SRI LANKA
FISHERIES EXPLOITATION
&
DEVELOPMENT

A. SOMASUNDARAMPILLAI B.A., F.C.A.,

SRI LANKA FISHERIES
EXPLOITATION AND DEVELOPMENT

A. SOMASUNDARAMPILLAI B.A., F.C.A.,

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From the Publisher's Desk

There is an urgent need for all to get united to develop the economy of Sri Lanka in general in and particular the North-East, which had been devastated by the intercene ethnic war for two decades. Every possible step should be taken both by Government and the private sector to undertake development in a systematic and coordinated manner bearing in mind the long term benefits rather than short term gains.

In order to prioritize the development work especially in the North East, one must be in possession of necessary knowledge and experience in the chosen field of development. Books, project report, and studies on economic development subjects applicable to our local environment are of urgent requirement to the planners and possible investors.

Fisheries is one of the area which was much neglected in the past and available resources were not exploited for economic development of the people.

On my recent visit to Yarlpanam, I happened to see a book in Thamil entitled "SRI LANKA FISHERIES – EXPLOITATION AND DEVELOPMENT" which traced the history of fisheries in Sri Lanka, highlighting the opportunities available in fisheries sector, proper methods of exploitation of fisheries together with a warning on over-exploiation of fisheries resources. I was pleasantly surprised to learn that the Author of the book was Mr. A. Somasundarampillai, B.A., FCA., Chartered Accountant known to me for years and a friend with similar visions in the development of the Thamil speaking nation in the North-East.

As I wanted the contents of this book be made available in English for the benefit of all those who are interested in the developmental activities, I promised to publish the book in English. Mr. Somasundarampillai readily accepted my proposal and accordingly sent his manuscript to me.

The Publishing Rights of the book was with the Center for Development of Fisheries, University of Jaffna and Dr.K. Chitavadivelu was kind enough to grant us the right to publish and republish the book in English. Our thanks are to him.

This book is the maiden publication of *"Ambalam Publications"* which name is in the memory of Mr.S. Ambalavaner, the International Tax Consulant & Creator of many Institutions for Social and Economic Activities. He was my Guru and at the same time was my friend, philosopher and guide.

Authors who have unpublished works on economic developments can look for assistance from *Ambalam Publications* which is a charity.

Chelliah Thangarajah

15.08.2002

PREFACE

International Thamil Foundation based in England, by its letter dated 12-12-1988, expressing a desire to develop/ industrialise the Thamil areas, solicited my opinions and suggestions for some projects. I submitted two concept papers for it's consideration - a model Dairy farm and a model Fishing Unit. The projects were carefully studied and Rs. 5 million for each project was offered. But, soon conditions in the country deteriorated and I wrote to them that things could not be done, then.

In order that my efforts taken to write the concept papers, do not go waste, I expanded these into full project reports. The need for a book on the 'Economics of Sri Lanka' was also in my mind.

In 1990, I happened to show my report, SRI LANKA FISHERIES - EXPLOITATION AND DEVELOPMENT, to Dr.K. Chitravadivelu. He had praise for it.

The University of Jaffna started a Centre for Development of Fisheries in 1998, with Dr. Chitravadivelu as its co-ordinator. In 2000, he inquired of my report and expressed a keenness to have it in Thamil. Miss. Abirami Balasubramaniam helped me in the translation.

When I expressed my desire to bring it out in book form, Dr. Chitravadivelu insisted that the information and statistics should be updated. I was not in full agreement. The North and the East which contributed 55% of the catch of the Island have collapsed. In this situation, the statistics of later years will not lead to reasonable conclusions. Yet, with the assistance of Dr. Soosai Ananthan, an attempt was made to update these. The reader should exercise due caution in using these.

Happening to see a copy of this book in Thamil, my friend, Mr. Chelliah Thangarajah, Attorney at Law, Management and Investment Consultant, wanted this in English and offered to have it published. I remain grateful to him.

A. Somasundrampillai, B.A., F.C.A.,

Chartered Accountant.

FORWARD

One of the important resources of our region is fisheries. Fisheries have now attracted the attention of all, from the uneducated to those at the University. In our efforts at economic development towards attaining self sufficiency, fisheries hold new promises.

The work of Mr. Somasundarampillai in collating various information, from an economic point of view and publishing this book "Sri Lanka Fisheries - Exploitation and Development" is commendable.

Fishing areas, their resources and exploitation, boats and accessories, their maintenance and requirements, facilities and financial aids and their utilisation, marketing, imports and exports and future development plans being dealt with in this book at the present moment, will provide the required incentives towards development in this field.

Students, others interested in this field and those taking efforts to develop this field, will in my belief, benefit by this book.

Wishing that he produces more books, I pray for God's blessings on him.

Dr.K. Chitravadivelu.
Co-ordinator,
Centre for Development of Fisheries,
University of Jaffna

15-01-2001

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1. INTRODUCTION

Sri Lanka is an island situated in the Indian Ocean, just south east of the southern tip of India and lies between latitudes 6' N and 10' N and longitudes 80' E to 82' E. The Maldive Islands lie 640 kilometres to the south west and the Andaman and Nicobar Islands, 1,120 kilometres to the east, leaving the southern side open as far as the Antarctic.

The island has a coast line of 1,700 kilometres of which the straight line is 1,200 kilometres and a total land area of approximately 66,000 sq. kilometers. The south-central portion is mountainous, 900 to 1,200 meters. This region is surrounded by an upland belt, 300 to 900 meters. The coastal plain is narrow in the south-eastern sector and broadens greatly to the north and east. The coastal plain continues out to the sea as the continental shelf. The 100 fathom line is close to the coast except to the north where it extends to include the Gulf of Mannar, the Palk Strait, the Pedro Banks and the Pearl Banks. The shelf with the exception of this area, rarely extends beyond 40 kilometres and averages 22 kilometres in width and covers an area of 32,500 sq. kilometres, ie. half the land area of the island itself.

The third United Nations Conference on the Law of the Sea gave countries greater sovreignty over their coasts and of the countries that participated in the Conference about a 100 declared a 320 kilometre Exclusive Economic Zone (EEZ). Although the island's sovreignty extends to 320 kilometres into the ocean, the extent is narrow on the north west and the south west because of the Exclusive Economic Zones of India and the Maldive Islands. Yet, the sovereignty extends over 536.000 sq. kilometres of the ocean and all the resources therein. This area is almost six times the land area.

In addition to these, there are artificially created rain and river water tanks and reservoirs, scattered throughout the country, constructed for storage of water for irrigation purposes and some of which are over a thousand years old. These cover an area of approximately 600 sq. kilometres ie. roughly 95,000 hectares. Lagoons and brackish water marshes, most of which are subject to considerable fluctuations in salinity content, consist of an additional 885 sq. kilometres (ie. 140,000 hectares). Aquaculture was introduced into Sri Lanka rather late, in 1950, about 25 years after it had assumed commercial proportions, elsewhere in the world. It holds great promise for the future.

Fish is comparable to meat and dairy products from the nutritional stand point. It contains 18-22% easily digestible protein and in common with other animal protein, essential amino acids that the human body cannot manufacture. In particular, the high percentage of the amino acid, lysine in fish, makes it an extremely efficient supplement to the low protein, high carbohydrate diets, commonly found in developing countries. It also contains other important nutrients such as Vitamins A, B and D calcium, phosphorous, iron, iodine and fluorine. Also, being a predominantly Budhist country, fish is the preferred source of animal protien in Sri Lanka.

Thus, the Fisheries sector in Sri Lanka, has a relatively high importance in the economy, compared to that in most countries.

However, fisheries had been the most neglected of all industries till the attainment of independence in 1948. During the last thirty years, there were numerous plans and proposals for the development of the fishing industry in Sri Lanka. But, these were ill conceived and ad hoc plans prompted more by political expediency than economic feasibility. It was as recently as 1977 that clear thinking flowed into the fishing industry and the Five Year Plan 1979 - 1983, for the development of fisheries, took shape.

2. FISHING GROUNDS

2.1 Coastal Fishery / the Continental Shelf

As on land where animals, birds and insects are found in places with lush vegetation, in the sea too, fish flock to areas with plenty of fish food, marine vegetation and tiny organisms known as 'plankton'. These are found in the shallow coastal waters in the Continental Shelf, brought down by the rivers and the action of sunlight on the nutrients in the bottom of the sea, also produces these. But there should be a churning up of the waters for better enrichment. There are on major oceanic currents or up-wellings which create significant seasonal movements of the coastal waters. Therefore, there is a low rate of exchange or interchange between the lagoon waters and the sea or the sea and the continental water. This together with a lack of significant tidal activity, has led to a low rate of enrichment of the coastal waters, resulting in a low but stable bio-mass.

However, the coastal zone on both sides of the island is exposed to two monsoons which cause substantial hydro-biological and oceanographical disturbances in the coastal zone - south west monsoon from May to September affects the west coast and the north east monsoon from November to February affects the east coast. When the monsoon winds churn up the bottom waters of the sea, the nutrients are pushed up to surface layers where the sunlight can penetrate ie. up to a depth of 50 fathoms. During the inter-monsoon period, there is some depressional activity producing cyclones. Thus, the small fish feed on the plankton and the larger ones from the deep sea, come on prey to the small fish.

It is known that certain varieties of fish travel long distances in search of food and for spawning in the shallow waters of the bays and inlets with mangroves and sea-weeds. Fish eggs cling to the vegetation found here and hatch in these shallow waters and around rocks. They migrate gradually to the deep sea and as they mature, return to the original spawning grounds.

In this area, there are good resources of pelagic (surface dwelling) and dimersal (bottom dwelling and rock-fish) species, with an annual sustainable yield of 250,000 ton. Of this, it is estimated that 170,000 tons is pelagic and 80,000 ton is dimersal. This is the area of the coastal fishery ie. upto 35 kilometres and has been the source of 80% of the catch of the island.

Marine mammals are also present in the coastal waters, though they have never constituted an important fishery. Porpoise are often seen surfacing in schools, but are avoided by fishermen because they are known to damage fishing nets. Young specimens of large Baleen whales have been found cast ashore and Sperm Whales are known to visit the coastal waters. Dugong is another mammal found in the shallow waters of the Gulf of Mannar. However, marine mammals, all over the world have got reduced in numbers and are internationally protected by law. These are now held as a tourist and local public attraction. It is said that revenues from whale watching are fast overtaking revenues collected by the commercial whaling industry in the world scene.

