

The Role of Fisheries Sector in the Coastal Fishing Communities of Sri Lanka

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Abstract

Sri Lanka is an island country with a land area of 65 610 km². With the declaration of the exclusive economic zone (EEZ) in 1976, the country gained sovereign rights over an ocean area of 536 000 km² and EEZ extending from 24 to 200 nm. The continental shelf is about 26 000 km² with an average width of around 22 km, and the coastline is 1 100 km long.

The total annual fish production of Sri Lanka was 25 000 t in 1952 and 269 850 t in 1998. Major fish species caught in Sri Lankan waters are skipjack, blood fish, yellow fin tuna, mullet, shark, trevally, Spanish mackerel, prawns, lobsters. Gross domestic product (GDP) is composed of services, agriculture including forestry and fishery, manufacturing, construction and mining and quarrying. Of these, the agriculture sector contributed 21% with 2.5% coming from the fisheries subsector in 1998. In 1975, fisheries contributed Rs420 million to GDP and substantially improved to Rs24 823 million (US\$382 million at 1 US\$ = 64.90 Sri Lanka Rupee; source: oanda.com) in 1998. Export volume from fisheries was 3 240 t in 1985, and 11 433 t in 1998; equivalent to an export value of Rs453 mil (US\$7 million) to Rs6 732 mil. (US\$104 million).

The fisheries sector has provided direct employment opportunities to over 115 000 people and indirect benefits to 100 000 people in related occupations such as fish processing, boat building and other equipment manufacture and trade and public sector organizations. A socioeconomic survey conducted in 1996 noted a fisher population of 83 776 with 81.7% having fishing as their sole source of income, 12.5% as their main source and 4.3% as their second source.

Fish is the main and preferred source of animal protein in Sri Lanka. Fish consumption accounts for 5% of the total food consumption and per capita fish consumption was 12.77 kg in 1998. However fish constitutes a substantial share of expenditure on food because of its high domestic price.

The policy of almost all fisheries projects in Sri Lanka has been to maximize the fisheries resource utilization for direct extractive purposes rather than for sustainable resource management. This short-range orientation has increased the efficiency of fishing operations through the application of advanced technologies in fish capture, leading to a shift from the traditional fishing methods to the adoption of modern fishing gear. This has led to the depletion of fishery resources, particularly in the coastal waters. Thus there is a need to adopt programmes that emphasize the development of offshore fishing and thereby reduce fishing pressure in the coastal areas. Implementation of alternative livelihood opportunities would also improve the quality of life of coastal fishers.

Introduction

Sri Lanka is situated between 6° and 10° N latitude and 80° and 82° East longitude in the Indian Ocean. The Palk Strait and the Gulf of Mannar separate India and Sri Lanka. The island has a land area of 65 610 km². With the declaration of the Exclusive Economic Zone (EEZ) in 1976, the Government of Sri Lanka obtained sovereign rights over an ocean area of 536 000 km² and the natural resources therein. Sri Lanka's sea area is approximately 7 times its land area and the sea area consists of a territorial sea extending up to 12 nm, a contiguous zone extending from 12 to 24 nm and an EEZ extending from 24 to 200 nm. The continental shelf of about 26 000 km² is narrow with an average width of around 22 km. The coastline is 1 100 km long, meanders along sandy beaches, extensive lagoons and estuaries, mangroves, coastal marshes and dunes. Seawards lie reefs of sandstone or coral and shallow beds of coastal and estuary seagrass.

Sri Lanka is divided into nine provinces, within which there are 25 administrative districts and about 317 subdivisions with clusters of villages headed by a divisional secretary. The total number of villages in Sri Lanka is approximately 38 000 and the total estimated population is 18.7 million (1998), which consists of Sinhalese (74%), Tamil (18%), Ceylon moors (7%) and Burghers and Malays (1%). Out of the total population, about 0.6% are estimated to be active fishers who live in 1 269 fishing villages in 15 District Fisheries Officer's Divisions. Accordingly, the estimated fishing population is around 538 560 (18.7 million x 0.6% x 4.8 average family size).

Two monsoons and two inter-monsoon periods mainly influence Sri Lanka's climate. From May to September is the southwest monsoon. It is also associated with cyclones, wind circulation or

depressions. The southwest monsoon brings heavy rainfall especially to the southwestern region of the country. The northeast monsoon period falls between December to February and then the northeastern part of the country experiences heavy rainfall. One inter-monsoon period is from March to April and the other is from October to November. This makes coastal fishing activities seasonal.

“Within Sri Lanka's coastal zone are found:

- *approximately 24% of the land area with 32% of the population;*
- *nearly 80% of the annual fish production, contributing 30% of the consumable animal protein;*
- *production of 40% of the gross domestic product (GDP);*
- *almost 70% of the industrial output;*
- *65% of the urban area;*
- *principal road and rail transport infrastructure, for e.g. coastal highways such as Galle Road and Negombo Road and railway lines form Colombo to Matara and Colombo to Puttalam;*
- *the country's salterns, commercial ports, fishery harbours and anchorages, and areas of brackish-water aquaculture;*
- *80% of tourism-related infrastructure, with the majority being located in the western and southwestern coastal belt (most of them 15 m away from the shoreline);*
- *80% of the country's fish production which, in 1996, was 228 550 t;*
- *some of the richest biodiversity areas include coral reefs, seagrass beds, mangroves, coastal wetland, estuaries, lagoons and sanctuaries covering 160 000 ha;*
- *substantial reserves of valuable minerals (e.g. Pulmudai mineral sands);*
- *a significant extent of agricultural land;*
- *sizable areas of usable land not yet developed;*
- *nearly 100 sites of special historical, archaeological, cultural, or religious significance; and*
- *another 100 sites of special scenic or recreational*

importance.” (*Pacific RIM Innovation and Management Exponents*, 1999).

The socioeconomic profile presented here encompasses the status of fishery resources and production, contribution of the fisheries sector to the economic growth and the social and economic status of small scale fishers in Sri Lanka.

In Sri Lanka, the following features identify small scale fisheries:

- a. Fishing fleet comprised of outboard motor craft, non-motorized traditional craft and traditional stationary fishing gear.
- b. Fishing operations carried out within a day and limited to coastal waters (40 km), lagoons, rivers and freshwater bodies.
- c. Foreign components as well as modern technical inputs are minimal and the fishing operations are controlled by seasonal changes.
- d. Operations mostly depend on family labor and a high level of owner participation.
- e. The important fishing gear used is drift-net.

The large-scale fishing operations in Sri Lanka embody the following features:

- a. Fishing fleet comprised of multi-day boats, which are propelled by in-board engines.
- b. Fishing operations generally continue from 10 to 45 days, beyond 40 km from the shore.
- c. Fishing generally is not affected by seasonal changes and the quantity of fish production is fairly high.
- d. Foreign component in production input is high. The use of modern equipment and technology is also high.
- e. Operations are capital intensive, but the owner's participation in the fishing operation is negligible.
- f. The important fishing gear in use is primarily drift-net, long line and troll line.

Generally, in Sri Lanka, the term 'small scale fisheries' is almost synonymous with coastal fisheries and 'offshore/deep-sea fishery' is synonymous with large scale fishery. (National Aquatic Resources Research and Development Agency (NARA) 1998).

Method and Limitations of the Study

The Ministry of Fisheries and Aquatic Resources Development in Sri Lanka is developing a database

with special emphasis on coastal fisheries under the project on Sustainable Management of Coastal Fish Stocks in Asia (ADB-RETA5766). Data collected from secondary sources on socioeconomic profiles of coastal fishery areas and population were used for the study.

Unfortunately, regular comprehensive assessment of fishing activities in Sri Lanka is seldom undertaken. The first national census of marine fisheries was conducted in 1972, and since then marine censuses have been confined to the west, south and the east coastal districts. Smaller regionally based studies have been conducted e.g. (Bay of Bengal Programme 1991), but Sri Lanka has been unable to conduct a general census of population and statistics due to ethnic conflicts in the north and east of the country. This paper is thus confined to a cross-sectional analysis of the social and economic conditions of coastal fisheries in Sri Lanka. The dearth of socioeconomic data related to other sectors makes it difficult to compare the quality of life of fishing households with those of others.

The statistics data were gathered from information collected under Research Study No. 99 by Hector Kobbekaduwa (Agrarian Research and Training Institute) on "Farming System of Kirindi Oya Irrigation and Settlement Project".

Status of Fishery Resources

The marine fisheries industry in Sri Lanka has a long history. During the early stages of development, traditional methods of fishing using canoes and gear, such as beach-seines, hand-line, nets made out of coir and stake nets, were used in coastal areas. The coastal inhabitants were primarily engaged in exploiting resources close to the shore in and around their settlements. Fish production in the 1940s was in the region of 40 000 t (de Zylva 1954). A high percentage of this production came predominantly from beach seines. The major fisheries such as beach seining and stake netting were under traditional control.

