greatly benefitted the larger-scale private sector.

Institutional problems at the NGO level include a lack of training in post-harvest issues. This limits their effectiveness in supporting the sub-sector.

Institutional problems at the community level revolve around a lack of organisation. Amongst the smaller traders, such as head-loaders, cycle traders and pingo carriers, there is very weak organisation. This is partly because they lack organisational skills, but also because they do not come from the same communities as each other and. thus. the community bond and trust is missing. This lack of organisation reduces their influence over the sub-sector and their impact on policy formulation at Government level. It also reduces the ease with which their particular problems and aspirations are expressed and, thus, support from Government, which specifically targets them, is reduced.

5.3.6 Political influences

The security situation in the North and East has. in the past, reduced the supply of fish to the market. It has also affected the location of landings, the species composition and the price of fish. As the drier weather is in the North, this has also reduced the opportunities for the drying of fish.

5.3.7 Technological influences

The availability of ice is a major factor affecting the preservation of fish. The expansion of ice production has reduced the need to process fish and has resulted in most fish now being consumed fresh. The extent to which the current ice production facilities are at, or below, the future needs of the country is unclear.

The technology used for holding iced fish in vessels. trucks and cycles appears to be a limiting factor in the effective use of ice and the preservation of the fish.

The technology used in the drying of fish is fairly basic, reducing the quality of the final product.

5.3.8 Social, cultural and demographic factors

The growing awareness within the population of the benefits of fish as a food source and the increasing sophistication of tastes will have an effect in the transformation of the product in the future.

The increase of women in the labour market will also affect the way urban consumers view fish and will change demand in terms of the product types required.

5.4 KEY PROBLEM AREAS

There are a range of problem areas as outlined below.

5.4.1 On-board handling

The handling of fish on-board the multi-day boats is reported to be poor. Handling deficiencies include:

- Poor separation of species and, thus, contamination of blood and smell from one species to another.
- Poor stacking and, thus, crushing and damage.
- Poor chilling of fish due either to poor use of ice or lack of insulation.
- Excessive movement of fish in the holds, resulting in physical damage to the fish.

These lead to reduced quality and value of the landed product.

5.4.2 Limited landing of sashimi grade fish

Iced sashimi grade tuna is currently landed by foreign-operated vessels in Sri Lanka and flown to Japan. The production of iced tuna from the local vessels is currently well below export standards for such markets. There could, however, be considerable potential for limited production from local boats to enter this export market if on-board storage fish handling is raised to appropriate levels. This is now a major growth area in some Pacific Island countries which, although closer to Japan, generally have weaker air links and poorer shore facilities.

The current lack of handling skills amongst the domestic fleet represents a significant loss of income. Efforts have been made by the Standards Bureau to impart skills in better methods of handling of tuna meant for these markets. These training programmes have, however, suffered on account of the lack of funding in the recent past.

5.4.3 Inadequate fish landing sites

The current landing sites, especially beach landing sites, are poorly catered for in terms of covered areas, water supply and hygienic working areas. There has been some development of the sites for landings from the larger multi-day boats, but the smaller vessels appear to have access to few facilities. Improved sites could have the potential benefit of improved fish quality and could offer the opportunity for the co-operatives and small-scale traders to assert greater control over the marketing of the fish.

5.4.4 Onshore fish handling

The current standards of onshore fish handling, both at the landing sites and at St John's Market, are poor. This results in physical damage and reduction in the quality of the fish. Poor handling results from a lack of understanding of better handling techniques, a lack of incentive to improve handling, and/or a lack of appropriate facilities. Improved skills and facilities could overcome these problems. A few training exercises in better fish handling methods have been conducted by the Project with assistance from NARA for operators of small craft and cycle traders.

5.4.5 Cycle traders

The cycle traders clearly occupy an important niche in fish distribution and marketing, with this commercial practice generating considerable employment. Improving their operating conditions could have a positive impact on their lives as well as on consumers, who rely on them for their fish supplies. The provision of an ice box would improve the quality of fish supplied. This could be supplied through associaitions exclusively for cycle traders.

5.4.6 Foot traders/small-scale static retailers

There is a need to organise these traders into associations especially in the districts. This would enable these traders to access formal sources of credit. Their inability to store fish overnight often results in losses. The provision of a suitable ice box is something that needs to be examined in greater detail.

5.4.7 Improved utilisation of low-value fish

There are several types of low-value fish which do not readily enter the fresh fish market or enter at very low prices. These are often handled by small-scale traders who salt and/or sun-dry the fish. Current processing practices are at a low level and possibilities for improvement exist.