2.2 Offshore Fishery.

With the declaration of Exclusive Economic Zone, the sovereignty of the coastal states extends to 320 kilometres from the shore. Fishery resources that were earlier regarded as common property are now owned by the coastal states. The ownership, in common with all ownership of resources, implies not only a right but also a responsibility to utilise them for the benefit of mankind.

Proper study and a correct assessment of the Offshore Fishery has not yet been done, but indirect estimates point to an annual catch potential of 60,000 to 70,000 tons of valuable tuna beyond the presently exploited range of the Sri Lanka EEZ. In 1996 the price of a kilogram of tuna averaged American $ 22 abroad and Rs. 150 locally.

Tuna shoals observed in the seas around Sri Lanka, have been identified broadly into, migratory shoals - fast moving parallel to the

shore and not responsive to churning, drifting shoals - mixed species, medium movement and responsive to churning and feeding shoals - very slow moving but active and prominently observable in the water. Prized tuna species of big-eye and yellow fish have been known to concentrate during the seasonal months from March to May and the average size of a single fish is around 25 kgs. It has also been estimated that the break-down proportion for the tuna catch is 45% yellow fin and big-eye and 10% marlin, skipjack and others.

2.3 Aquaculture - Inland Fishery

Consultants here and abroad, expressed surprise that the island had for so long not seriously thought of developing fresh water fisheries in the island. The country is endowed with numerous fresh water tanks and reservoirs, scattered throughout the country, originally constructed for irrigation purposes. Of this an area of 600 sq. kilometres (95 hectares) of fresh water storages are available for fish culture. About 230 large and medium scale water bodies have been identified. It was only as late as 1950, that certain exotic species of fresh water fish, particularly Tilapia Mossambica, were introduced into the irrigation reservoirs.

In simple terms, the process consists of establishing fish breeding centres or hatcheries and transferring the fingerlings into the water bodies and harvesting these, when grown up. Initially, difficulties were experienced in all these three aspects of breeding, stocking and harvesting. Some of these difficulties were transitional, like disinterest of inland residents in fishing, conflicts between migrant fishermen from coastal regions and inland residents, and conflicts arising from the competing uses of water for irrigation and drinking purposes. Real difficulties were also experienced in that many of the techniques of intensive aquaculture were not known and / or have not been tested in Sri Lanka. There is also a consumer bias towards inland fish. However these are not insurmountable problems.

There is a great future for inland fisheries, with the coastal fishery exploitation reaching an optimum level and offshore fishing becoming costly with high prices of oil as well as the other imported item like engines and gear. Concerted efforts towards greater intensive culture in cages and pens will produce excellent results.

2.4 Aquaculture - Brackish Water Fishing

Brackish water fisheries are found in river estuaries, lagoons and salt marshes, chiefly along the coasts of the dry zone and cover an area of 140,000 hectares. The species here include window-pane oysters (which area source of pearls), edible oysters, shrimps (prawns), spiny lobsters, fan shell, edible crabs, giant perch and grey mullet. Besides these, sea fishes likes tarpon, milk fish, lady fish, bream and cat fish are also found in the lagoons. Also, the coastal waters of the Palk Bay and the Gulf of Mannar have provided a long standing fishery from early historical times for a variety of molluscs such as chanks, which are exported to Bengal, melon shell, scorpion shell, cowries, and cones which are of great interest to shell collectors.

The importance of Brackish water fishery, really lies in shrimps (commonly referred to locally as prawns) for export. Shrimps for export in the early eighties came from the collecting centres of Colombo based companies, in Chilaw, Kalpitiya, Mannar, Jaffna, Batticaloa, Mullaitivu and Pamunugama. Mannar, Kachchativu and Pesalai have large resources of panaeid shrimps.

In 1986, The export development Board billed shrimp farming as one of the most dynamic agro-based industries of the Indo-Pacific and Central American regions. In 1981, U.S.A., Japan and Western Europe imported 450,000 tons of shrimp at an estimated cost of 3 billion dollars (U.S.). This market has been steadily increasing. But in 1985, Sri Lanka exported only 3,000 metric tons, earning 0.5 billion rupees. This was not touching the tip of the iceberg of promise. Hence the Export Development Board attached great importance to the promotion of Shrimp

culture. By 1986, Private sector companies moved into pond culture of shrimps in the lagoons of Puttalam and Batticaloa.

2.5 Aquarium Fish

In 1988, the Export Development Board wanted breeding of aquarium fish for Export, in the face of a vast and growing international market for ornamental fish which was growing at the rate of 10% per annum, and is not matched by supply.

Fresh water fish had been kept as pets over centuries but the breeding and rearing of them in captivity for ornamental purposes, is of recent origin. This was due to the development of civil aviation providing a very quick and relatively inexpensive mode of transport of live fish from Asian countries to Europe and North America.

The Marine fish fauna in the coastal waters around Sri Lanka is very rich in species which are present in varying quantities. Over 500 species of fish are found here ranging from the two-inch sprat of the 15 feet long marlins, sharks and saw fish, apart from marine mammals.

Breeding of good quality fresh water aquarium fish of indigenous species and wherever possible, imported fishes which are popular in the major markets, will be a lucrative business.

3. EXPLOITATION OF FISHERIES

3.1 Requirement of the Country and Plans

The Government did not pay much attention to fisheries up to the attainment of independence and even for a long time thereafter. In 1952, 25,000 tons of fish were produced but dried fish was imported to the wet fish equivalent of 100,000 tons. In 1958 the production was increased to 40,000 tons and dried fish was imported to the wet fish equivalent of 120,000 tons. The following figures for a few more years are revealing.

	1970	1972	1974	1976	1977	1978
	(in thousand tons)					
Total local production	97.0	100.0	109.0	134.0	137.0	154.0
Less - Export (wet fish equivalent)	0.5	0.6	1.8	2.7	3.1	4.5
Imports (wet fish equivalent)	81.0	86.0	37.0	16.0	19.0	9.0
Total Fish Supply	177.0	185.0	144.0	147.0	143.0	158.0
Mid-year population (in million)	12.5	13.0	13.3	13.7	13.9	14.2
Per Capita annual consumption (kgs)	14.0	14.0	10.8	13.3	10.2	11.0

In the years that followed the per capita consumption has been as follows:

	(in kilograms)		
	Total	Island's share	Imported share
1979	14.6	11.32	3.28
1980	16.4	12.42	3.98
1982	16.5	13.96	2.54
1984	17.9	10.57	7.33
1986	16.1	11.07	5.03
1988	18.6	11.72	6.88
1990	15.0	9.46	5.54
1992	14.9	11.80	3.10
1993	15.4	12.48	2.92
1994	15.5	12.49	3.01
1995	16.7	13.07	3.63
1996	15.6	12.14	3.46
1997	16.6	12.62	3.98
1998	16.9	13.16	3.76

Source - Sri Lanka, Fisheries Year Book - 1999

It would be observed that the per capita consumption declined from 14 kilos in 1972 to 11 kilos in 1978. The decline was mainly due to the foreign exchange difficulties the country ran into.

During this period, there had been a spate of plans for the development of the fishing industry. These were all ad hoe plans prompted by political expediency and did not take into account, the basic realities and the larger interests of the industry.

Taking stock of the position, the first five year Master Plan 1979-1983 for the development of fisheries, was prepared, with the objectives of -

- increasing production,
- laying a strong foundation for off shore fishery with the Abu Dhabi Fund for Economic Development,
- satisfying the consumer demand,
- providing economic and social gains to the partici pants in production, and
- creation of additional employment opportunities.

Targets were set for the various fishery sectors as follows, based on the 1978 actual catch:-

,000 tons.

	1978 Actual	1983 Target	1983 Actual
Coastal Fishery	135	216	184
Offshore Fishery	3	34	1
Inland Fishery	16	50	36
	154	300	221

Areawise, the coastal fishery production falls as follows:-

	Tons	%
Jaffna, Mullaitivu, Mannar	69,900	38.0
Trincomalee, Batticaloa, Kalmunai	32,000	17.3
Puttalam, Chilaw, Negombo	48,000	26.0
Galle, Matara, Hambantota	26,300	14.3
Others	8,200	4.4
	184,000	100.0

On this island's productions of 184,400 tons, the Thamil areas of the Northern and and the Eastern Provinces contributed 101,900 tons. The military operations that started the following year and the declaration of security zones in the coastal areas of the sea, the contribution of these areas fell drastically to almost nothing. Hence, the island's production also fell.

Great efforts were made with foreign assistance in the other regions and in 1992 a catch of 185,000 tons was reached. On the other hand, the fishermen of the North and the East who contributed 55% of the catch in 1983, went as refugees to Thamil Nadu in large numbers, some migrated to places like Negombo and Chilaw where they had connections, the younger generation took refuge in foreign countries. The others who remained exist on state assistance of dry rations etc. But all the boats, nets and personal belongings were lost and they are left with nothing.

Having failed to achieve the target set out in the Master Plan, the ministry continued to work on the same lines for the next few years. The second Master Plan 1987 - 1991, aimed at -

- increased production,
- thereby, increase the income of the fishermen,
- raising the standard of living of the small fishermen, and
- increased foreign exchange earnings by exporting high value species of fish.

However, the continuing 'war' drastically cut down production in the North and the East. The island's production continued as follows:-

,000 tons

	Coastal	Offshore	Inland	Total
1983	184.0	0.7	36.1	220.8
1984	136.6	0.8	31.9	169.3
1985	140.4	2.4	32.6	175.4
1986	144.3	3.4	35.4	183.1
1987	149.3	4.3	36.4	190.0
1988	155.1	4.4	38.0	197.5
1989	157.4	8.2	39.7	205.3
1990	134.1	11.7	17.8	163.6
1991	159.1	15.1	23.9	198.1
1992	163.1	22.0	21.0	206.1
1993	169.9	33.0	18.0	220.9
1994	174.5	37.5	12.0	224.0
1995	157.5	60.0	20.0	237.5
1996	149.3	57.0	22.2	228.5
1997	152.8	62.0	27.2	242.0
1998	166.7	63.5	29.9	260.1

The Master Plan for 1990 - 1994 had almost the same objectives as the earlier ones. During this period, the state assistance for inland fisheries was stopped and this sector was neglected. Soon, with strong and enterprising private sector coming forward aquaculture saw fast development. This Master Plan aimed at promoting the self reliance of the fishing community by channelling state aid through Fishermen's Co-operative Societies with a membership of 77,656. Tax exemptions, loan incentives and the selective market activities of the Sri Lanka Fisheries Corporation produced an attractive environment for the private sector.