A stage of rapid development in fisheries began in the late 1950s with motorization and the introduction of modern craft and methods (Joseph 1983). With these technological developments and the open-access nature of operations, fishing effort has accelerated over the years, both by increasing fishing power and fishing units. In addition, the

state provided incentives in the form of subsidies on capital goods and institutional credit (De Silva et al. 1996) The technological inputs increased coastal fish production from 84 400 t in 1962 to 152 750 t in 1999.

The stable phase of coastal fisheries development, with a reduced rate of increment in production has led to a leveling off at around 150 000 - 160 000 t since the 1980s. The fishing effort has increased with the catch remaining static. The fishing sector has reacted to this declining catch rate by investing in new fishing gear such as purse seine, ring net in pelagic fisheries and bottom long-line and trammel nets in demersal fisheries. This type of gear is beyond the capital resources of the majority of small scale fishers. There is therefore inequitable distribution of income from fishing, leading to increased conflicts among fishers in traditional fisheries and in modern fisheries (Fernando 1984). However, improvement in technology has led to marginal increases in catch per unit effort (CPUE), but also to the over-exploitation of coastal resources. The involvement of around 120 000 fishers in mostly small scale fishing in the coastal waters has forced the government to consider small scale fisheries in Sri Lanka as a priority target for poverty relief.

Reliable and up-dated information on fishery resources in Sri Lanka is a major deficiency. The following excerpt presents some of the assessments arrived at in a past survey.

“The Fridtjot Nansen” Survey in 1978 - 80 estimated the potential yield from coastal fish resources within the continental shelf to be 250 000 t per year of pelagic and demersal species; pelagic fish were estimated to have a maximum sustainable yield of 170 000 t per year and demersal species 80 000 t. The present yield from demersal species is around 35 000 t. Inshore demersal resources of shrimp (5 000 - 7 000 t) and spiny lobster (600 t) are most valuable”. (Atapattu 1996)

“Preliminary estimates of Sri Lanka’s offshore resources indicate that 50 000 - 90 000 t per year could be taken without the risk of overexploitation. The species include yellow fin tuna, skipjack tuna, big-eye tuna, billfishes and pelagic and sharks. The total marine fisheries resources, including Sri Lanka’s offshore area, could thus perhaps yield up to 350 000 t per year (Atapattu 1996)”

Fish Production

The total annual Sri Lankan fisheries production in 1952 was of the order of 25 000 t (De Bruin et al. 1994). In 1960, it reached 53 359 t of which 91% (48 760 t) was from the coastal fisheries. The percentage of coastal fish production out of total fish production had been within the range of 80 - 90% until 1990. In 1983, when coastal fish production peaked at 184 000 t, the coastal fishery contribution to the total production was 80%. The total fish production in 1998 was 269 850 t. Out of this, 62% was from coastal fisheries, 27% was from the offshore and deep-sea fisheries, whereas only 11% was from the inland fisheries.

The highest level of coastal fish production in the recent past was recorded in 1994 (Table 1). Production declined by 12% in 1995 and 13% in 1996 from 1994 levels. There is now a continuing downward trend in the contribution of the coastal fish production to total fish production. This decline is mainly in the north and the east of the country.

Table 1. Contributions of coastal fish production to total fish production.

Year	Coastal Fish Production (t)	Percentage of Total Production
1960	48 760	91
1970	85 015	88
1974	100 805	90
1983	184 049	80
1984	136 642	80
1990	134 132	81
1993	169 900	76
1994	174 500	78
1995	157 500	66
1996	149 300	65
1997	152 750	63
1998	166 700	62

Source: Ministry of Fisheries and Aquatic Resources Development (MFARD) 1999b.

Coastal fish production by major fish species is shown in Table 2. (The category 'others' shows the weaknesses of the data collection system). Beach seine species (mackerel, sardines and anchovies etc.) have continuously added a marked tonnage to coastal fish production. The total coastal fish production in 1991 was 156 150 t and the individual contributions of skipjack and beach seine species and 'others' is shown as 10%, 21% and 27% respectively. By 1998, the total coastal fish production of major species had risen to 16 670

and the percentage addition of the 'others' category had decreased to 19% while skipjack and beach seine species increased to 17% and 29% respectively. The total percentage of skipjack, yellowfin tuna and other tuna in 1991 was 23% and continued to increase; in 1996 it was 36.4% and in 1998 it was 34.3%. Tuna have been the major catch in Sri Lanka's coastal waters over the years, and there has been a diminishing catch of seer, trawley and sharks.

Table 2. Coastal fish production (t) by major fish species from 1991 to 1998.

Fish species	Year							
	1991	1992	1993	1994	1995	1996	1997	1998
Seer (Spanish mackerel)	3 916	3 524	3 369	3 200	2 993	2 170	2 400	2 500
Trevally	8 975	8 526	8 378	8 000	6 910	6 090	6 900	7 000
Skipjack	16 690	18 359	19 316	20 475	23 548	25 630	27 600	28 200
Yellow Fin	10 664	11 730	11 981	13 180	12 050	12 740	14 600	13 900
Blood fish (Other tuna)	9 325	10 258	10 681	11 215	17 642	15 940	14 800	15 100
Shark	19 045	18 306	19 061	19 500	14 017	7 110	8 800	8 500
Mullet	8 658	9 870	10 277	10 585	7 088	8 970	9 100	9 200
Beach seine	33 426	35 097	37 379	38 870	49 785	48 220	42 700	49 800
Prawns	5 176	6 470	6 737	7 000	**	**	**	**
Lobsters	789	828	862	1 000	400	**	**	**
Others	42 486	40 202	41 859	41 475	23 067	22 430	25 850	32 500
TOTAL	156 150	163 170	169 900	174 500	157 500	149 300	152 750	166 700

Note: ** Included under others

Source: Ministry of Fisheries and Aquatic Resources Development (MFARD) 1999b.

Contribution of Fisheries Sector to Gross Domestic Product (GDP)

After the liberalization of the economy in 1977, the sectoral composition of the GDP of Sri Lanka changed and the service sector became the major contributor. The agricultural sector with the sub-sectors of forestry and fisheries contributed 21% percent to GDP in 1998 (Fig. 1). The fisheries sub-sector contribution to GDP in 1998 was 2.5%.

The total GDP in 1975 increased 36-fold to Rs985 586 million (US\$15 186 million) by 1998 and to Rs773 500 million (US\$13 115 million at 1 US\$ = 58.98 Rs), a 28-fold increase by 1997 (Table 3). The fisheries sector contribution to GDP of 1975 increased by 59-fold to Rs24 823 million (US\$384 million) by 1998 and to Rs21 265 million (US\$361 million), a 50-fold increase by 1997.

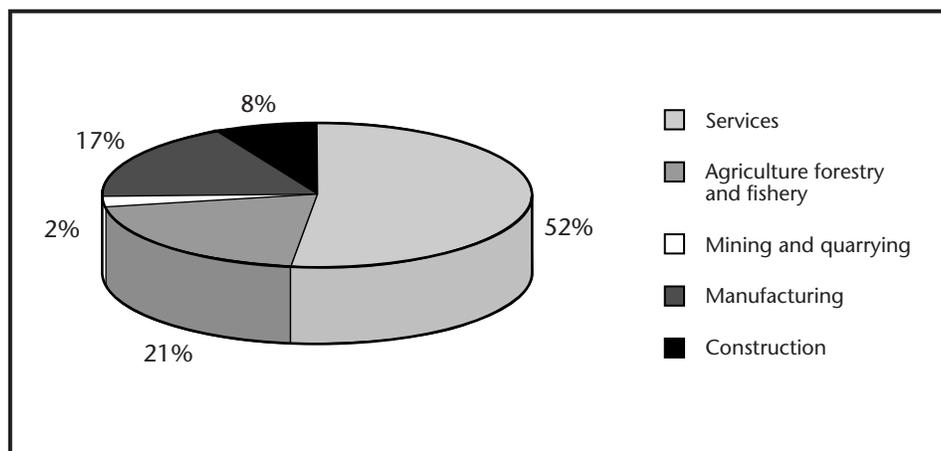


Fig. 1. Sectoral composition of GDP in Sri Lanka 1998.

Table 3. Contributions of the fisheries sector to GDP.

Year	Total GDP (Rs million)	Fisheries Sector (Rs million)	Percentage
1975	27 040	420	1.5
1983	119 202	1 733	1.4
1984	147 344	2 590	1.7
1989	248 230	5 087	2.0
1990	317 904	5 800	1.8
1994	571 131	14 376	2.5
1996	669 934	18 763	2.7
1997	773 500	21 265	2.7
1998	985 586	24 823	2.5

Source: Central Bank of Sri Lanka 1998 - 99.

Environmental Impacts

Due to the inefficient planning of fishery harbours, Sri Lanka experiences some erosion in the vicinity of such structures. In addition, coral reefs have been endangered by destructive fishing practices (use of dynamite), over-harvesting and pollution.