5.4.8 Aquarium fish handling

The aquarium fish trade in Sri Lanka is of growing importance as an export earner and as a source of employment for small-scale operators. There are reported to be, however, serious losses between harvesting and export due to poor handling techniques.

5.4 9 Limited ice production

Ice now plays a vital part in the preservation of most fish in Sri Lanka, much of it produced by the private sector. There is, however, a reported shortage of supply which is affecting fish quality.

5.4.10 Compliance with EC import regulations

The export industry in Sri Lanka is an area of growth. To retain its share of the world market it must conform with the ever more stringent import requirements of its customers. Recent changes made by the EC in the health and hygiene conditions during production, handling and processing, place a particular burden on exporters.

5.4.11 Alternative income-generating opportunities

In some areas of the coast, the Government is encouraging fishermen to move out of the fishery to avoid overexploitation of the resource. Some are moving into the processing, distribution and marketing areas of the sector. In some locations these activities are also believed to be over-subscribed and there is a

shortage of produce to go around. Growth of participants within the processing and distribution areas could lead to the displacement of poorer operators.

5.4.12 Post-harvest information dissemination

There has been considerable work on some post-harvest issues in Sri Lanka. Unfortunately much of this work remains hidden in files or internal reports and rarely benefits the participants in the sector or workers in other countries in the region.

The post-harvest sector is poorly monitored and the ongoing research coverage is at a low level. As a consequence there is little input of knowledge about the problems and prospects of the post-harvest sub-sector into the formulation of overall fisheries sector policy. The potential changes in the sub-sector, which may result from wider policy changes in the macro-economy and the fisheries sector, are, thus, little understood. This can result in conflicts between strategies aimed at different policy areas within the sector.

5.4.13 Lack of training in post-harvest issues

The current staff involved in post-harvest issues in the private sector, Government and NGOs who have the appropriate skills necessary to address the needs of the sub-sector in the future on a sustainable basis are few (see also 5.5.1 below). Those currently involved in research in this area are over-stretched and under-resourced. There is a need to assess training requirements, draw up a human resource development plan and implement it.

5.5 CURRENT INTERVENTION

5.5.1 Non-Governmental sector

Quite a number of the NGOs have carried out activities to promote improvements in the post-harvest sub-sector although little appears to be documented on their success and failures. There was a need for training of NGO staff identified, but little appears to have been carried out in this area. It is uncertain how many NGOs are currently active in the post-harvest sub-sector.

The primary and secondary fisheries co-operatives are engaged in fish marketing, the delivery of credit, education, and the promotion of AIGOs.

5.5.2 Private sector

The larger scale private sector is currently attempting to upgrade its skills through training schemes provided by the Government and through the FAO's INFOFISH.

The private sector is also trying to play a more active role in expanding the provision of ice, though this is hampered by a lack of investment knowledge. They have also experimented with value-added products which are now on sale. Considerable attention is now being paid to increasing quality standards to be in line with directives of the EU and FDA of the United States.

5.5.3 Government

The main support for the sub-sector comes from the Ministry of Fisheries and Aquatic Resources. The Ministry include the following departments, corporations and institutions:

- The Department of Fisheries and Aquatic Resources (DFAR)
- Ceylon Fisheries Corporation (CFC)
- Ceylon Fishery Harbours Corporation (CFHC)
- National Aquatic Resources Agency (NARA)
- Cey-Nor Foundation Ltd

The principal agencies engaged in post-harvest interventions are DFAR, CFC, CFHC and NARA. The Ministry establishes policy for the sector and it is implemented by these departments.

DFAR has two principal roles: the promotion of fish production. and the improved welfare of fishworkers. It is actively involved in increasing the supply to the market and of improving the shore-handling and marketing of product. It also stimulates the flow of credit to fishing communities through the co-operatives. Its post-harvest activities have included extension, the provision of sanitary and other facilities in fishing communities, and the operation of the Fisherfolk Radio Programme. Specific post-harvest interventions have included a range of credit and training programmes through several development projects which support and promote improved fish marketing. DFAR also provides training through the Sri Lanka Fisheries Training Institute in Colombo and at its regional training centres in Negombo, Tangalla, Batticaloa and Jaffna.

The CFC is responsible for participating in the distribution and marketing of fish, the production of ice, and the provision of cold storage. Much of these activities have been handed over to co-operatives or the private sector in recent years and the CFC plays a greatly reduced role in post-harvest activities.