In the Master Plan for Fisheries Development 1995 - 2000, priority is given for Inland Fisheries and aquaculture.

3.2 Coastal Fishery

The potential catch of the coastal fishery has been estimated at different times at different figures. A survey of fish resources by the Norwegian research vessel "Dr. Fridtjof Nansen" estimated a potential sustainable annual yield of 250,000 tons from the coastal waters of Sri Lanka - an area extending up to the Continental Shelf. This is made up of 170,000 tons of pelagic or surface dwelling and 800 tons of dimersal or bottom dwelling and rock fish species. This has been accepted as a reasonable and workable estimate.

A general classification of the number of boats in 1979 and the target for 1983, is given below:-

	1979 No.of Boats	1983 No.of Boats	1983 Catch Average tons	1983 Total Catch tons
28-32 foot / 3.5 ton boats.	2,273	2,888	22	63,536
17-24 foot boats	3,050	5,000	12	60,000
Indigenous mechanised crafts	3,720	5,180	8	41,440
Indigenous non-mechanised crafts	13,315	12.785	4	51,140
	22,358	25,853		216,116

Drift netting has been the most widely used important fishing method (70%). Beach seiners and purse seiners are also used (5%)

It may be noticed that fishing continues to be confined to the Continental Shelf and with the collapse of the industry in the North and the East due to the internal warfare, the entire attention is centred on the other areas. In these areas production has exceeded the sustainable yield as far as the pelagic species are concerned. Yet, the dimersal species were not fully exploited.

With the continuance of the ethnic 'war', there was an expansion in the use of purse seine nets with light attraction to catch small and medium pelagic (surface dwelling) fish in the coastal waters. The nets are operated at nights with lights powered by portable generators. Heavy landings are reported - the catch being mainly sardines and herrings. Purse seiners were extensively used in some of the world largest fisheries which have since dramatically collapsed as a result mainly of uncontrolled exploitation. Naturally the Ministry was disturbed over this trend. In the Master Plan for 1995 - 2000, importance is given to management to reduce the pressure on the coastal fisheries.

3.3 Offshore Fishery

The target set for the offshore fishery in the Master Plan 1997 - 1983 remained only in paper. With the escalating oil prices, the introduction of the larger fishing vessel of the 50 foot class was not attempted. Further, the escalation of prices of other vital inputs like gear and boat building materials, compelled the authorities to shift emphasis to inland fisheries, where the capital investment as well as the harvesting costs were considerably low.

However, concerted efforts were made in the second Master Plan 1987 - 1991 and some progress had been made and by 1992 the offshore fisheries produced 22,000 tons of fish.

Feasibility studies for offshore fishing for tuna was completed by 1981. The study recommended 10 Nos. 350 ton vessels and

as there was lack of experience in this field, it was decided that -

either - a) Local companies should purchase the vessels and hire foreign management and crew for a five year transitional period, financed by a World Bank Loan,

or - b) Joint venture between local and foreign companies should be established.

The North West Coast Project funded by the Abu Dhabi Fund for Arab Economic Development was intended to develop the offshore fishery around the Gulf of Mannar. The project was expected to be completed in 1982 at a total cost of Rs. 123 million of which Rs. 93 million was by the Abu Dhabi Fund. 80 Nos. 34 foot vessels, 10 Nos. trawler vessels and 2 Nos. 50 foot vessels were embodied in this project. The newly designed 34 foot vessels could stay at sea up to a week, economising on consumption and increasing the fishing hours. The 2 Nos. 50 foot vessels were solely intended for deep-sea fishing, on an experimental basis for the Ministry to establish the financial and economic feasibility of deep-sea fishing operations. The results were expected to guide the private sector to venture into deep-sea fishing. The results however, could not induce the private sector investment and participation anticipated.

Yet, continued efforts with foreign expertise and financial aid produced quick growth in offshore fishing in the last decade. 1,700 multi day boats, varying in sizes from 30 to 70 feet were used. In these years fishing extended up to the Exclusive Economic Zone (EEZ) and beyond too. In this exploitation, Float Gill Nets and Long Line Nets were mainly in use. The offshore fishery that produced 11,600 tons in 1990, increased production to 57,000 tons in 1996 and contributed 28% of the total catch. The offshore production consisted of 50% tuna and 35% shark. During this period the shark flesh fetched a higher price than tuna and shark fins gained importance as an item of export.

In 1995, 127 tons of shark fins were exported, valued at Rs. 160 millions. Also, the production of shark liver oil rose in importance and the Pharmaceutical Corporation began exporting this after meeting the country's needs.

The Master Plan for Fisheries 1995 - 2000 aimed at -

- giving priority to inland fisheries and aquaculture,
- reducing pressure on coastal fisheries by effective management,
- development of offshore fishing,
- sets a target of 294,000 tons for the year 2000, and
- encourages joint ventures between local and foreign ntrepreneurs.

Fishing, marketing, exports, building boats and such other activities are all left to the private sector. The government will provide the infrastructure and provide all the necessary incentives.

3.4 Inland Fishery - Fresh water

With the escalation of prices of oil and gear and boat building materials and other inputs necessary for marine fisheries, inland fisheries in fresh water resources assumed importance and diverted towards it, the attention of the developers. In 1978 the inland fisheries produced 16,000 tons of fish and it was planned to raise it to 50,000 tons by 1983. But although the target was not reached, substantial increase in production to around 36,000 tons was achieved and the target of 50,000 tons continued for the future.

However, it should be observed that during this period, the Government subsidised the construction of ponds to the extent of Rs. 2,000/= to Rs. 10,000/= per 10 perches to an acre. The international Development Research Centre (IDRC), Canada, financed a project of experimented trials to raise fish in cages and pens and this proved a greater success than pond culture.

Quality fingerlings was the prime need. It was estimated that by the year 2000, 40 million fingerlings would be required. While the Government took necessary measures in Dambulla and Udawalawe, the private sector started hatcheries in Murutuwela, Panapitya and Ginigathena.

The production potential of inland fresh water fisheries is estimated as follows:-

	Metric tons.
Large irrigation tanks and reservoirs	21,751
Medium irrigation tanks and reservoirs	8,481
Small irrigation tanks and reservoirs	13,744
Up country reservoirs	8,097
Mahaweli reservoirs	7,838
Flooded Plains	5,000
Source - Economic review - Sept. 1997	64,911

The following deficiencies should be removed at the earliest -

- shortage of trained personnel,
- selection of suitable techiniques,
- want of proper training in breeding, stocking and harvesting,
- reasonably priced fish feed,
- disease preventive measures.

3.5 Inland Fishery - Brackish Water

The Inland Brackish Water Fishery has made great strides forward. Various species are available in river estuaries, lagoons and salt marshes along the coasts of the dry zone, for capture fishing and these fetch higher prices than the normal marine fish.

But aquaculture, of breeding fish is presently confined to shrimps (prawns) because of the excellent world market for the product. In March 1985 Mr. Sjif van Eyes, International Trade Expert of INFOFISH, Malaysia, presenting a paper at the World Shrimp Conference held in

Acupulco, Maxico, observed, "The young Sri Lanka Shrimp Industry holds great promise to an international market where demand exceeds supply. This is contrary to the shrimp industry in most other Asian countries and the prospects of Sri Lanka expanding its trade in the world market is excellent on the grounds that Sri Lanka's exports of shrimps are excellent in quality, and positive attempts are made to expand the trade".

Besides the two brackish water stations at Pitipana and Pambala, several private shrimp culture projects were established. Two important shrimp culture areas in Sri Lanka are situated in the west coast from Negombo to Puttalam and on the east coast in the lagoon areas around Batticaloa.

The Bay of Bengal news reported in early 1986, "On the east coast are two pond complexes: a 200 ha. pond farm is in use and the 400 ha. farm is under construction. The 200 ha. pond complex was built two years ago by Serendib Sea Foods Ltd., the first private company to start intensive pond culture of marine shrimp in the country. It is one of the largest shrimp farms in Asia. The stocking rate is 60,000 pl/ha (post larva per hectare) and shrimp grow up to 40 gm. in individual weight. The growth rate is said to be good". Also, "a major Asian Development Bank Project to finance aquaculture activities in Sri Lanka will come up in 1986. The project will focus on - among others construction of a shrimp hatchery to produce 20 million marine shrimp post larvas annually".

Note:

Production of fingerlings of fresh and brackish water species and the stocking of these.

Fingerlings	- 13 stations	- Jan/June 90	5,384,000 *
Stockings	- 20 stations	- Jan/June 90	3,254,000 *

Hence for the year 1990, the production and stockings could be double.

* *Source - Ministry of Fisheries - Administration Report 1990*

Shrimp is a high value product of export as may be gauged by the fact that in 1981 U.S.A., Japan and Western Europe imported 450,000 tons at an estimated cost of U.S. $3 billion. The boom in large scale aquaculture development in Sri Lanka augurs well for the future.

Today, Shrimps occupy an important place in the fish products exported. In 1996, this produced a foreign exchange earning equivalent to Rs. 2,365 millions. Production was approximately 800 - 1,000 tons. Because of the local demand and the demand from tourist hotels, in 1996 only 236 tons were exported.

Bech de mer is harvested in the large saline lagoons of the Northern and North Eastern regions and is an important item of export. In 1996, 430 tons were exported.

3.6 Aquarium Fish

Nearly 80% of the aquarium fish exported from Sri Lanka are marine species collected from the wild. The balance 20% came from breeding of fresh water species and collections of other indigenous species from rivers and river water bodies. The major collecting areas of marine species are Trincomalee, Tangalle, Batticaloa, Mannar, Kalpitiya and Galle.

In 1981, Sri Lanka was exporting a volume of 140 tons to the value of Rs. 30.7 million. In 1987, the figures were, volume 130 tons, value Rs. 37.7 million. The internal war has affected the industry.

In the fisheries export sector of Sri Lanka, aquarium fish is second only to shrimp.

(Information - extracted from Business World - 20.09.1998)

In the recent past, the major portion of the exports consisted of marine species. Recently, the fresh water species are also gaining in importance. It will be a very profitable industry to breed local as well as imported varieties of aquarium fish, that are popular in the export market.

The export earning of aquarium fish in 1996, reached Rs. 300 millions.