“Mangroves which are closely associated with estuaries and lagoons have also been harvested for various uses. Apart from the domestic uses, shrimp culture has become an exterminating factor where the mangroves in Puttalm District are concerned. Mangrove areas are

converted for use as shrimp pond aquaculture and for lowland agriculture. Over 600 ha of coastal areas between Chilaw and Puttalam, much of it mangrove forest, has been developed for aquaculture. The conversion process not only results in direct loss of mangroves by clear-cutting but also alters water flow patterns that may cause the surrounding mangroves to die. A loss of 63% of the previously existing mangroves in Puttalam lagoon has been reported to have occurred in the ten-year period from 1981 - 92 (Dayaratne and De Silva 1995)”.

Seagrass beds as well as lagoons and estuaries are

also adversely affected by fishing and related activities. In respect of seagrass beds, beach seining and dragging of propellers cause degradation. When lagoons such as those in Negombo, Mawella and Chilaw are used as harbours, various forms of effluents discharged by fishing boats contribute to contamination and pollution.

Contribution of Fishing to Income and Employment

Although the fisheries sector has contributed only around 2% to the gross national product (GNP) of the country over the years, it has provided direct employment opportunities to over 115 000 and further employment to 100 000 in related occupations such as fish processing, boat building and other equipment manufacture, and also in trade and public sector organizations. According to the

Census of Marine Fisheries in 1972, there were 969 marine fishing villages in the entire coastal region of the country. Of them, 51.3% were in small villages with 1 - 19 households, 36.3% lived in medium size villages with 20 - 99 households and 12.4% were in large fishing villages with 100 or more households. The percentage of fishing and fish processing households in small villages amounted only to 8.4%. In contrast, 54% of the households are from larger fishing villages. Over 50% of the households were in larger villages and the balance were scattered in many villages along the coastal belt. Table 4 shows a comparison of the numbers of fishing villages and the active fishers by district in 1972 and 1995. The fishing villages in the four District Fisheries Extension Officer (DFEO) divisions, namely Mannar, Jaffna, Mullativu and Killinochchi located in the northern part of the country, were excluded from the marine fisheries survey conducted in 1995.

Table 4. Active fishers by district and fishing population at the village level in Sri Lanka.

DFEO Divisions	Fishing Villages		Active Fishers by District		Fishing Population	
	1972	1995	1972	1995	1972	1995
Colombo	25	36	2 583	2 235	11 088	8 756
Negombo	23	82	5 102	10 146	21 877	38 601
Puttalam	132	108	10 806	9 795	35 665	35 812
Mannar	32	N/A	2 849	N/A	12 022	N/A
Jaffna	107	N/A	10 827	N/A	41 613	N/A
Mullativu	20	N/A	1 350	N/A	4 874	N/A
Trincomalee	61	120	2 815	7 557	13 283	33 900
Batticaloa	91	225	5 571	13 533	25 323	57 922
Kalmunai	45	246	5 826	13 224	25 691	59 064
Tangalle	91	79	1 823	4 843	8 727	19 844
Matara	53	72	3 280	5 120	16 240	21 967
Galle	231	158	3 472	5 134	18 182	21 054
Kalutara	58	78	2 210	4 150	10 477	16 667
Chilaw	N/A	65	N/A	8 039	N/A	30 901
Kilinochchi	N/A	N/A	-	-	-	-
TOTAL	969	1 269	58 514	83 776	245 062	344 488

Source: Department of Fisheries (DOF) 1973; Department of Fisheries (DOF) 1989.

Note: N/A = Not available.

Contribution of the Fisheries Sector to Foreign Exchange Earning

The details relating to foreign exchange earnings are given in Table 5. The import value in 1985 was 10 times greater than the export value for the

same year. This adverse ratio escalated to a ratio of 28 kg of imported fish to 1 kg of exported fish in 1991. However, the balance of payments of fish trading shown in Table 5 has improved since 1994. The export and import volume ratios were 1:10 in 1995, and 1:6 in 1998

Table 5. Contribution of the fisheries sector to foreign exchange earnings in Sri Lanka.

Year	Export		Import		Balance of Payment	
	Volume (t)	Value (Rs million)	Volume (t)	Value (Rs million)	Volume (t)	Value (Rs million)
1985	3 240	453	35 974	756	32 733	(303)
1986	3 410	608	32 399	838	28 988	(230)
1987	2 376	575	38 135	956	35 758	(381)
1988	3 496	824	45 632	437	42 135	(312)
1989	3 982	1 137	35 996	1 059	32 013	(48)
1990	3 162	883	37 627	949	34 464	(66)
1991	1 827	855	52 107	2 003	50 279	(1 147)
1992	3 734	1 303	55 000	2 334	51 265	(1 030)
1993	5 895	2 144	53 485	2 187	47 590	(43)
1994	7 193	3 291	56 261	2 893	49 068	398
1995	7 457	3 655	68 343	3 369	60 886	286
1996	8 364	4 125	62 883	3 426	54 518	699
1997	8 477	4 326	73 951	4 120	65 475	205
1998	11 433	6 732	71 214	3 923	58 780	2 809

Source: Central Bank of Sri Lanka 1998 - 99.

Contribution of the Fishing Sector to Domestic Nutrition

Fish is the main and preferred source of animal protein in Sri Lanka even though the level of retail fish prices has remained consistently high. All income groups consume fish in varying amounts. Fish accounts for 5% of total food consumption, although it constitutes a substantial share of expenditure on food.

According to the food balance sheet from the Department of Census and Statistics the total fish consumption in 1976 amounted to 115 000 t, representing a per capita annual consumption of 8.38 kg (Table 6). This had risen to 240 000 t and

12.77 kg respectively by 1998. The Medical Research Institute of Sri Lanka has recommended an intake of 21.0 kg of fish·head⁻¹·annum⁻¹, however this is not realistic in rural areas due to the high price of fish.

The wholesale and retail prices of fresh fish·kg⁻¹ in the Pettah Market (Colombo) are given in Table 7. During the period 1995 - 98, the retail price of every species of fish increased.

Per capita availability of calories·day⁻¹ in 1992 amounted to 2147.1 and out of this 51 calories (2.4 % of the total) was from fish. (Table 8). In 1998 the calorie intake from fish was 60 calories (2.7% of total calories 2 230)·day⁻¹.

Table 6. Contribution of fisheries sector to domestic nutrition in Sri Lanka.

Year	Production ('000 t)	Available domestic supply ('000 t)	Population ('000)	Per capita supply (kg)
1976	135	115	13 730	8.38
1980	187	155	14 738	10.56
1982	232	194	15 189	12.77
1994	224	190	17 865	10.67
1995	237	197	18 112	10.90
1996	228	240	18 315	11.47
1997	242	224	18 552	12.08
1998	260	240	18 800	12.77

Source: Department of Census and Statistics (DCS) 1976 - 98.

Table 7. Wholesale and retail prices of fresh fish in Pettah Market, Sri Lanka.

Species	1995		1996		1997		1998	
	Wholesale	Retail	Wholesale	Retail	Wholesale	Retail	Wholesale	Retail
Sardine (Salaya)	40.00	47.00	34.00	53.00	45.00	65.00	46.00	65.00
Trenched Sardine (Hurulla)	53.00	63.00	58.00	81.00	61.00	86.00	65.00	86.00
Skipjack (Balaya)	62.00	77.00	66.00	110.00	100.00	116.00	66.00	86.00
Yellow Fin Tuna (Kelawalla)	85.00	135.00	90.00	152.00	104.00	166.00	98.00	162.00
Seer (Thora)	180.70	248.00	173.00	279.00	133.00	298.00	200.00	283.00
Travelly (Paraw)	107.20	154.00	140.00	190.00	125.00	203.00	129.00	210.70
Shark (Mora)	45.00	60.00	57.00	108.00	82.00	117.00	82.00	118.00
Mackerel (Kumbalawa)	89.90	103.00	58.00	90.00	114.00	96.00	95.00	113.00
Sail Fish (Talopath)	76.00	118.00	97.00	170.00	142.00	185.00	140.00	190.00

Source: Department of Census and Statistics (DCS) 1976 - 98.

Table 8. Per capita availability of calories, protein and fat from vegetables, fish and animal resources in Sri Lanka from 1992 to 1998.