CFHC was also engaged in the management of shore facilities until recently when it was restructured. It is now responsible for the maintenance and management

of fishing harbours and anchorages. Many of the assets of the CFHC have now been transferred to the co-operatives.

NARA is the research arm of the Ministry. It covers a wide range of topics. including post-harvest activities through its Institute of Post-Harvest Technology. Its main focus in the past has been the development of processing technology. Jt also provides training inputs to other departments and to community groups.

The Ministry also promotes improved export quality products through training courses arranged between the Export Development Board, the Sri Lanka Standards Institute and NARA.

The importance of, and use of, fish is taught in schools as part of a wider programme of nutrition education.

Credit is provided by the state-owned banks. Re-finance is provided by the National Development Bank for credit extended under the subsidy programmes.

The marketing facilities are inspected by public health inspectors.

5.6 FURTHER ACTION

There are a range of activities which need to be carried out in the transformation area of the post-harvest sub-sector. These are:

5.6.1 On-board handling

There is a need to quantify the problems associated with on-board handling. to identify if changes will result in post-harvest gains in quantity. quality or value. and, if appropriate. for a programme of action to be implemented.

5.6.2 Small-boat sashimi grade production

The technical, social and economic feasibility of producing fresh sashimi grade fish from the domestic fleet needs to be assessed and, if viable and sustainable. a programme for implementation drawn up for the information of Government.

5.6.3 Fish landing site assessment

Limited assessment of the shore facilities has been carried out in the past by NARA. This needs to be extended to a much more comprehensive assessment of the country. This assessment could cover a description of current facilities and landing practices, major problem areas. potential improvements, and associated costs and benefits to the different groups concerned. This would then provide Government with a comprehensive planning tool.

5.6.4 Improved onshore handling

There is a need to determine the benefits to be derived from improved onshore handling of fish and to determine appropriate strategies accordingly.

5.6.5 Support to cycle, foot and static retailers

The Post-Harvest Fisheries Project has progressed well with the identification of basic needs. assisting in the formation of an association under the co-operative framework to provide access to credit from formal sources. This needs to be built upon by extending the activity to other parts of the country.

5.6.6 Improved utilisation of low-value fish

There may be scope for adding value to low-value fish through improved processing, such as the use of techniques similar to those used in the South India Anchovy Project, or the production of jaadi.

There is a need in the first instance to identify the extent of the availability of this low-value fish. where it is landed, how it is currently used, and what are the possibilities for improved utilisation (in terms of markets and techniques). Where viable possibilities exist, it will be necessary to develop these to the production stage and extend them at the community level.

5.6.7 Improved aquarium fish handling

It is estimated that about 5 - 10% of the fish is lost on capture and another 3-4% is lost during transport. There is need to identify suitable measures to reduce these losses. At present, BOBP has a programme aimed at reducing such losses. However, the extent of its impact remains unknown.

5.6.8 Assessment of ice shortages

There is a need to quantify the ice supply shortfall in terms of where it occurs. when it occurs and why. If a shortfall exists which can be viably overcome, then technical and investment profiles should be prepared for credit institutions and the private sector.

5.6.9 Compliance with EC import regulations

As a consequence of the growing penetration of the EC market there is a need to assist Government's current efforts to establish standards for premises, product and practices which conform with these regulations, and to train inspectors and industry workers in the implementation and enforcement of these regulations. The Bureau of Standards is currently been given the job of certifying if a product meets EC requirements which are in line with ISO 9000. Only

three staff members have been given accredation to carry out such checks. Out of an estimated 30 units, only six have been certified as meeting requirements. The other units remain to be inspected and the paucity of accredited staff is cited as the reason for the delay.

5.6.10 Alternative income-generating opportunities (AIGOS)

Considerable progress has been made in identifying alternative income-generating opportunities for fish workers and traders under the ADB-sponsored Fisheries Sector Community Development Programme. There is a need to ensure sustained interest on the part of Government and the community in actively seeking alternate sources of employment.

5.6.11 Information dissemination

There is a need to bring the wide range of information and knowledge of post-harvest issues in Sri Lanka together and distribute it in a form which can be usable to the industry, to planners and other researchers in the region.

5.6.12 Improved post-harvest planning and policy formulation

In the post-harvest sub-sector, the social and economic conditions of the participants particularly need to be more clearly understood. In addition, the consequences of strategy conflicts on all participants in the post-harvest sub-sector need to be determined in much more detail if access to the benefits from development within the sector is to be equitably distributed. This information then needs to be made accessible to policy-makers and planners so that the sub-sector is more effectively represented.