4. FISHING BOATS AND GEAR

4.1 Fishing Boats

The District Implementation Plans - 1977, as given in the general description of Marine Small Scale Fisheries FAO/UNDP (RAS/74/031), give the number of boats as follows:

	Mechanised	Non-mechanised
Gear without craft.		8,075
Indigenous crafts.	2,780	
17 - 18 foot FRP Boats.	2,501	
3.5 ton (28 - 32 foot) Boats.	2,408	
11 ton (34 foot) Boats	12	
Long liners - (317 G.T.)	2	
Trawlers - (236 G.T.)	5	

The number of fishing boats targeted in Master Plan 1979 - 1983 for Coastal Fisheries is as follows -

	1979	1983
28 - 32 foot boats	2,305	3,026
17 - 24 foot boats	3,250	5,250
Indigenous mechanised boats	4,290	5,280
Non-mechanised Indigenous crafts	13,230	12,735

Also, under various foreign funded projects, it was hoped to introduce for offshore fisheries:-

Project	Fund	Boats	Nos
South West Coast	Asian Development Bank	38 foot FRP	30
North West Coast	Abu Dhabi	34 foot trawlers	50
		34 foot drift net	50

		34 foot combination	50
		50 foot comminution	2
East Coast	Netherlands	33 foot drift net	30
West Coast	Asian Development Bank	34 foot combination	50
		50 foot combination	2
Cey.Nor Projects		38 - 65 foot	29

It was also hoped to procure 5 vessels for Deep sea tuna fishing.

In the West Coast Project was a novel component of 1,500 Nos. 20 foot class vessels fitted with sails to increase speed, with some of these provided with propeller ducts to save on fuel consumption.

It was a peculiar situation that the fishermen were poor throughout and did not have the financial stability to participate in the mechanisation programmes of the government or in its drive to increase the number of fishing boats towards development. The government had to provide large subsidies to the fisheries sector to increase the number of boats to meet its target.

The first five year Master Plan 1979 - 1983 itself carried the following subsidies:-

New outboard Motors	-	50% on cost.
New inboard Motors	-	50% on cost.
New boats of 17 - 24 feet	-	35% on cost of hull, engine and gear.
New boats of 28 - 32 feet	-	35% on cost of hull, engine and gear.
New boats of 32 - 40 feet	-	35% on cost of hull and engine
New boats of over 40 feet	-	25% on cost of hull and engine.

Even these subsidies were not enough to induce the fishermen to purchase boats, engines and gear. The government arranged

with the two state owned banks to provide loans up to 88% of the balance cost, thus reducing the initial payment to 12% of the balance cost or 7.8% of the total cost. Further the bank's collateral requirements were made less stringent, with their accepting guarantees of other fishermen - borrowers as well as the boats purchased under the scheme as security for the loans.

The Administration Report 1990 of the Ministry of Fisheries give the number of boats in operation as:

- Traditional boats - non - mechanised	14,929
- Traditional boats - mechanised with out board motors	3,491
- 17' - 23' FRP. boats with outboard motors	8,341
- 3.5 tons (28' - 32') with inboard motors	3,385
- above 3.5 tons - (above 32')	228
	30,374

Most of the boats in the North and the Eastern provinces did not operate during this period.

Similar credit on easy terms was extended for repairs as well as replacements of engines and gear.

The Sri Lankan boatyards were considered adequate and competent to build the coastal vessels. But, for the offshore vessels, the 34 foot class and above, foreign technical know-how had to be obtained. Under the Abu Dhabi North West Coast Project, the White Fish Authority of U.K., an internationally recognised firm in the field of fishing vessel construction, were the consultants.

4.2 Fishing Gear

Shortage of fishing gear has been, almost a permanent constraint in the fishing industry.

With the first Master Plan 1979 - 1983, the import duty on nets was removed. The monopoly of the Ceylon Fisheries Corporation in importing nets was also removed, with the private sector swinging into full participation in solving the problem.

The private sector also moved into the manufacture of fishing nets, encouraged by the tax incentives offered. The Ceylon Petroleum Corporation commissioned a plant for the manufacture of nylon yarn to meet the local demand.

However, imports continue to meet the demand for floats and certain newer and rarer types of gear such as equipment for poll and line, long line, purse seine and trawl fishing.

It has already been noted that buyers of boats of 17 - 32 feet could get a government subsidy of 35% on their purchases of gear, while all were entitled to bank loan facilities of 88% of the cost - (net cost, if subsidised).

4.3 Repairs and maintenance of boats

Hull repairs have not been a serious problem as the fishermen undertake these themselves with relatively little assistance.

Maintenance of the engines has always been a problem to the fishermen. To start with the suppliers of engines failed -

(a) to supply with the inboard engines, instructions on installations, often resulting in incorrect installations.

(b) to supply with the engines, operating and maintenance manuals in the language of the fisherman. These were in the language of the manufacturers.

(c) to import and make readily available adequate spare parts and thereby sell these at exceptionally high prices.

(d) to provide repair facilities. Generally, they restricted themselves to

providing repair and maintenance services during the guarantee period, by using mobile repair vans. These services were technically inadequate and too infrequent.

(e) to provide training facilities to private mechanics boat in their work shops as well as with the manufacturers.

So, generally, all repairs are done in auto repair shops which lack specialised equipment for handling marine engines and by mechanics not skilled in dismantling marine engines and diagnosing faults.

5. ACCESSORIES AND FACILITIES

5.1 Ice

Fish landing in Sri Lanka are iced for transport and sale and not frozen. The fish are packed with broken ice and saw dust in wooden crates and transported by lorry or van. In 1978, ice was manufactured in 44 ice-making plants, 30 of which belonged to the private sectors and 50% of the ice-making plants were located in Colombo, with the balance in the fish producing areas, along the coast.

The supply of ice for fish storage and transport, in 1978, was about 60,000 tons as against a demand for 70,000 tons. The shortage caused some fish wastage and supply of poor quality products.

The Master Plan 1979 - 1983, included a programme for 48 insulated beach holding rooms, 10 refrigerated holding rooms in consumer districts, one cold storage complex, 69 ice plants, 4 mobile ice plants and 22 refrigerated trucks. The most important component of the programme was the construction of 69 ice plants, of varying sizes but mostly of 5 to 10 tons/day production capacity.

Whilst the private sector was willing to make a substantial contribution, the state had to play a major role in the investment programme, because of the remoteness of many fish landing points, the fluctuating nature of fish landings and operational difficulties arising from a lack good water and electricity supplies in some areas, making investments less attractive.

The 10 refrigerated holding rooms in the consumer (inland) districts could hold fish on ice and provide ice for district retail operations. The cold storage complex was planned for the Jaffna District which had inadequate cold storage facilities.

The 48 insulated beach holding rooms were to be located at strategic intervals along the beaches and cater to the 400 principal landing

points, from which the fishing fleet operates. They would hold wet fish on ice and were meant for use by the fishermen and private traders as well their operators, the Ceylon Fisheries Corporation.

The Ceylon fisheries Corporation was to operate the 22 refrigerated trucks, moving frozen fish from cold storage tow holesale and retail markets.

Freezing as well as distribution of frozen fish, will be undertaken as a last resort during the glut or to build up a store of bait for longlining, since freezing is expensive and also, frozen fish is not preferred by consumers.

5.2 Marketing

The Ceylon Fisheries Corporation established in 1964, to catch, purchase and sell fish on a national basis and the re-organisation in 1970 of 292 small co-operatives societies, did not make any impact on the proper marketing of fish.

The services and marketing role, which these societies should have developed, continued to be in the hands of the traditional "mudalalis" or middle men and the small traders.

Under the Master Plan 1979 - 1983, the Ceylon Fisheries Corporation was assigned an important role. "The primary objective of the Corporation in fish marketing is to improve and stabilise the supply of fish in the market. In order to achieve this objective, it will extend its fish purchasing schemes both in terms of value and purchasing areas covered by the schemes. It will store fish purchases in the peak fishing seasons for releases in the off seasons. By increasing its share of the total domestic fish purchases and sales and by maintaining reasonable marketing margins the CFC will act as a price leader ensuring a fair deal to both the producer and the consumer. The CFC will also play a significant role, in the improvement of the quality of fish supplied to the market by improving its methods of handling processing, storing and

retailing its own products and by selling increased quantities of ice and cold storage space to the private sector".

However, nearly all the fish landings are still made by small scale fishing units. Most of the fishing crafts are small, being, say, less than 30 feet in length and the landings are besides the homes of the fishermen in the open coast or protected bays or lagoons. The thousand fishing villages are thousand landing points. Harbours are unnecessarily elaborate and too far apart. The middlemen or 'mudalalis' are there at the landing point, purchase the bulk of the fish, pack it in ice, transport it to the sales centres and also sell it. They, also, finance the majority of the fishing households, through a linked chain within themselves which link the middlemen at the final sales point to the consumer, to the middlemen at the first sales point of the fishermen after they had beached their craft. The fish is sold un-iced to the trader and since the fish deteriorates quickly in the hot and humid climate of the coasts, the fishermen do not bargain but accept a pre-arranged price. This enables the fisherman to purchase his daily requirements from the shop of the middleman, thus getting entangled in debt and obligation, in the traditional way, without a hope of redemption.

5.3 Harbours

Fishing harbours at Mutual, Galle and Trincomalee have all the facilities- ice and freezing plants, curing yards, canneries and other processing plants, storage and export facilities.

Secondary harbours were established at Tangalle, Mirissa, Beruwela, Negombo, Wennapuwa, Kalpitya, Mannar, Myliddy and Valaichchenai. Facilities include subways, repair shops, ice plants, cold storage and others.

The needs of the planned offshore fleet are mostly covered by these harbours.

Most of the fishing craft engaged in coastal fishing are of less than 30 feet in length, and the fishermen like to beach these besides their homes. The result is that most of the small mechanised boats are unable to operate on large sections of the coastal fishing grounds during monsoon periods. Harbours with break waters are too expensive to justify the supporting of coastal fishing vessels at any one fishing centre. Lower cost alternatives have to be tried. These include the opening of river and canal mouths to fishing boats, and the construction of jetties, beacon lights and shore facilities at suitably sheltered places. These facilities shall include among others, cold storages, fish on ice storage, ice plant, ice storages, bunkering and repair work shops.

6. IMPORTS AND EXPORTS

Imports of fish have always been allowed liberally, except when curtailed, due to shortages in foreign exchange. There have always been a consumer demand for imported dried fish from the Maldives - Maldive Fish. From the point of view of the Sri Lankan consumer, there is no substitute for this.

The unsettled conditions in the North and East from 1983, led to a fall in the total catch and in 1990, there was practically no catch from the Northern and the Eastern provinces. This led to increased imports.

Exports have always been encouraged, of the high value species like shrimps, lobsters, shark fins, beche-de-mer and mussels.