Item	1992	1993	1994	1995	1996	1997	1998
Calories per day							
Total	2 147.10	2 141.00	2 314.40	2 259.80	2 183.40	2 208.20	2 230.60
Vegetable	2 006.60	1 992.20	2 170.90	2 108.80	2 035.30	2 056.00	2 059.30
Fish	51.30	59.53	50.82	51.69	53.46	58.54	59.86
Other Animal	89.20	89.27	92.68	99.31	94.64	93.66	101.44
Protein (g/day)							
Total	51.60	53.20	56.10	56.50	54.30	54.40	54.20
Vegetable	37.20	36.90	41.00	40.80	38.90	38.10	36.90
Fish	8.81	10.56	8.99	8.97	8.98	9.76	9.97
Other Animal	5.59	5.74	6.11	6.73	6.42	6.54	7.33

Table 8. Per capita availability of calories, protein and fat from vegetables, fish and animal resources in Sri Lanka from 1992 to 1998. (continued)

Item	1992	1993	1994	1995	1996	1997	1998
Fat (g/day)							
Total	39.40	39.00	43.20	43.10	42.00	41.00	43.60
Vegetable	32.30	31.90	36.30	35.60	34.70	33.60	35.80
Fish	1.56	1.66	1.43	1.56	1.73	1.96	2.00
Other Animal	5.54	5.44	5.47	5.94	5.57	5.44	5.80

Source: Department of Census and Statistics (DCS) 1991 - 98.

Contribution of the Fishery Sector to National Food Security

In a broad sense, food security is the stock of food available for consumption. The stock of food comprises the total production along with the imports but excluding the exports. Table 9 provides the figures on per capita fish availability for consumption during the period 1985 - 98.

The total fish production of the country in 1985 was 175 403 t of which 2.5% was exported. The total fish availability in 1985 was 208 137 t, including imports of 35 974 t. Thus the per capita fish

availability amounted to 13.1 kg in 1985; subsequently it declined to 8.9 kg in 1988 and to 9.8 kg in 1989. From 1991, per capita availability increased and by 1998 the per capita fish availability was 17.0 kg·annum⁻¹.

A projection of the fisheries sector contributions to national food security for the coming years is depicted in Table 10. A greater promise is seen in the deep sea and in the aquaculture harvest for the targeted per capita fish supply in the future. The supply of fish is expected to reach the target of 19.6 kg·capita⁻¹·annum⁻¹ by 2004.

Table 9. Contribution of the fishery sector to national food security in Sri Lanka.

Year	Production (t)	Export (t)	Import (t)	Total Supply (t) (P+ I - E)*	Mid Year Population ('000)	Per Capita Fish Availability (kg)
1985	175 403	3 240	35 974	208 137	15 842	13.1
1986	183 060	3 410	32 399	215 624	16 127	13.3
1987	190 005	2 376	38 135	225 944	16 361	13.8
1988	197 527	3 496	45 632	148 392	16 586	8.9
1989	205 285	3 982	35 996	165 304	16 806	9.8
1990	183 900	3 162	37 627	218 365	16 993	12.8
1991	198 012	1 827	52 107	248 292	17 247	14.3
1992	206 170	3 734	55 000	257 436	17 405	14.7
1993	220 900	5 895	53 485	288 490	17 619	15.2
1994	224 000	7 193	56 261	273 068	17 885	15.4
1995	235 750	7 457	68 343	296 636	18 112	16.3
1996	228 550	8 364	62 883	283 063	18 315	15.4
1997	242 000	8 477	73 951	307 474	18 532	16.5
1998	260 100	11 433	71 214	319 881	18 800	17.0

Source: Ministry of Fisheries and Aquatic Resources Development (MFARD) 1999a.

Note: * P + I - E = production plus imports minus export

Table 10. Estimated per capita fish supply for Sri Lanka in 1999 - 2004.

Sub sector	1999	2000	2001	2002	2003	2004
Coastal (t)	185 000	191 000	197 000	203 000	209 000	215 000
Offshore/Deep sea (t)	65 000	69 000	74 000	80 000	86 000	92 000
Inland and Aquaculture (t)	30 000	32 000	35 000	40 100	45 900	51 000
Total (t)	280 000	292 000	306 000	323 100	340 900	350 000
Import (t)	71 266	68 898	65 790	64 000	63 000	58 000
Export (t)	8 915	10 202	11 696	13 434	15 460	17 827
Fish supply for local consumption (t)	342 351	350 660	360 094	373 666	388 440	398 173
Mid year population (millions)	19.0	19.2	19.4	19.7	20.0	20.3
Per capita fish supply per annum (kg)	18.0	18.2	18.6	19.0	19.4	19.6

Source: Ministry of Fisheries and Aquatic Resources Development (MFARD) 1999b.

Socioeconomic Status of Coastal Fishers Fishing Households by Ethnic and Religious Group

Sri Lanka is a multi-ethnic and multi-religion country. Its population comprises Sinhalese, Tamils, Moors, Malays and others. The majority (74%) of

the population is Sinhalese (Table 11), of which 60% are Buddhists Tamils are generally Hindus. Moors and the Malays follow the Islamic faith.

The total population in 1998 was 18.7 million of which 0.6% representing 538 580 persons could be treated as the fishing population belonging to 107 716 fishing households.

Table 11. Population by ethnic group and religion in Sri Lanka.

Race	Percentage	Religion	Percentage
Sinhalese	73.98	Buddhist	69.31
Tamils	18.16	Hindu	15.46
Moors	7.12	Muslim	7.64
Malays	0.29	Christian	7.49
Others	0.46	Others	0.10

Source: Department of Census and Statistics (DCS) 1976 - 98.

According to the Census of Marine Fisheries - 1972 of Sri Lanka, there were 969 fishing villages around the coastal belt with 43 352 households and 58 298 fishers engaged in active direct fishing. The total fishing population was 245 065. A survey conducted by the Census of Marine Fisheries in Sri Lanka in 1996 gave the following information: total villages in the DFEO divisions from the south, west and east numbered 1 269, with 72 133 households. These households consisted of 83 776 active fishers,

totaling 344 497 people.

Munasinghe and Cruz (1994) pointed out that more Catholics and Hindus are engaged in fishing than Buddhists. However, the socioeconomic study of the fisherfolk of four fisheries districts carried out in 1991 under the Bay of Bengal Program (BOBP) revealed the rates of the fishing households in relation to ethnic groups and religions depicted in Figure 2.

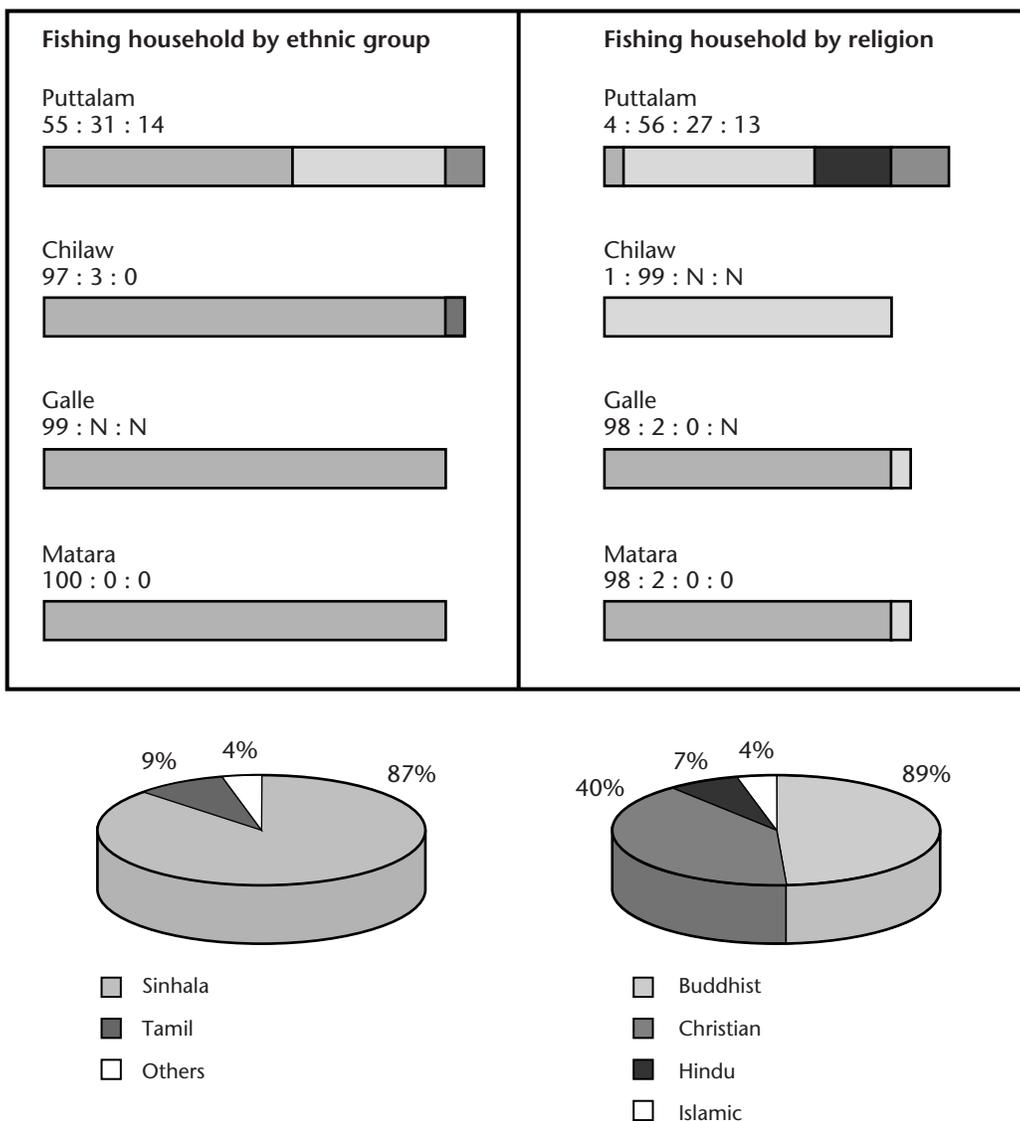


Fig. 2. Percentage of ethnic and religious groups in Sri Lanka.