5.6.13 Improved post-harvest fisheries training

The number of staff in Government, NGOs and the private sector who have the skills necessary to bring about the above changes on a sustainable basis and to evolve with future changes in the sector is small.

Those who are involved in research and training in the post-harvest sub-sector are over-stretched and under-resourced. There is a need to increase the number of skilled post-harvest staff in planning, education and training, research and development institutions.

APPENDIX 1

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APPENDIX 2

TABLES

TABLE 1: CONSUMPTION OF FISH BY TYPE AND CONSUMER SEGMENT

Fish type	*Grams/person/year by demand segment*			
	Urban	*Rural*	*Estate*	*All-Island*
MarineLarge	*5767.2*	1534.8	364.8	2266.8
Marine Small	6998.4	4192.8	*435.6*	4482.0
Freshwater	388.8	1462.8	111.6	1167.6
AllWet	13154.4	7190.4	912.0	**7916.4**
Dried	2138.4	3075.6	1916.4	2820.0
Tinned	2028	1740	9360	2292
AilFish	15495.6	10440.0	3764.4	*10965.6*

Source Karunanayake (1988)

TABLE 2: EXPORT OF FISH BY PRODUCT TYPE (1988-1992)

(Volume in metric tons, value in Rs mil.

Product	*1988*		*1989*		*1990*		*1991*		*1992*	
	Vol	*Val*	*Vol*	*Val*	*Vol*	*Val*	*vol*	*Val*	*Vol*	*Val*
Prawn	1826	527	2598	767	1855	486	943	455	1246	613
Lobster	223	28	228	99	165	50	188	140	*154*	125
Crabs	45	31	lOt	64	—	—	323	39	533	67
Beche-de-mer	54	24	51	27	36	27	19	14	21	25
Ornamental	162	74	260	106	154	68	98	41	246	143
Other Crust.	310	23	—		821	175	70	23	93	12
Otherdried, salted, chilled	575	106	729	70	1	13	182	109	252	178
FrozenFish	1	0.03	2	0.4	78	29	*5*	29	1130	116
Fish fillets andmeat	300	11	13	5	51	35	1	6	*55*	12
Total	3497	824	3982	1137	3163	883	1328	855	3731	1292

Source: Department of Fisheries and Aquatic Resources

TABLE **3: POPULATION GROWTH RATE** BY **YEAR**

Year	1978	/989	/990	/99/	1992*
Population (million)	14.19	16.806	16.993	17.247	17.405
Growth Rate (%)	1.8	1.3	1.1	1.5	1.0

source: Stastics Dept.. Central Bank ot Sri Lanka. Provisional

TABLE 4: RELIGIOUS ANt) ETHNIC (;ROUPS **AS A PERCENTAGE** OF **THE TOTAL POPULATION**

Religion	%of Population	Ethnicity	% of Population
Buddhists	69.3	Sinhalese	74.0
Hindus	15.5	Sri Lankan Tamils	12.6
Muslims	7.6	Indian Tamils	5.6
Christians	7.5	Moors	7.1
Others	0.1	Burghers	0.3
		MaIaya	0.3
		Others	0.1

Source:Central Bank of Sri Lanka Economic and Social Statistics. 1992..

TABLE *5:* LITERACY RATE IN SRI LANKA COMPARED WITH OTHER COUNTRIES IN THE REGION

	year	Sri Lanka	India	Malaysía	Pakistan	Plulippines	Thuiland
Literacy Rate	1990	89%	48%	79%	35%	90%	93%

*Source: Gov*t. Statististics.

TABLE **6: SUPPLY CHARACTERISTICS FOR** ALL **FISH**

Characteristics	Weight in M T(1991)
Total production of fish	198.159
Export (wet weight equivalent)	5,533
Total local supply for consumption	192.626
Imports (wet weight equivalent)	83,371
Total fish supply	275.997

Source: **Dept. of** Fisheries and Aquatic Resources. Administrative Report 1991.

TABLE 7: CHANGES IN THE QUANTITY OF FISH LANDED IN SRI LANKA, 19851990.