Imports and Exports for a few years are as follows -

	Imports		Exports	
	Tons	Value Rs. Million	Tons	Value Rs. Million
1991	52,101	2,000	2,496	770
1992	55,000	2,330	4,477	1,480
1993	58,486	2,190	9,007	3,180
1994	56,262	2,890	9,007	3,180
1995	68,370	3,370	8,468	3,770
1996	-	-	8,570	4,380

Source - Imports - Administrative Reports of the Ministry of Fisheries.

Exports - Customs - Foreign Trade Statistics.

It may be noted the while the imports are of cheap varieties, the exports consist of high priced ones.

7. THE FISHING POPULATION

The first Census of Marine Fisheries was carried out, in 1972. A total of 43,352 households were enumerated as engaged in fishing and fish processing. Of these 40,194 households were engaged in fishing only, 3,075 in fishing and fish processing and 83 in fish processing only. The total number of persons enumerated in the 43,352 households was 244,642.

The Census of Inland Fisheries limited itself to 23 of the biggest inland tank areas (covering about 40,000 hectares) as it was felt that the rest of the inland fishing was carried out, only for home consumption. It identified 412 households permanently engaged in fishing and fish processing. There were an additional 377 migrant fishing households but these were considered to have been included in the 43,352 households living in the marine villages.

The 43,352 fishing households lived in 969 villages. Of these 54.6% of the households were in large villages of over 100 families each, 37% in villages of 20 - 100 households and 8.4% in small villages of under 20 households.

The fishermen are generally poor. The Socio-Economic survey of the fishing population of 1972, indicated that over 54% of the households lived in temporary structures where the walls are constructed of wattle and daub and thatched with cadjans, palmyrah leaves or straw. Nearly 60% of the households lived in dwelling of less than 30 sq. ft. floor space with an average of 5 - 6 persons in each.

The number of fishermen steadily increased to 57,000 in 1978 to 72,413 in 1981. The Fisheries Survey conducted in 1989, enumerated 110,000 persons engaged in the Fisheries Industry. The Fishing population as per the Administrative Report - 1990 was 468,109 of which 412,200 and 55,909 belonged to the marine and inland fisheries sectors respectively.

The fishing community has the lowest literacy rate and the highest fertility rate. Women are not engaged in income generating activities except in helping their families by mending nets.

The Women's Bureau of Sri Lanka did a survey of 8 fishing villages in 1981 and reported that the fisherwomen of Negombo, are the most active in every aspect of fishing industry (except actually going out to sea). In the southern coastline, there are women engaged in coconut fibre rope making and also, in lace making, handicrafts and ornaments which have a sale with the tourists. But, 66% of the women are reported to do nothing except cooking and looking after the children.

Apart from providing the means of production and increasing production, the Master Plans also paid some attention to raising the standard of living of the fishermen. The first Master Plan provided for the construction of 10,800 houses with latrines and 1,350 wells.

Storms and cyclones, with resultant loss of life and property have caused considerable distress to the fishing community. It was arranged to broadcast storm warnings and also set up beacon lights for guidance, improved radio communication with vessels and co-ordinated air-sea operations of rescue. Further, expanded and improved schemes of insurance against loss of life and property were worked out with the Insurance Corporation with special features of coverage during all seasons and operations, even outside the marine waters of Sri Lanka and of low premia. Subsequently a non-contributory state financed accident compensation scheme was also introduced.

8. GOVERNMENT FINANCE AND FOREIGN ASSISTANCE

8.1 Government Finance

It is necessary and appropriate at this stage to examine the amount of money spent on the fisheries sector, both the Government Funds and Foreign Assistance received.

The increased priority accorded to fisheries development is clearly reflected in the increased capital expenditure released to the Ministry of Fisheries through the annual budgets.

	Rs. (million)		Rs. (million)
1975	67.8	1987	367.9
1978	115.1	1996	862.6
1980	236.4	1997	921.0
1983	132.0	1998	1,096.0
1985	235.5		

Source - Central Bank reports.

8.2 Foreign Assistance

A. Technical Assistance

1. FAO / UNDP: Development of small-scale fisheries in South West Asia - RAS/74/031

- assist the participating countries in formulating policy guidelines
- and development conceptes.

Started: October 1975.

Duration: 27 months.

Budget - UNDP:$ 160,000

Governments:$ 25,000

Location - Colombo.

		- identify constraints limiting the development of small scale fisheries.	
2.	**FAO / UNDP**	Sri Lanka Fisheries Development Project - SRC/72/051 - To assist in establishing a modern skipjack industry with live bait, - to establish a supporting live bait fishery, - to establish canning & fish meal plants. - determine feasibility for purse seine fishery, pole and line and gill net fishery. others	Started: January 1973 Duration: 60 months. Budget - UNDP $ 1,568,460 Government - $ 824,154
3.	**FAO / UNDP:**	Central Institute of Aquaculture, Development and Training - SRL/74/085 - To assist development of Inland aquaulture by imparting the theoretical and practical training.	Budget - UNDE:- UNDP $ 1,652,250 - Government Rs. 10,220,700
4.	**FAO/SIDA:** Regional	Centre for the development of traditional fishing communities. - Establish a system for collection of data revalent	Started - August 1976 Duration - upto 6 years.

		to small scale fisheries. - Assist in the formulation of plans and projects. - Implement projects of experimental and demonstrational nature. - Train staff of fishery administration and develop extension services.	(Preparatory phase - 1 year) Budget : SIDA $ 180,000 for phase I Location - Colombo for prep. phase.
5.	**FAO/SIDE**	Institute of fish technology SRL/28/SWE. - reduce spoilage of fish products. - find uses for presently under utilised species. - further knowledge on improved handling, preservation, processing and marketing.	Started: July 1976 Duration: 5 years with prep. phase - 1 yr Budget: SIDA: $ 547,000 Govt. Rs. 5,900,000 Location: Colombo.
6.	**Japan Bilateral Aid.**	Sri Lanka Fisheries Training Institute. - To provide training, practical and theoretical, to persons who will work as skippers and engineers of larger fishing vessels. - To conduct research and experiments for the improvement and development of offshore and deep-sea fishing techniques.	Started; April 1975 Budget: Yen 295 Million. Govt. Rs. 3,556,000 Location: Colombo.

7.	**DANIDA**	Technical assistance (refrigeration) to the Ceylon Fisheries Corporation.	Started: November 1975 Duration: 2 years. Location: Colombo.
8.	**Norges Godtemplar Ungdoms Forbund Norway.**	Cey-nor Development Foundation. - To assist development of fisheries in Sri Lanka, to create employment opportunities by carrying out the following:- - Construction of f.r.p. and ferro- cement boats. - processing and export of sea food. - production of ice. - manufacture of fishing nets. - commercial fishing operations.	Started: 1967 Duration: 10 yaars. Budget: Rs. 7.85 m upto 1976. Government - Nil Location: Jaffna
9.	**CIDA**	Small boat repair Workshop Project. - To establish repair workshop in selected fishing centres for operation by fisheries Co-operatives.	
10.	**CIDA**	Assistance in planning fisheries research and resources assessment.	

B. Investment Projects

11.	**World Bank**	Tuna Fishery Development Project. 11/76/CEY/8. To undertake economic development of - Tuns resources using small boats: Six 70 foot liner boats. Six 45 foot pole and line boats.	Locations: Galle Fisheries Harbour.
12.	**Dutch Govt**	East Coast Fishery Development Project. - to increase production from the coastal and offshore fishery off the east coast of Sri Lanka by providing - - Fifty 10 metre mechanised fishing vessels. - a fishery harbour at Valaichenai to serve as a base for the operation of the vessels.. - shore facilities - vessel repairs, ice. cold storage, fuel ect.	Netherlands.
13.	**Miseror. Germany**	Establishment of ice and holding room facilities at large fish landing centres.	Started: May 1975. Budget. DM. 400,000 Govt.Rs. 450,000

		- at 5 fishing centres for short term storage of wet fish on ice to protect the producer from heavy fluctuations in prices.	
14.	**Prepared**	South East Coast Fishery Development Project. - to increase production from the coastal fishery off the south east coast of Sri Lanka by the introduction of 175 small surf landing fishing boats.	
15.	**Norwegian Financed**	Trawler Project:- - to provide seven fishing trawlers to exploit dimersal resources on Pedro Bank.	Started: 1977 Location: Trincomalee
16.	**Abu Dhabi fund for Arab Economic Development**	Small boat trawling project for Palk Bay and Gulf of Mannar - - to introduce 150 Nos. 32' F.R.P. trawlers for exploiting prawns and dimersal fish resources in the coastal waters of the Gulf of Mannar and Palk Bay. - to introduce 20 Nos. 38' and 2 Nos. 60' multi-purpose vessels to other areas.	Received: Rs. 170 million
17.	**Asian Development Bank.**	Sri Lanka Fisheries Project. to augment the mechanisation programme for the coastal fishery by introducing 200 Nos. locally built 28' f.r.p. boats off the south and south west coasts. - to introduce 30 Nos f.r.p. 38' fishing vessels for offshore pelagic resources off the south and south west coast. - improvement of harbour and anchorage facilities for offshore fishing boats. - to provide supplementary inputs for vessel maintenance and fish marketing. eg: vehicles, repair workshops and fish storage cabinets. - to provide expert consultant services in the form of a Fishing Boat Expert, a Project Advisor and two Master Fishermen.	Started: March 1973. Budget: $ 3,100,000 Govt. Rs. 16 million. Location: Galle.
18.	**Chinese Bilateral Aid**	Experimental fish Breeding station. - experimental breeding of larger species of Chinese Fresh Water Fish and the production of fry for use in the programme of aquaculture development with special emphasis on intensive pond fish culture.	Started: June 1976 Budget: Yuan 520,000 Plus Rs.5,255,000 Govt. Rs. 1,650,000
19.	**Prepared**	Fishing Gear Factory Project. - to establish a factory for the local manufacture of synthetic twine, nets and ropes.	(Joint Venture)

Source: Ministry of Fisheries - General description of Marine Small Scale Fisheries - Sri Lanka (RAS/74/03 - wp No. a (Rev)

SOME MORE NEW PROJECTS

1. Sri Lanka - China Joint Venture styled 'Lankdua' for harvesting marine delicacies for export such a beche-de-mer and jelly fish.

2. Asian Development Bank funded Rs. 346m. West Coast Fishery Project aimed at improving the living conditions of the fishermen while work had been done on fuel economy methods and the introduction of propeller ducts on 600 fishing vessels.