The Census of Marine Fisheries in Sri Lanka 1996 (Department of Fisheries and Aquatic Resources (DFAR), 1997) indicated that there were 55 782 (77%) nuclear family households out of the total fishing households of 72 133, of which 75% (54 124) have their own houses. In some DFEO Divisions (Colombo, Kalutara, Galle, Matara, Tangalle and Puttalam), this percentage varied from 56% - 66%. The number of household members in a fishing family varied from one to nine. In 1996, there were 129 357 persons below 15 years of age and 6 614 persons over 65 years of age. The age distribution of the total work force is as follows: 20% are aged 15 to 24, 15% are aged 25 to 34, and 13% are between 35 and 44 years old. The age distribution among working fishing folk over 12 years is as follows: the age group of 35 - 44 years constitutes 28.8% of the active fishers, and the 25 - 34 years group constitutes 27.5%.

Women's participation in active fishing is minimal since the gender distribution of the fisherfolk is totally in favour of males (99.3%). The women are treated as unpaid laborers while child-caring, housekeeping and family management activities are totally entrusted to them. Some women take part in fish collection, net mending and fish marketing etc.

Although fishing in Sri Lanka is reported to be an open access activity, there is a high degree of family linkage among the fishing population. Out

of the total active fishers (83 776) in 1996, 75.2% were the sons of fishermen.

Fishing as a Source of Household Income and Employment

Table 12 provides data on the significance of fishing as a source of employment and income. Fishing in 1996 was still around 92% in terms of both sole and main income sources. There is very little fishing activity during the off-season. Fishers may be content to stay at home, or be unable to find other employment because of lack of opportunities in their own areas, or because of social barriers that do not permit change of occupation.

Table 12b. Fishing as source of employment in coastal fishing villages in Sri Lanka in 1996.

Fishing involvement	Fishers	%
Sole job	68 481	81.7
Main job	10 476	12.5
Second or Other	570	4.3
No Income from Fishing	1 249	1.5
TOTAL	83 776	100

Source Department of Fisheries and Aquatic Resources (DFAR) 1997.

Table 12a. Fishing as a source of household income in coastal villages in Sri Lanka.

Sources of Income	1972		1996	
	No. of Households	%	No. of Households	%
Sole income	35 773	82.7	51 332	71.2
Main	4 467	10.3	15 234	21.1
Second or Other	3 029	7.0	4 590	6.4
No Income from Fishing	-	-	977	1.4
TOTAL	43 269	100	72 133	100

Source: Department of Fisheries (DOF) 1973; Department of Fisheries and Aquatic Resources (DFAR) 1997.

Table 13 gives a general view of the average monthly net income obtained by the different craft owners of four DFEO divisions. The level of income varies from place to place even if the same kind of craft is used for fishing. The average income of a fisher depends on four major factors namely, method of fishing operation, size of the crew, type/category of the craft and the sharing system between the craft owner and the crew members.

The study covered gillnet fishing operations. The number of crew members in the study was as follows. For multiday boats 5; FRP boats 2 to 3; motorized traditional boats 2; non-motorized traditional *oru* 2 and non-motorized *theppam* 1 or 2. Table 13b is based on a sharing scheme for fishing crew members recommended by a committee.

Traditional crop farmers in the Kirindi Oya Irrigation and Settlement Project receive incomes of Rs2 066 (US\$31.83 in 1998) and 2 756 (US\$42.46 in 1998) respectively, very similar to the income of a crew member of non-motorized traditional *oru*s and *theppams*. The level of income of the crew of FRP boats is comparable to the rural sector income level, and to the level of the crop and livestock farmers under the new system of the Kirindi Oya Irrigation and Settlement Project (Table 14). A multiday boat crew member's income (Rs5 000 - 6 000; US\$ = 77 - 92) is comparable to the average income of an urban sector employee, and to the average income of a livestock farmer under the old system in the Kirindi Oya Irrigation and Settlement Project. (Tables 14, 15 & 16)

Table 13a. Average monthly net income obtained by craft owners in four DFEO divisions in Sri Lanka.

DFEO Division	Multiday Boat	FRP* Boat	Traditional Motorized craft	Non Motorized Traditional Oru	Non Motorized Theppam
Chilaw	28 827	17 815	-	-	6 456
Negombo	24 171	8 420	-	-	1 831
Kalutara	24 601	4 630	-	1 263	-
Galle	20 183	6 048	5 329	1 516	-
Total Average	24 445	9 228	5 329	1 389	4 143

Source: Comparative study on the economics of large and small scale fishing operations, Sri Lanka June 1998.

Note: * FRP - local name in Sri Lanka which stands for fiberglass reinforced boat.

Table 13b. Income sharing system in four DFEO divisions in Sri Lanka.

DFEO Division	Sharing proportions									
	Multiday Boats (MB)		FRP		Traditional Motorized (TM)		Non-motorized Traditional Oru (NMTO)		Non-motorized Theppam (NMT)	
	Owner	Crew	Owner	Crew	Owner	Crew	Owner	Crew	Owner	Crew
Chilaw	1/2	1/2	3/5	2/5	1/3	2/3	-	-	1/3	2/3
Negombo	1/2	1/2	1/2	1/2	1/3	2/3	-	-	1/2	1/2
Kalutara	1/2	1/2	1/2	1/2	1/2	1/2	-	-	-	-
Galle	1/2	1/2	-	-	1/2	1/2	-	-	-	-

Table 14. Average monthly income per fisher depending on type of craft used.

Type of boat for crew member	Monthly income (Rs)
Multiday	5000 - 6000
FRD	2500 - 4500
Traditional motorized	2000 - 2750
Non motorized traditional Oru	1250 - 2500
Non motorized <i>Theppam</i>	1800 - 4000

Table 15. Kirindi Oya Irrigation and Settlement Project annual family income.

Category of Farmer	New System	Old System
	Average Farm Income	Farmer Income
Crop	24 800	32 717
Livestock	-	76 621
Crop- livestock	56 445 (4 703)	110 421

Source: Survey data 1993, Kirindi Oya project .

Table 16. Average monthly income in Sri Lanka.

Sector	Average income per income receiver			
	1995/96	1990/91	1985/86	1980/81
All island	3 367	1 819	941	469
Urban	5 662	3 374	1 428	694
Rural	3 065	1 470	836	431
Estate	1 923	1 084	609	313

Source: Department of Census and Statistics (DCS) 1995 - 96.

A rapid social assessment survey conducted under TA No. 3034-SRI, Coastal Resource Management Project showed that there are about 76 500 households in the project area which covers six districts namely, Puttalm, Gampaha, Colombo, Kalutara, Galle and Hambantota, with an average annual income of Rs80 000 (or \$1 174 at an exchange rate of US\$1 = Rs68.17 in 1999). This income level is attained by 76% of the total population in the area. The majority of these households (39%) belong to low to moderate income earners with

an annual income of Rs30 000 - 63 000. The next largest group constitutes the “poor” (13%), with annual household income of around Rs30 001. The “downright poor” (24%) have an annual household income between Rs18 001 and 30 000. The remaining households, estimated to be about 24 200 are those of moderate and high income earners with annual household incomes over Rs81 000. About 24 000 households fall below the poverty line of Rs30 000 per year.

Non-fishery Sources of Employment

The employment status of all fishers can be divided into four basic groups: fishing as the sole job, the main job, the second or other job and occupation without income. Fishing is the sole source of income /employment for a very high percentage (81.7%). Table 12b shows that the number of fishers who do not earn an income from fishing is 1 249 (1.5%) of the total 8 3776 active fishers. There are 570 fishers who regard fishing as another source of employment (Table 12b).

Commercial Fishers with Other Employment

Commercial fishers are those who obtain any income from fishing activities including any trading/ bartering with the fishers. As per the 1996 Census of Marine Fisheries, the commercial fishers with other forms of employment by industry are given in Table 17. Fish drying and trading employed 1 378 commercial fishers and the agriculture sector employed 3 650 commercial fishers.

Level of Education

Sri Lanka’s literacy rate is outstanding when compared with other countries in the region. This applies to the fisheries sector too, even though there are generation links in those engaged in fisheries. There is a free education system in the country, and MFARD (Ministry of Fisheries and Aquatic Resources Development) provides basic equipment for nurseries in fishing villages.