Groups of Fish	*Nominal catches in MT (FAO, I 990)*					
English Name	*I985*	*1986*	1987	I988	1989	1990
Tilapia	32743	35390	36465	38012	39720	31265
Demersal percomorphs	0	0	0	0	0	0
Carangid	0	0	0	0	0	0
Clupeoid	27682	2847 1	29460	30608	31064	27958
Sp. mackerel	3475	3574	3698	3842	3899	3314
Frigate and bullet tuna	3498	1367	I474	1588	2198	1580
Kawakawa	2800	1360	1541	1580	2170	1560
Skipjack tuna	12118	13737	I2896	I3398	I3957	I2237
Yellowfin tuna	6716	7977	7147	7426	7536	6406
Blue marlin	321	1113	1273	I327	1778	1280
Black marlin	137	918	—			
Striped marlin	I832	107	134	151	173	120
Marlin, sailfish. spearfish	1053	748	1877	1820	1918	I380
Swordfish	411	371	403	492	591	430
Other tunas	0	4	0	5	2	9
Mackerels	13000	13000	13000	I 3000	13000	10500
Silky shark	11300	1 1700	12100	12500	12685	11450
Other shark, skates, rays	3813	3843	3983	4210	4273	3813
Other marine	38372	37374	39124	45583	48003	32587
Crustaceans	4784	4919	5090	5289	5367	5098
Molluscs	0	0	0	0	0	0
Total	179163	181511	185743	197536	205286	165397

Source: FAO Yearbook of Statistics. 1 YYO.

TABLE 8: ENGLISH, LATIN AND SINHALESE FISH NAMES

Groups of Fish		
English name	*Latin name*	*Sinhalese name*
Tilapia	Oreochromis	Koraliya
Demersal percomorphs	Pertciformes	
Carangids	Carangidae	Paraw, katta, parati
Clupeoids	Clupeoidei	Salaya, hurula
Sp. mackerel	S. commerson	Thora, anjila
Frigate and **bullet tuna**	Auxis	Alagoduwa
Kawakawa	Euthynnus affinis	Attawala
Skipiack tuna	Katsuwonus pelamis	Balaya
Yellowfin tuna	Thunnus albacares	Kalawalla
Blue marlin	Makaira mazara	Koppara
Black marlin	M. indica	Koppara
Striped marlin	Tetrapturus **audax**	Koppara
Marlin, sailfish. spearfish	Istiophoridae	Koppara, Thalapath
Swordfish	Xiphias gladius	Gappara
Other tunas	Scombroidei	
Mackerels	Scombroidei	Kumbala
Silky shark	Carccharinus falciformis	Mora
Other shark. skates. rays	Elasmobanchii	Mora
Other marine	Osteichthyes	
Crustaceans	Crustacea	Issa, Pokirissa, Kalapukakuluwa
Molluscs	Mollusca	Dhalla, Boovalla

Source: FAO Yearbook of Statistics (1990)

TABLE 9: PERCENTAGE OF CATCH BY SPECIES GROUP

Variety of fish	*% of total production in 1991*
Seer	2.5
Paraw	5.6
Balaya	10.5
Kelawalla	6.7
Other Bloodfish	5.9
Shark	5.4
Skate	6.1
Rockfish	5.4
Shore Seine varieties	21.0
Prawn	3.3
Lobster	0.5
Other	27.1

Source: Dept. of Fisheries and Aquatic Resources

TABLE 10: FISH PRODUCTION BY DISTRICT IN 1991

DFEO Division	*% Of landings in 1991*
Batticaloa	5.5
Chilaw	10.9
Colombo	1.6
Galle	8.4
Jaffna	5.3
Kalmunai	5.8
Kalutara	5.4
Mannar	5.5
Matara	7.9
Mullaitivu	2.0
Negombo	12.2
Puttalam	14.7
Tangalla	7.6
Trincomalee	7.2
Total	100.0

Source: Dept. of Fisheries and Aquatic Resources

TABLE 11: THE COMPOSITION OF SUPPLY FROM DIFFERENT SUB-SECTORS OF THE INDUSTRY

Year	*Total Fish Production (MT)*	*Marine (MT)*		*Inland (MT)*
		Offshore & Deep Sea	*Coastal*	
1991	198,063	15,080	159,151	23,832

Source: Dept. of Fisheries and Aquatic Resources.

TABLE 12: PRODUCER AND RETAIL PRICES OF SELECTED FISH DURING 1991

Fish Type	*Producer Price (Rs/Kg)*	*All-island Retail Price (Rs/Kg.)*
Seer	78.49	156.41
Trevally	60.06	117.23
Skipjack	44.86	86.06
Tuna	5 1.26	98.77
Sailfish	41.69	112.69

Source: Statistics Department of the Central Bank of Sri Lanka.