3. The Asian Development Bank had approved a Rs. 434m. aquaculture project.

4. US Aid Sail Boat Project - Rs. 2.68m. to determine the feasibility of sail power and the construction of 5 boats using he basic design of a 31 ton boat that could be modified for both engine and sail power.

5. The experimental beach landing craft that was first brought to Sri Lanka had been modified into a 28 foot fibre glass prototype with British Aid and five vessels were doing test runs under Bruce de Weeny.

NOTE

Information on further flow of foreign assistance is not available to the writer. Yet, it is noted that Foreign Aid had continued to flow in a large way. If observed very closely, these are efforts to create markets of the developed countries, for their finished products by improving the purchasing power of the recipient countries and to control the growing inflation in their countries. Some consider it as humanitarian assistance too.

8.3 Food and Agriculture Organisation (F.A.O.)

Having seen the flow of Foreign Technical Assistance and Foreign Funds into the country for development of the fishing industry, it is necessary to take special notice of the role of the Food and Agriculture Organisation (F.A.O) in this development. The F.A.O. is an allied social welfare agency of the United Nations Organisation, like the World Health Organisation (WHO), The United Nations Children's Fund (UNICEF) and others.

The F.A.O. had six regional bodies of which the Indian Ocean Fisheries Commission (I.O.F.C.) was set up in 1967 with some 40 members - 30 of the members were coastal states bordering the Indian Ocean and others were developed countries with commercial or development co-operation interests in the area. The IOFC had three subsidiary bodies for the Gulfs, the South West Indian Ocean and the Bay of Bengal. The Committee for the Development and Management of Fisheries in the Bay of Bengal (Bay of Bengal Committee) had its inaugural session in Dec. 1981 in Colombo. The member countries were India, Bangladesh, Burma, Malaysia, Maldives, Thailand and Sri Lanka.

The Eighth Session of the IOFC Committee on the management of Indian Ocean Tuna was held on 3 - 5th Dec. 1985. In response to the discussions in the Joint Tuna Management Committee of the Indo-Pacific Fisheries Commission and the Indian Ocean Fisheries Commission and on the recommendation of these parent commissions, the Indo-Pacific Tuna Development and Management Programme (IPTP) was established in Colombo.

The F.A.O. assisted Sri Lanka's Fisheries Development in various ways:

1. Motorisation of the fishing fleet.
   In 1950's and 1960's during the initial stages of the government mechanisation programme, the FAO provided development support for a diesel inboard engined 3.5 tonner, which with a few

modifications, is still the most popular motorised boat and the successful outboard mechanisation of kattumarans.

2. Items 1 to (under - Foreign Assistance - A. Technical Assistance) in the previous section.

3. With the declaration of the EEZ in 1978, provided assistance in various fields -

   indicating the most feasible capture methods.

   possible commercial arrangements with foreign fishing organisations on mutually advantageous terms including joint ventures with other countries.

   fielded a consultancy mission for studying the possibility of developing cheaper alternatives to expensive harbours.

   legal expertise for revision of national legislation for the management and development of fish resources within the EEZ.

   efforts to reduce the cost of fishing, particularly in the small scale sector eg. sails for propulsion and stationery fishing methods.

   assist in the efficient management and utilisation of fishery resources that are available to the member countries within the 320 kilometre EEZ.

   international arrangements for surveillance and control.

   others.

8.4 National Aquatic Resources Agency (NARA)

NARA shines as an organisation of prime importance in the management of the national aquatic resources. It was the research division of the Department of Fisheries that was uplifted in 1981 to

become the National Aquatic Resources Agency and functions as a multi-faceted organisation under the Ministry of Fisheries and Aquatic resources, identifying the living and non-living resources in the island's sea and inland waters, managing, developing and controlling these are the objectives of this Agency.

At present more than 40 scientists are working in various fields. But, in Sri Lanka except in the University of Ruhunu, fishing is not a subject for a university degree. It is thus difficult to obtain the required, suitable researchers in fishing.

Except for the North and the East, the coastal fisheries have exceeded the optimum level of production. Providing proper management to maintain the sustainable yield of these resources, development of offshore fishing, management of inland waters to maintain a sustainable output, assessment of the potential of the coral reefs where aquarium fishes breed, and the inland fresh waters for aquarium fish breeding, the capacity of the environment to maintain its safe status in the face of the fast developing shrimp culture, are some of the many fields in which the institution is engaged.

The recently obtained research vessel named Sayuri is engaged in research in the ocean waters.

8.5 Centre for Development of Fisheries - University of Jaffna

The University of Jaffna started a Centre for Development of Fisheries in early 1998. It is expected to develop into the Faculty of Fisheries, with proper research divisions, to be located in Mullaitivu, in the futures.

The Centre provides a Diploma course of one year duration. This is blessing to those students who though qualified to enter the University, find themselves left out, because of the cut off marks system. Annually, 50 students are trained, and the course of study includes technical know-how in fishing, management of resources and social development.

9. DANGERS OF OVER-EXPLOITATION COLLAPSE OF FAMOUS FISHERIES

Having come to an end of a review of the fisheries activities in Sri Lanka, it is felt necessary to record a note of warning on over exploitation of fish resources.

Under the caption, "Technological innovations - a mixed blessing", Dr. Veravat Hongskul, Secretary General of SEAFDEC (South East Asian Fisheries Development Centre) has stated at an FAO Symposium, "increased production resulting from technological advances is unfortunately not matched by fish stock productivity. In fact, as the first increases, the second decreases". He continued, "Trawling activities also damage bottom communities. At the beginning of trawling in the Gulf of Thailand, a great number of Neptune's cup sponges which provide shelter for bottom fishes were destroyed by trawlers. The practice of "muro ami" operations in the Philippines also, destroys the coral reefs". - SEAFDEC vol. .9 No. 2. 1986.

Some countries which have already destroyed these resources by over fishing, using the so called efficient modern gear, have realised their folly and banned "Otter Board" trawl and small meshed weighted dram nets which scrape the sea bed, trapping all the fish, big and small and uprooting all vegetation and destroy the fishing ground. These countries are now constructing artificial breeding places, shelters, and floating rafts to attract fish to breed.

In tropical countries like Sri Lanka, fish resources comprise a large number of varieties of species with generally low levels of abundance, compared with temperate waters which are characterised by a relatively fewer number of species, present in very large numbers. The mixed resource in the tropics would contain fish in various sizes, at various stages in the life cycle, all sharing the same habitat. In the continental shelf of Sri Lanka are reefs, rocks and depressions on the sea bed where marine vegetation and all types of tiny organisms - plankton

flourish, providing good food for all varieties of fish. The small varieties feed on the plankton and the larger ones from the deep sea come to prey on the small ones. Also, certain varieties travel long distances for spawning in the sheltered waters of the bays and inlets of the continental shelf.

In Sri Lanka, the coastal waters tend to be over exploited or may be said to have reached the maximum yield as far as the pelagic (surface dwelling) species are concerned. With the collapse of production in the North and the East which contributed 55% of the catch of the island, Government funds as well as Foreign Aid, all went into the south and the west. The schemes formulated for offshore and deep sea fishing failed and the boats issued meant for these destinations, fished in the coastal waters due to escalating oil prices. The new comers to fishing, (those coming from the non-traditional fishing sectors) operating mechanised boats belonging to non-fishermen middlemen, do not know that there is more in fishing than just catching or hunting. The traditional fishermen make wise use of existing resources and conserve fish and keep stocks in areas where they can be obtained when required ie. farming of fish as opposed to hunting. Further, the traditional fishermen have nets of various sizes and fish particular species of fish at particular seasons or even according to the phases of the moon. He does not collect all species at all stages of life as can be collected into purse seine nets. Some of the modern gear and devices like the purse seine with light attractions and Fish Aggregating Devices (FAD) can produce voluminous catches but ruin the fishery. It is well advised to reserve the coastal fishery to the traditional fishermen and send the commercial or more enterprising to the offshore or the deep. In due course this was realised and the alternative of encouraging offshore fishing was resorted to. The offshore fishing which produced 0.7 ton in 1983 produced 60 ton in 1995. Yet, it may be observed that the problem continues in the south and the west.

Here is a record of fisheries that collapsed dramatically as a result of uncontrolled exploitation, irrespective of the gear used:-

* Sardine fishery of California, one of the biggest fisheries in the world, had a peak catch in 1936/37 of 800,000 tons and declined to virtually nothing.

* Anchovy fishery off Peru, the biggest single specie fishery in the world, with a potential yield of 10 million tons, disappeared due to changes in environment and over-exploitation.

* The Japanese herring fishery in the North Pacific, the herring fishery in the North Sea, the pilchard fishery off South Africa and Namibia, the British Columbia herring fishery off North East Pacific, have all become records in history.

In the fact of all these, serious note must be taken of the FAO's advice of better management, to secure long lasting and justly distributed benefits from the valuable and renewable resources. Some possible measures suggested are:-

* "Limited entry" - number of fishing units are kept at a level commensurate with the size of the fish stocks.

* Catch quota - only specific amount of certain fish, in certain areas, is landed each year.

* Closed season to protect spawners.

* Gear regulations restricting design (mesh sizes of the nets) and their use.

Careful thought should be given to the implementation of these measures. They can produce side effects like initially reducing the earnings of fishermen and ban on certain type of gear will affect those who have already invested in such gear.

There is however, a bright side to the dismal scene. FAO itself reported that there do exist, resources that are largely untapped. For Sri Lanka, the offshore and the deep sea continue to hold good promise.

DEVELOPMENT OF FISHERIES WITH SPECIAL ATTENTION TO THAMIL AREAS

10. THAMIL AREAS

10.1 The Projection

Having made a reasonable study of various aspects of the fisheries industry of Sri Lanka, the richness of the resources and the historical progress of their exploitation and the development of the infra-structure, an attempt is now made, to project the development into the future of the fisheries of the Thamil areas. This shall form the basis for future action. This is also meant to allay the fears of those infested with doubts on the economic feasibility of the Thamil areas by themselves. However, the theory and philosophy of developments, shall apply equally well to Sri Lanka as a whole.

The objectives of the development plan shall be:-

1. to make the fishing population, rich and self reliant, enjoying a standard of living, equal to that of any other sector.

2. to exploit the available sustainable yield of the fish resources to satisfy the consumers needs of the Tamil areas and the rest of the population of Sri Lanka as well as to develop an export trade of fish and fish products.