Of the total number of active fishers, 40.6% have received education below grade five (Table 18). In the bracket “primary schools not completed (grade 1 - 5)”, there are some fishers who are illiterate. The socioeconomic study conducted by Bay of Bengal Programme (1991) showed that the over-all literacy rate of fishers was 87%, 40.4% of the sample had passed grade 5, and 15.4% of them

Table 17. Forms of employment of commercial fishers in Sri Lanka in 1996.

Forms of Employment	Number	Percentage
Fishing related activities (drying, trading)	1 378	9.7
Agriculture	3 650	26.0
Govt. sector	426	3.0
Other Industries	8 592	61.2
TOTAL	14 045	100.0

Table 18. Educational qualifications of fishers in Sri Lanka.

Level of Education	Number	Percentage
Primary school - not completed	34 014	40.6
- completed	33 876	40.4
Junior secondary school completed	12 908	15.4
Senior secondary school completed	2 978	3.6
Tertiary completed	0	0
TOTAL	83 776	100.0

Source: Census of Marine Fisheries 1998.

had passed General Certificate of Education, which is the minimum qualification required for government or private sector employment.

The level of education of the fishing community is on a par with the national level. Relative to the Kirindi Oya Irrigation and Settlement Project secondary education in the fisheries sector is not satisfactory.

Health and Nutritional Status

Sri Lanka has serious nutrition problems, especially in the rural sector as indicated by anthropometric evidence in neonates, children and perhaps mothers. However, malnutrition is not generally a serious problem in the fisheries sector

“It could be stated from general observation that malnutrition is not a problem in the two villages. The extremely emaciated or ulcerised children or those with enlarged abdomens are not in evidence. This absence of under nourishment could perhaps be attributed to the

high protein intake in the form of seafood in these villages resulting in high resistance despite health hazards which prevailed... The main problems relating to health seem to be related to sanitation and environmental factors. Twenty one percent of the houses in Nainamadama and 31% in Mankuliya do not have toilet facilities at all. It is not uncommon to find children de-faecating within the home compound, and adults using the beach in lieu of a latrine in Nainamadama, creating problems of health and environmental pollution (Leitan and Gunasekara 1995)”.

Coastal Fishing Conflicts

In Sri Lanka there was offshore commercial trawl fishing from 1920 to 1975 on the Wedge Bank. As a result of the Indo-Sri Lanka border demarcation, the whole of the Wedge Bank and one-third of the Pedro Bank were connected with the Indian Exclusive Economic Zone from 1976. This inter-governmental policy decision eliminated trawl fishing in these waters and such fishing was confined to the north and northwestern coast where the trawling grounds are suitable for prawn fishing. Unfortunately, the terrorist activities starting in the 1980s crippled the fishing industry, particularly in the north and the east of the country, making those valuable fishing grounds unavailable for trawling. Therefore, trawling for prawn is limited to the Chilaw area. This prawn trawling is conducted by 3.5 GT mechanized boats. The number of boats in operation is about 140 and they trawl throughout the season. The small scale fishers were badly affected and a conflict rose to its peak in 1991.

The Old Dutch Canal and the Mundel Lagoon fishing regulations in 1994 were spawned by the dispute that broke out between the Mundel and Udappuwa fishers. Trap net and drag net operators of Udappuwa controlled the lagoon preventing the drift netters from operating, and the Mundel fishers objected to their use of drag nets.

Purse seine gear was introduced to the fishing industry in 1950 but was not continued. As a result of the UNDP survey conducted in the 1980s on the use of the live bait and small pelagic resources, the fishers in the southwest and the northwest coastal areas started using the purse seine. Although this gear was very effective, artisanal fishers were opposed, since their areas were badly affected.

Recently, as a result of the uncontrolled proliferation of shrimp farms adjoining the Puttalam lagoon

in the Mundal lake and along the Hamilton Canal that flows through the lake ending in a lagoon in the northwestern province, conflicts have erupted between the traditional fisherfolk and the shrimp culture farmers. These shrimp culture farms have adversely affected the livelihood of the fishing communities and to a lesser degree, a small community of paddy cultivators in the area. There were 5 950 traditional fishing families in 27 villages whose livelihood was directly related to the sea, using simple “catamarans” or boats with outboard engines. When the monsoons came, they confined their fishing to the lagoon for prawn, crab and wild shrimp. The shrimp farms emitted pollutants into the lagoon, threatening its biodiversity, and this has damaged the ecosystem. As the shrimp farmers had obtained legal title deeds for the land they have converted into shrimp farms, the traditional fishers’ common property rights have diminished, resulting in conflict.

Institutions in the Fisheries Sector

The Village Communities Ordinance No. 24 of 1889, a piece of historical evidence, indicates that fishing has been an economic activity in the coastal area of Sri Lanka since time immemorial. However, the fisheries sector became a separate entity only in 1940 with the establishment of the Department of Fisheries under the provision of the Fisheries Ordinance No. 24 of 1940. A separate Ministry for Fisheries was established in 1970. Until then the Fisheries Department had been attached to large ministries such as Agriculture, Industries or Irrigation. There are four specialized divisions in addition to the Administration and Finance Divisions in the Ministry, namely, Fisheries Social Development, Planning and Monitoring Export Development and Controlling Surveillance and Air Sea Rescue. The two departments under the Ministry are the Department of Fisheries and Aquatic Resources (MFARD) and the Department of Coast Conservation. These two departments execute the Fisheries and Aquatic Resource Act No. 2 of 1996 and the Coast Conservation Act No. 57 of 1981. Apart from these, there are six agencies under the MFARD, namely, Ceylon Fisheries Harbours Corporation (CFC), Ceylon Fishery Corporation (CFC), National Aquatic Resources Research and Development Agency (NARA), Cey-nor Foundation Ltd. (Cey-nor) and the newly established National Aquaculture Development Authority (NAQDA) and National Institute of Fisheries and Nautical Engineering (NIFNE).

The 13th amendment to the constitution of Sri Lanka of November 1987, brought the provincial councils into existence. Accordingly, the 25 existing districts were grouped into eight provinces (presently nine provinces) in the north and east, and have been amalgamated into one provincial council. Four of these councils are maritime, namely northwestern, western, southern and northeastern. The provincial council does not include any matters pertaining to fisheries in its jurisdiction. “Fishing and fisheries beyond territorial water” are matters for the central government, but “fisheries other than fishing beyond territorial waters” comes under both provincial councils and the central government.

Non-governmental Organizations (NGOs)

Several non-governmental organizations (NGOs) are concerned with the fisheries sector in Sri Lanka. Some NGOs were established solely for the welfare/development of fisherfolk and others have a history of partial involvement in fisheries/fisherfolk development, particularly the marine fisherfolk. Most of the NGOs started during the 1980s and basically fall into the category of voluntary social service organizations. They are required to register with the National Secretariat for NGOs established recently under the amendment No 8 of 1998 to the Voluntary Social Services Organizations (Registration and Supervision) Act No. 31 of 1980. NGOs are registered under numerous acts and ordinances; sometimes as approved charities under the company act or incorporated bodies under an Act of Parliament or under legislation such as the Catholic Bishop Conference Act, Mutual Societies Ordinance or the Trust Ordinance. Therefore, it is very difficult to determine the number of NGOs working in the fisheries sector. The National Secretariat for NGOs had registered five NGOs working in the fisheries sector in July 2000: National Fisheries Solidarity, Small Fishers Federation, United Negombo Lagoon Fisher-Peoples Organization and Center for Fisheries Development Cooperation. The NGOs’ activities in the fisheries sector involve marketing programmes for lagoon prawn fisheries, the provision of small fishing craft, poultry farming, projects for the fishing community, assistance to migrant fishers, assistance to fishers to obtain bank loans, relief for displaced fishers, lace making, coir, rope and sewing projects to improve the income of women in the fishing communities, saving-credit schemes for fishers, small scale brackish-water prawn farming projects, leadership training, assistance in setting up fishers’ organization etc.

Fisheries Cooperative Societies

The fisheries cooperative societies are formed by the fisherfolk themselves. These societies constitute a three layer structure namely, primary societies, secondary unions and an apex federation. These societies come under the supervision of both the Department of Fisheries and the Department of Cooperatives. The fishery and community aspect is handled by the Fisheries Department whereas the Department of Cooperatives is involved in the regulatory and management aspects of the fisheries cooperatives. There are 723 village level marine fishery cooperative primary societies with a membership of 92 772 (Table 19). Fisheries subsidy schemes were of great assistance to the cooperative societies until this scheme was scrapped and the fisheries companies were formed under the Company Act.

Fisheries Cooperative Banks (IDIWARA BANKS)

Village level fisheries cooperatives, dedicated to service and highly concerned with fishing community living standards, were transformed into Idiwara Banks. This enabled the use of the managerial skills in the banking sector to strengthen the fishing community. The number of fisheries banks so established as of December 1999 was 43.

Social Implications of Fishery Policies

The policy thrust of almost all fisheries projects in Sri Lanka has been to maximize the resource utilization for direct extractive purposes rather than for sustainable resource management. This short-sighted orientation has increased the short-term efficiency of fishing operations through the application of modern advanced fish capture technology. The resulting shift from traditional fishing methods to advanced technology has depleted fish resources, particularly in the coastal waters. The lesson learnt emphasizes the necessity for reducing pressure on coastal fishery resources. Accordingly, some programmes have been implemented which encourage offshore fishing, and others which aim to improve the quality of life through providing alternative livelihood opportunities.

A novel programme has been introduced to transform fishers into entrepreneurs. This scheme established limited liability companies with the production subsidy that was earlier given to individual fishers or cooperative societies. This program selected five fishers to become the shareholders of a limited liability company registered under the Company Act. Unfortunately this has not been successful, partly due to non-availability of a legal involvement between the MFARD and the limited liability companies.

Table 19. Status of the fisheries cooperative societies in Sri Lanka as of December 1998.

Fishery Cooperative Societies	Number of Societies	Membership
Village level marine fishery co-operative primary societies	723	92 772
Reservoir-based freshwater co-operative societies	101	5 016
District level mechanised boat owners' societies (28' day boats and multi-day boats)	6	650
All ceylon madel owner's co-op. society Ltd.	1	145
District fishery co-op. unions	8	-
Other fishery societies (marketing, societies, boat building societies, ornamental fish co-op. societies)	5	205
National Fisheries co-op. Federation	1	-
TOTAL	845	98 827

MFARD has established a separate statutory body, the National Aquaculture Development Authority of Sri Lanka. This is a major policy change in the recent past, backed by another policy decision to enhance the quality of life of fishers by providing them with better shelters along with the basic infrastructure facilities, such as access roads, electricity, potable water etc. The government under its budget for 1999 allocated Rs200 million (US\$2.8 million) for a housing programme. A Japanese grant was also received for a scattered housing scheme. The government included inland reservoir areas in the housing programme.

The Ceylon Fisheries Corporation (CFC) that was listed for privatization in 1990 has continued its operation as a statutory body, coming under the preview of the MFARD. CFC, which at one time had a fleet of vessels for fish exploitation, has now confined itself to fish sales and distribution, and plays a role in providing fair prices to coastal fishers, and also quality fish at fair prices for consumers. CFC has a number of freezer-trucks and a network of attractive trade outlets. Unfortunately CFC's service is limited to selected areas owing to financial constraints.

Fisheries Cooperative Societies were a good mechanism for years for empowering fishers. These cooperative societies were reorganized in the 1980s to provide subsidies, boats, loans and assistance for income generation activities offered by the government. As these facilities are no longer available, there is little interest among members and 165 cooperative societies are now semi-active and 231 inactive out of the total 824 cooperative societies.

Development Interventions

Sri Lanka has floated seven fisheries development plans starting with the first ten-year plan in 1959. The prime objective of this multi-sectoral plan was for Sri Lanka to achieve self-sufficiency in fish production. Mechanization of the craft, deep-sea fishing by the public sector and the provision of concessionary assistance to coastal fishers were the strategies adopted towards achieving self-sufficiency. Inboard motorization of the 28ft craft (9m) was undertaken in 1958. The introduction of nylon netting, etc. in 1962 was intended to increase fish exports to the level of tea exports. The second ten-year CFC plan (1965 - 75) included a strategy of self-financing fisheries development.

Aiming at a production target of 1 756 000 t, the number of mechanized boats was increased by the third planning cycle that began during 1971 - 76. A major development project was undertaken with the assistance of the Asian Development Bank, introducing 200 9m (28ft) inboard motorized boats and 30 large 12m (38ft.) boats under the Producer/Institutional Credit.

The Fisheries Sector Five-Year Master Plan was implemented in 1979 - 83. New fishing vessels sized 28 ft - 32 ft (9 m - 10 m) and 17 ½ ft - 23 ft (5.6 m - 7 m) were introduced. Inboard and outboard motors were issued to replace existing ones and to mechanize traditional craft.

During the fifth planning cycle government assistance to fisherfolk was channeled through the Fisheries Cooperative Societies. Under this policy shift about 750 FCSs were established and subsidized. The 1994 - 2000 plan has been replaced by the Six Year Development Programme for 1999 to 2004.

The government capital expenditure on fisheries is shown in Table 20. It increased by about 5.5 times between 1986 and 1999.

In 1998, the government spent Rs676.5 million as capital expenditure to produce 265 100 t of fish valued at Rs28 222 480 (calculated at an average price of fish per kg as Rs142 irrespective of price differences; adopted and modified from Sri Lanka Fisheries Year Book 1999). The Government thus spent Rs255 •kgfish⁻¹ in capital expenditure.

In 1998, the total GDP recorded was Rs985 586 million and the contribution of the fisheries sector to GDP amounted to Rs24 823 million (2.5% of GDP). If the capital expenditure on the fisheries sector (Rs676.5 million) is taken as a percentage of the fisheries sector contribution to GDP, the fisheries contribution comes to 2.7%, which is equivalent to the treasury allocation to the fisheries sector.

Foreign Assistance

Development efforts in the fisheries sector have been supported by foreign assistance through loans, technical assistance, grants and regional cooperation projects across the multilateral and bilateral funding agencies. ADB, UN/FAO, UNDP and World Bank are the multilateral donors. Abu Dhabi fund, CIDA, DANIDA, EU, GTZ, JICA, KOICA, NORAD,

Table 20. Summary of the capital expenditure in million Rs by the MFARD.

Year	MFARD	DFAR#	Total
1986	214.0	N/A	214.0
1987	192.8	N/A	192.8
1988	185.5	N/A	181.5
1989	242.4	N/A	242.4
1990	96.3	23.7	120.0
1991	50.4	49.7	100.1
1992	137.2	117.1	254.3
1993	118.0	94.7	212.7
1994	*	*	*
1995	436.3	77.7	513.0
1996	289.5	104.0	392.5
1997	557.7	22.0	576.7
1998	637.0	39.5	676.5
1999	1 270.2	20.0	1 290.2
2000**	1 171.8	19.4	1 191.2

Source: Ministry of Finance (MF) 1986 - 2000.

Note: * There was no national budget

** Estimate

Department of Fisheries and Aquatic Resources

N/A = Not available

ODA, SIDA and USAID are among the bilateral donor agencies.

During 1972 - 98, the total foreign assistance to the fisheries subsector amounted to US\$130 million. Over the 15 year period (1983 - 98), 20 fisheries projects amounting to US\$60 million were implemented with technical assistance grants from ADB, FAO, JICA, SIDA and UNDP. Through these projects, the following activities were undertaken in the fisheries sector:

- i. Purchase of new fishing boats and gear;
- ii. Institutional strengthening;
- iii. Development of inland fisheries and coastal aquaculture;
- iv. Improvement of post-harvest facilities;
- v. Fish stock assessment;
- vi. Coastal fisheries management;

- vii. Improvement of living conditions of fishers;
- viii. Infrastructure facilities including development of fishing harbours and anchorages.

Catch-Effort Analysis

Past experience has shown that biological assessment alone did not help much in the management of fishery resources in Sri Lanka (Fernando 1984). The lack of information pertaining to resources, technology and socioeconomic aspects of the small-scale fisheries has hindered the planning and development of an effective management scheme.

A study on bio and socioeconomics of small pelagic fisheries in the western coastal waters of Sri Lanka built an information base for policies to solve the conflict between the purse seine fishers and other small scale fishers (Dayaratne and De Silva 1995). With a similar objective, Vidanage and Wimalasena (2000) undertook a socioeconomic study of a small tuna fishery using ring-nets and gillnets on the southern coast. The economics of fishing with various craft-gear combinations in different localities was compared by Fernando (1984) and Wimalasena and Rupamoorthy (1998).

Materials and Methods

Secondary data used in this study were obtained from various sources such as the National Aquatic Resources Research and Development Agency (NARA), Ministry of Fisheries and Aquatic Resource Development (MFARD) and the other institutes. The information on costs associated with coastal fishing operations and the fish prices were gathered from the following:

1. Bioeconomics of fishing for small pelagic fish along the southwest coast of Sri Lanka (Dayaratne and De Silva 1995)
2. Comparative study on the economics of large and small scale fishing operations in Sri Lanka (Wimalasena and Rupamoorthy 1998), Biosocioeconomics of ring net and gillnet fishing for small tuna on the southern coast of Sri Lanka (Vidanage and Wimalasena 2000), Biosocioeconomics of demersal fisheries off Negombo on the west coast of Sri Lanka (Maldeniya 2001), Cost and profitability of small scale fishing operations in Sri Lanka (Fernando 1984).

Fisheries statistics were gathered from the Department of Fisheries (MFARD).