3. to develop and foster allied industries like boat building and net manufacture as well as subsidiary industries like the production of fish meal for animal husbandry and the processing and canning of fish for human consumption.

4. to provide avenues of employment in the fishing, allied and ancillary industries.

The Thamil areas are in a peculiar situation of having to do reconstruction and development. Reconstruction has to be done, because al though it has a history of having produced 55% of the catch of Sri Lanka, the ethnic 'war' has reduced production to nothing. Now, it has to start from scratch. There is an advantage in this, however, in that, starting from seratch there are no inherited mistakes to amend.

10.2 Fishing Grounds of the Tamil areas

a. Coastal fishery

About two-thirds of the entire sea coast of Sri Lanka, belong to the north and the east, which have been the traditional homeland of the Thamils.

The sea coast extends as follows:-

Department of Fisheries Extension Officers' Divisions	km.
Jaffna - Kilinochchi	392.6
Puttalam - Chilaw	206.0
Mannar	164.1
Mullaitivu	96.5
Trincomalee	141.6
Batticaloa	251.0
Kalmunai	115.8
	1,367.6
Sri Lanka total coastline	1,739.3

Source - Sri Lanka Fisheries Year Book 1997 - 1999

The 100 fathom line extends in the north-west to join the Indian continental shelf and in the north-east, the Pedro Banks. The Palk Bay and the Gulf of Mannar in the north-west and the Pedro Banks in the north east provide trawling grounds of around 5,180 sq. kilometres, in additions to the continental shelf around the rest of the coast line. Thus, the proportion of Sri Lanka fisheries, falling within the Thamil areas is in far excess of two thirds.

b. Aquaculture

Further, nearly 30% of the fresh water tanks and reservoirs, originally constructed for irrigational purposes and found suitable also for aquaculture, fall within the Thamil areas. The Jaffna, Puttalam and Batticaloa lagoons which form about 90% of the brackish water lagoons and marshes, suitable for aquaculture, fall in the Thamil areas.

DFEO Divisions	Inland Fishery in Hectares		
	Fresh water	Saline water	Marshes
Jaffna	6,711	45,525	2,276
Kilinochchi	-	11,917	7,070
Mannar	4,867	3,828	874
Puttalam, Chilaw	3,833	39,119	3,210
Mullaitivu	8,595	9,232	428
Trincomalee	8,133	18,317	2,043
Batticaloa	9,541	13,682	1,303
Kalmunai	18,642	7,235	100
	60,322	148,855	17,304
	201,832	158,016	18,489

Source - Resource Development, Ministry of Lands and Mahaweli Development.

11. DEVELOPMENT OF THE FISHERIES

11.1 Coastal Fishery

The coastal fishery shall be exclusively reserved for the traditional fishermen.

Experience has shown an over crowding of fishing activities in the coastal zone, with the boats meant for offshore fishing also concentrating in the coastal area. The commercial fishermen, the new comers attracted to fishing, have no sense of conservation of fish and they fish and over-fish taking with them babies and females with eggs and all. On the contrary, the traditional fisherman knows the spawning grounds and avoids them as his reserve for a future day. Also, he uses nets of different mesh sizes in different seasons and even for the different phases of the moon, to avoid smaller ones of the bigger varieties and catch only mature ones of even the small species. Also, it is known that in Sri Lanka, the maximum sustainable yield has been reached in the coastal pelagic (surface dwelling) species and attention has to be directed to the dimersal (bottom dwelling and rock) species. Hence this reservation of the coastal fishery or the continental shelf for the traditional fishermen, shall give them better catches and thereby raise their standard of living to the required heights.

A question arises as to how this reservation can be enforced. Having to start from scratch, this can be done without difficulty, by stipulating the boat sizes. The indigenous fishing crafts with or without engines and FRP (fibreglass reinforced plastic) boats of 17' to 24' with engines shall only be used in the coastal waters. Boats of over 24' shall not be seen fishing in the coastal waters.

11.2 Offshore Fishery

On the offshore fishery, a detailed study has yet to be done of the potential resources and the best fishing methods. However, the

research and the exploratory fishing done so far, have shown most promising resources. These consist of migratory shoals of large pelagic species of skipjack, tuna and shark, generally weighing up to 25 kg. a single fish.

The present 11 ton (34') boats shall do fishing only in the offshore and beyond (and not in the coastal waters). The best fishing vessels to exploit these stocks are combination drift net and pole and line vessels. The resources of the small pelagic species of the coastal zone shall provide the required bait. These 11 ton boats were designed in 1982 to meet the requirements of the Abu Dhabi funded North-west Coast Fishery Development Project.

These are fitted with 56 h.p. engines, S.S.B. radio and net/line haulers. They have insulated holds which can carry about 6 tons of fish and ice, provision for crew accommodation and can stay at sea for 3 to 4 days. 60 sets of large mesh gill nets and 80 sets of tuna long lines provide the required complement of nets.

Other boats that could be introduced to the offshore waters will be up to 50 feet in length with all facilities.

It may be noted here, that the 3.5 ton (28' - 32') boats in use now, have been found unsuitable for their intended purposes. They were intended for offshore and to stay at sea for more than one day at a time. But experience has shown that they have too little fish holding capacity and crew accommodations for this purpose. Hence they crowd the coastal waters. The 22' - 24' boats with smaller engines have produced the same results at lesser costs.

11.3 Ocean Fishery

Various efforts were made in the past. The chief constraints have been the large capital costs of the vessels and the gear and equipment and the lack of experience in ocean fishing. Feasibility studies were done for the introduction of 350 ton vessels, with local companies purchasing the vessels and hiring foreign management and crew for a five year period,

financed by Work Bank loan or joint ventures between local and foreign companies with provision for training locals in ocean fishing and company management.

Attempts at licensing foreign vessels to fish in Sri Lanka waters, on terms of benefit to the country, failed to produce the required results, as enforcement was not effective. Joint ventures with foreign companies have produced problems. These vessels compete with the traditional fishermen in the coastal waters and do not necessarily go to the ocean as agreed.

It may be possible to obtain technical and financial assistance through the Food and Agriculture Organisation (F.A.O) in general and in particular through its subsidiary, the Indian Ocean Management Tuna Secretariat in Colombo. The assistance could include possible commerciat arrangements with foreign fishing organisations on mutually advantageous terms, identifying resources indicating the most feasible capture methods,fielding consultancy missions for developing cheaper alternatives to expensive harbours and others.

Whatever and to whomever the approach is made for expertise and finance it is absolutely essential that the ocean tuna fisheries should be exploited without delay as -

> Japanese and Taiwanese trawlers are known to poach in our tuna rich waters. A conservative estimate had put the figures poached out of our waters at 50,000 tons annually. This not only deprives us of our legitimate resources but carries along with it the danger of over-exploitation of the fisheries. Plunderers cannot be expected to conserve at the same time. Once the fisheries collapse due to over exploitation and damage to the ecology, it will take a couple of centuries to recover.

Thamil areas will require all the foreign exchange it can earn, for its development and prosperity and tuna is valued for home consumption as well as export. An indirect estimate points to an annual potential of 60,000 to 70,000 ton of tuna, beyond the presently exploited range of the EEZ.

11.4 Aquaculture - Inland Fishery

The process of aquaculture is in simple terms, hatching, stocking and harvesting. This shall continue on an extensive basis in the large water bodies and reservoirs. The following varieties of fish have been found suitable- tilapia mozambica and nairotica, traditional carp, milk fish, stinging cat fish, etrophus, striped snake heads, fresh water shark and the common and flower resberra. These have to be bred in suitable combinations and protection has to be provided against predators like otters, water snakes, carnivorous birds and iguanas.

Raising of fish for human consumption, in cages and pens, is a traditional practice in many South East Asian and Latin American countries. This was gaining popularity because of the ease of operation and the relatively low harvesting costs. The inland fisheries division of the Ministry under a project financed by the International Development Research Centre ((IDRC), Canada, conducted trials in cages and pens (enclosures) put in large water bodies and excellent results were obtained.

"The growth of fingerlings of different cultivable fish species such as the Chinese carps, Indian carps and tilapia species, the effect of low and high density stocking on production and size and the feeding of the fish with a prepared supplementary diet as against non-feeding were studied in detail.

The results showed that the fish cage frames could be constructed out of bamboo and the net cages out of a nylon netting with a mesh size of 10mm. The pens or enclosures could be constructed of water resistant wooden poles such as hora or palu, driven into the lagoon bottom at 10 foot intervals, with nylon net attached to each pole to complete the enclosure.

Of the species tester for culture in cages the most desired was Oreochromis niloticus. This species of tilapia had a fast growth rate, consume artificial diets readily and was resistant to disease usually common where fish are concentrated in confined spaces.

The results showed that the optimum stocking density for culture of 0. niloticus in cages, ranged from 200 to 400 fingerlings per cu. metre and that the most economical diet and that containing a crude protein level of 17%. The trials also showed that it was possible to harvest marketable fish ranging individually from 175 to 240 gms . throughout the year, after the initial 6 months grow out period. The average production per cage, volume 5 cu. meters, per month was around 350 kg., giving a annual production of 4,200 kg.

For a fisherman who could take to cage culture activity during his off period, a minimum number of 9 cages was needed to achieve this productivity.

Pen culture trials with chanos chanos (milk fish) showed that the technologically sound and the most economical area of a pen was 0.25 hectare and a stocking density of 3 fingerlings per cubic meter, yielded around, 2,000 kg of milk fish per hectare per annum.

This technology has to be extended to fishermen living in areas adjoining large reservoirs. The method of cage and pen construction, preparation of artificial diets for fish using rice bran, poonac, maize residue and non-conventional food stuffs such as Ipil Ipil leaves, will have to be carefully demonstrated to the fish farmer for cage and pen culture to be taken up on large scale successfully" *from a statement of Mr. Festus Perera, Minister of Fisheries - Daily News, February 25th, 1987.*

Since construction of ponds require suitable land and capital, pond fish culture may be considered obsolete for our environment.

Cage and pen culture will prove attractive, particularly to those living in lands adjoining irrigation reservoirs and brackish water lagoons.

To fully develop its resources, Thamil areas should develop all its irrigation tanks and water bodies for, what may be called 'extensive' cultivation of fish. All encouragement should be given, whenever required for 'intensive' culture in cages and pens.

It may also be noted that the fishing craft to be used in the Inland water bodies, shall be the traditional or FRP non-mechanised boats.

Those interested in mixed farming around water bodies will find that ducks, pigs and other animal husbandry contribute to fish rearing in that they make the water bodies more fertile and richer by their refuse. Also, kitchen and garden refuse can be used to feed fish in cages and pens as well as ponds and tanks.

11.5 Aquaculture - Brackish Water Fishery

Brackish water fishery, so far, is concentrated in the farming of shrimp only, although every other marine specie could be cultivated equally well, because of the high price it commands in the export market. Shrimp culture is a sophisticated business. But training could be had in the private commercial farms already established in Batticaloa and in other parts of the country. Also, it is a fast developing industry in India and the Marine Products Export Development Authority (MPEDA) of India, has district organisations in many parts of the country, including the Tanjore District, and training could be had in one of their centres. Training is required on:-

- selection of site for culture,
- stocking, breeding and harvesting,
- care of the water and the use of fertilisers,
- feed preparation for the shrimps,
- handling and processing for export,
- others.

As shrimp farming is capital intensive, the Export Development Board of Sri Lanka envisaged the development of small scale farming in 0.5 ha, 1 ha, 2 ha, alongside the large scale farms, so that they could benefit by mutual co-operation. The small scale farmers could obtain their requirements of fry, feed, and whatever necessary technical advice from the large scale operators. They could in turn sell their harvests to the commercial scale operators at prevailing market prices.

The cages and pen culture described under "Inland Fishery" applies equally well to aquaculture in brackish water and in particular to shrimp culture. This will benefit the small fishermen who are now, only collectors in the brackish waters.

Scientists in the Universities of Sri Lanka have carried out studies and surveys to investigate cultivable species in the future. It has been shown that sea weed, mussel and oyster could be cultured in many lagoons, especially in the northern districts. The studies on Artemia (brine shrimp) well known food organism for shrimp and other fish, indicate that it could be cultured in more than 2,000 ha, of ponds already used for salt production. The Artemia cysts, thus produced without affecting salt production, will be used in the aquaculture programme. The excess, if any, can be exported to Indonesia, Thailand, and the Philippines. Adult artemia can also be used to strengthen the protein content in the human food.

Although strictly outside the scope of this work, it may be mentioned here, that the scientific breeding of farm animals has extended itself to fish breeding too. Artificial selection, line breeding and line crossing have all been applied to fishes. The Japanese fish farmers when they buy their seed stock from the hatcheries specify their requirements as "all females stock" or "all triploid stock". Hybrid, disease resistant species as well as new species can now be produced.

11.6 Aquarium Fish

The share of the Thamil areas in the export of Aquarium fish should be maintained and expanded further. Aquaculture of aquarium fish on a commercial basis should be encouraged. School children could take to it as a hobby and could earn their pocket money.

11.7 Oyster Fishing

Pearl Oyster fishing was a regular feature during the British rule. The last fishing operation was carried out in 1950. Perhaps, there

was over exploitation and/or damage to the ecology and no operation has been done thereafter. According to Dr. Bruin, F.A.O. consultant, pearl oysters are found in the Mannar Bay from February to May. A survey carried out in 1981, recorded oyster resources off the coast of chilavathurai. But, a detailed survey is necessary to obtain information on the feasibility of exploiting these resources. Divers with aqua lungs only, should carry out the survey, no dredgers or other appliances should be used.

Perhaps, Japanese assistance could be obtained to explore possibilities of culturing pearl oysters on a regular basis.

11.8 Whale Watching

Sri Lanka and particularly the Thamil areas, for some reason of nature is blessed with a significant concentration of whales, not observed in any other part of the Northern Indian Ocean. On the world scene, whales and other marine mammals have been reduced in numbers of a serious plight as a result of poorly regulated commercial exploitation. But our country has had a long commitment to conservation that accompanied the development of our civilisation over many centuries. The values that guide our people towards conservation of wild life, lead to a non-consumptive approach towards marine mammals, mainly the whales, dugong and dolphin. It has now been found that commercial whale watching produces revenues greater than their commercial exploitation.

Whale watching off Trincomalee and of dolphins and dugong off Mannar, could be developed as tourist attractions.

12. OTHER REQUIREMENTS

12.1 Fishing Boats

It has been noted that the present 3.5 ton (28'-32') boats should be given up. These were originally meant for offshore fishing. But they did not have the required fish holding capacity and crew accommodation for the purpose and began to crowd the coastal waters. In the coastal waters, the smaller boats, 17' - 24' are more efficient with smaller engines.

Research should continue with beachable crafts. The traditional fishermen like to moor their boats beside their homes at night, for reasons of security and convenience and in keeping with this tradition easily beachable crafts, will reduce the need for many harbours and jetties.

An F.A.O. consultant and naval architect Mr. Oyvind Gulbradsen designed SRL II, a 28' vessel, which saved 30% on fuel and can be used on open beaches and does not involve harbours. Its propeller and rudder can be lifted with a lever mechanism installed within. This makes it possible to navigate shallow waters.

50 foot vessels, initiated by the White Fish Authority of U.K. who are reputed consultants in boat designing, could be introduced to do exploratory work in the ocean as well as to fish in the offshore.

Our boat building technology and facilities were good and the boat construction industry has to be revived. All the boats could be constructed locally except those meant for ocean fishing. These have to be purchased from abroad.

12.2 Fishing Gear

Imports have to be made of floats and certain types of gear such as equipment for pole and line, long line and trawl fishing. The private sector could be encouraged to set up factories for net and rope manufacture.

12.3 Marketing

Marketing should be well organised and no fisherman shall be left to the mercy of the middleman. Well organised co-operative societies should take over marketing. State organisations should step in, in times of glut with guaranteed prices.

Insulated holding rooms shall also e established at strategic consumer points.

Refrigerated trucks should be used for transport of fish, particularly to main harbours for processing and / or export.

12.4 Harbours and Ice Plants

Fishing harbours at Valaichenai and Trincomalee have all the facilities. It is necessary to raise the secondary harbours at Myliddy and Mannar also to first grade harbours. These harbours should have all the facilities which modern fishing harbours have. The facilities include ice and freezing plants, storages, curing yards, canneries, and other processing plants, export facilities, repair shops with slipways and all the other facilities of the secondary harbours.

Secondary harbours shall be established at Sinnapalamunai (Akaraipattu), Kalkuddah, Mankerni (Vakarai), Kokilai, Mullaitivu, Point Pedro, Karainagar, Chilavathurai and Kalpitiya. Facilities that should be provided are repair shops, ice plants and cold stores, insulated holding rooms, bunkering and others.

Beacon lights shall be installed at strategic points to cover up the entire coast line.

12.5 Research and Education in Fisheries

1. Central Fisheries Research Institute

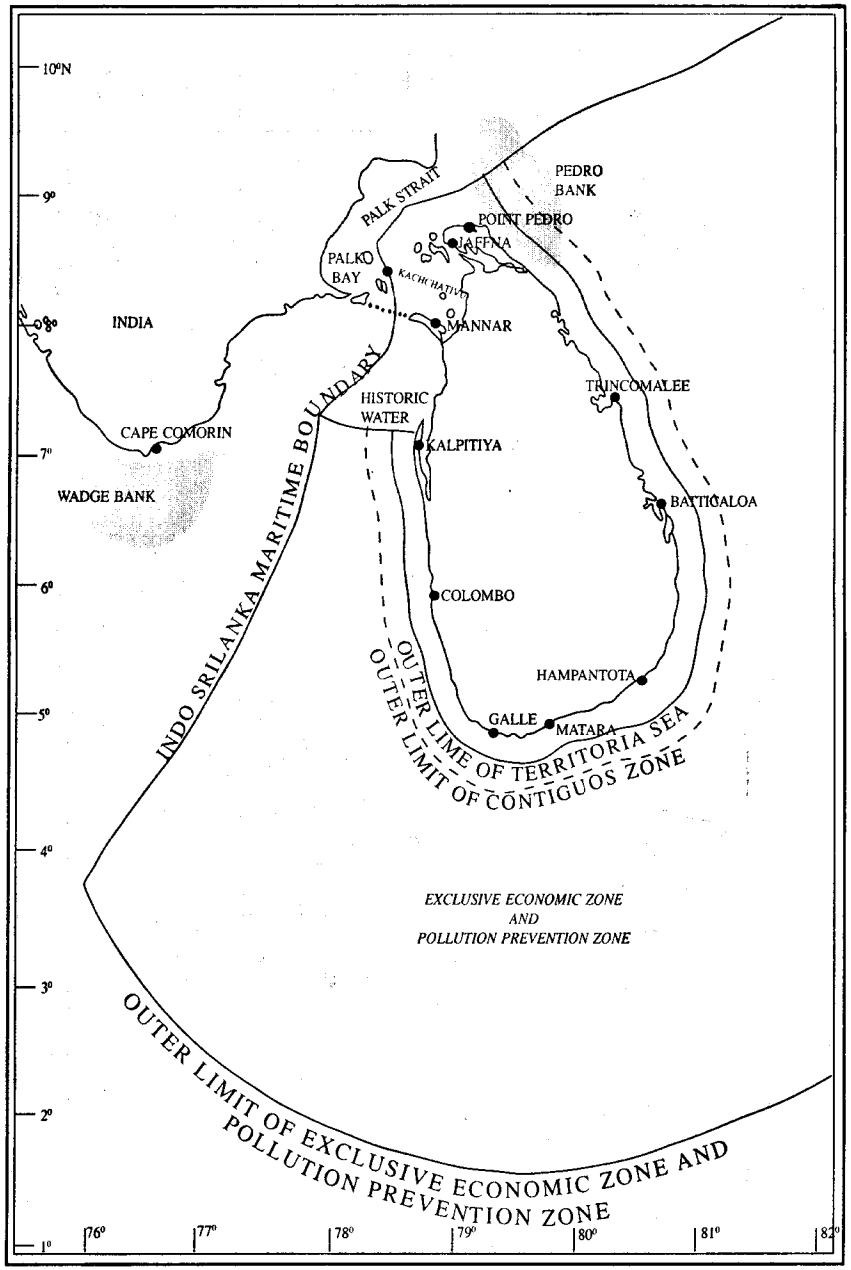
   - marine fisheries - identifying fish resources,
   - aquaculture of all types,
   - fishing craft and gear technology,
   - fish handling and processing.
   - development of fish products,
   - others.

2. Fisheries Training Institute and Fishermen Training Centres

   The Fisheries Training Institute shall provide high level training courses in the various fields of fishing and guide and supervise and control the Fishermen Training Centres.

   The Fishermen Training Centres shall provide vocational courses in various fields to suit the needs and demands of the community.

ANNEXTURE I



ANNEXTURE II