Cost

Costs are differentiated into fixed cost and variable cost. Fixed cost (FC) constitutes those items that in the short-run cannot be varied by the fishers. This includes cost of depreciation of fishing assets (craft and gear), license and insurance fee. Fishing crafts operating in coastal waters are generally not insured, but gear has had to be licensed since 1998.

The annual depreciation (D) cost was estimated as

$$D = P/L,$$

where

P = purchasing price of fishing assets

L = economic life in years

Fixed cost (FC) was estimated as

$$FC = D + I,$$

where

D = depreciation cost

I = license fee.

Variable cost (VC) is the sum of costs of all inputs that are incurred only when the fishing unit operates. There are two kinds of variable cost namely, operational cost (fuel, ice, bait, food, maintenance etc.) and labor cost (crew share). Thus the total cost (TC) is

$$TC = FC + VC.$$

All cost items were generally calculated on an annual basis but in this study cost items were assigned in proportion to fishing effort (fishing day). The number of days of fishing per annum was taken as 240 for all coastal fisheries except the demersal fisheries in Negombo area. For the demersal fisheries, the number of fishing days was considered to be 300.

Revenue

The revenue of fishing operations was estimated by multiplying the catch by its unit price.

Sharing System

The income of crew is derived from divisible income (revenue - operational cost) according to the prevailing sharing system. Craft owner and crew generally base the share system on acceptable norms.

Profitability

Profitability is the margin between revenue and cost. The profitability measures used include operating or gross profit and net profit or financial profit.

$$\text{Gross profit} = TR - VC,$$

where

TR = Total revenue

VC = Variable cost

$$\text{Net profit} = TR - TC.$$

A fishing unit is expected to continue operating as long as a gross profit is earned. Net profit is a prerequisite for the long-term viability of a fishing unit.

Coastal Fishing Operations

Coastal fisheries mainly target pelagic resources (small and large), demersal resources, and shellfish such as prawns, lobsters and crabs. The present study is limited to pelagic and demersal fisheries.

Small Pelagic

Small pelagic fishing is mainly conducted with small mesh gillnets and also by beach seine. Small mesh gillnets vary normally from 0.5" to 1.75". They target anchovies and sardines, mainly spotted sardinella (*Ambligaster sirm*). Outboard motor 17 - 22ft (5m - 7m) FRP boats and motorised traditional crafts are mainly engaged in small mesh gillnet operations.

Large Pelagic

Medium mesh (2.5" - 3.5"), large mesh (5" - 6") and ring nets (1.2" - 2.5") are mainly used in large pelagic fishing. Two kinds of crafts, 3.5 ton 30 - 32ft (9m - 10m) IBM (inboard motor boats) and 17 - 22ft (5m - 7m) FRP OBM (outboard motor boats), are generally involved in drift-net fishing. Ring-nets are operated with motorized out-trigger canoes called 'vallam'. Both vessels target small tuna species namely, *Auxis thazard* (frigate mackerel), *Auxis rochei* (bullet tuna) and *Euthynnus affinis* (kawakawa).

Demersal

In the Negombo area, demersal fishing is conducted mainly with FRP OBM boats. In addition, some of the 3.5 ton inboard motor prawn-trawling boats conduct fishing during the lean season for prawn trawling. The main fishing methods operating in the area are hand-line, bottom long-line, bottom set gillnet, trammel net and a few spear fishing units. Two types of hand-line are used, hand-line alone or combined with small mesh drift nets.

Economic Aspects of Coastal Fishing

The craft-gear combinations engaged in major coastal fisheries are summarized in Table 21.

Capital Investment

Average replacement costs of assets were used to find investment costs. Table 22 provides the investment cost of fishing assets in different fisheries.

Table 21. Types of fishing craft engaged in different fisheries in Sri Lanka.

Fishing craft	Fishery		
	Small pelagic	Large pelagic	Demersal
17 - 22' OBM	Small mesh gillnet	Medium mesh drift net	Hand-line, bottom long-line, trammel net, bottom set gillnet
3.5 ton IBM	–	Large/medium mesh gillnet	–
Traditional craft-OBM	Small mesh gillnet	Medium mesh gillnet/Ring net	–

Table 22. Investment costs of fishing assets in Sri Lanka.

Craft details	Investment Cost (Rs)		Depreciation Cost (Rs) daily equivalent		Economic life years	
	17 - 22'* OBM	Traditional craft OBM	17 - 22' OBM	Traditional craft OBM	17 - 22' OBM	Traditional craft OBM
Hull	43 500	72 411	11.33	18.85	16	16
Engine	72 409	74 117	30.17	30.88	4	4
Fishing gear						
Small mesh drift net	25 000	25 000	34.72	24.72	3	3
Medium mesh drift net	73 409	73 409	101.96	–	3	3
Ring net	–	87 823	–	121.98	–	3
Bottom long-line	9 245	–	15.41	–	2	–
Trammel net	26 115	–	29.02	–	3	–
Bottom set gillnet	30 575	–	33.97	–	3	–

Note: * 5m - 7m outboard motor boats.

To estimate the depreciation costs average economic life was calculated. The average economic lifetime as well as the estimated depreciation costs of the assets adjusted to daily equivalents are given in Table 22.

Variable Cost

The variable costs of a fishing day using various craft-gear combinations is given in Table 23.

Labor is the most important input in all fishing activities followed by fuel cost. In the ring-net fishery labor costs accounted for 64% of the variable cost. In the hand-line and bottom long-line fisheries, bait cost is more important than fuel cost.

Fishing Price and Revenue

Coastal fisheries are multi-species and multi-gear. Thus the unit price of the catch varies with the gear

Table 23. Daily variable costs by different craft-gear combinations in Sri Lanka.

Craft-gear combination	Cost items (Rs)						Variable cost per fishing day
	Fuel	Bait	Food	Ice	Labor	Repairs	
Large pelagic							
17 - 22'OBM/DN	439.00		217.80		736.90	330.80	1 718.50
TR OBM/RN	689.20		327.90		3 085.90	237.90	4 340.00
Small pelagic							
17 - 22'OBM/DN	309.34		96.68		219.33	N/A	1 126.15
TR OBM/DN	N/A		N/A		148.70	N/A	884.37
Demersal							
17 - 22'OBM/HL	286.70	344.93	78.20	93.65	996.78	N/A	1 852.29
17 - 22' OBM/BLL	369.57	409.84	107.71	43.13	1 413.20	N/A	1 611.09
17 - 22' OBM/BTN	281.97				459.51	N/A	795.88
17 - 22' OBM/BSN	331.69				835.30	N/A	1 219.70

Note: DN = Drift net RN = Ring net HL = Hand-line OBM = Out board motor
 BLL = Bottom long-line BTN = Bottom trammel net BSN = Bottom set gillnet. TR = Traditional crafts (*Vallam*)
 N/A = Not Available

Table 24. The average daily revenue of fishing operations in Sri Lanka.

Fishing gear	Unit price of fish (Rs)	Daily revenue (Rs)
Large pelagic		
17 - 22'OBM/DN	44.90	2 087.85
TR OBM/RN	55.30	7 819.42
Small pelagic		
17 - 22'OBM/DN	NA	808.50
TR OBM/DN	NA	
Demersal		
17 - 22'OBM/HL	89.68	2 098.51
17 - 22' OBM/BLL	88.12	2 613.64
17 - 22' OBM/BTN	54.76	1 024.01
17 - 22' OBM/BSN	43.97	1 776.83

used. The average unit price by different gear and the estimated daily revenue are given in Table 24.

Lowest revenues were for small pelagic fish in the gillnet fishery, due to relatively low prices and low catches.

Total Cost

The estimated daily total costs of fishing operations by different craft-gear combinations are given in Table 25.

Profitability

Table 26 presents the daily profitability for coastal fishing operations with different craft-gear combinations.

The variation of gross profit closely follows the variation of net profit. Ring-net and bottom long-line are the most profitable gear operating in the coastal waters. Trammel net, hand-line and small mesh gillnet earned low profits during 1998 - 99. All types of craft-gear combinations operating in coastal waters generated net profits, indicating the long term viability of the fisheries.

Income and Income Distribution

The income of the boat owner and the crew depends on the volume of the catch, fish price and running costs. The volume of the catch in turn depends on the size, quality and type of the catch and the marketing competition. The size and the type of the catch depend on the type of craft-gear combination used.

Table 25. Estimated daily total cost of fishing operations by different craft-gear combinations.

Craft-gear combinaton	Fixed cost (Rs)	Variable cost (Rs)	Total cost (Rs)
Large pelagic			
17 - 22'OBM/DN	143.46	1 718.50	1 861.96
TR OBM/RN	171.71	4 340.00	4 511.71
Small pelagic			
17 - 22'OBM/DN	76.22	1 126.15	1 202.37
TR OBM/DN	74.45	884.37	958.82
Demersal			
17 - 22'OBM/HL	41.50	1 852.29	1 893.79
17 - 22' OBM/BLL	56.91	1 611.09	1 668.00
17 - 22' OBM/BTN	70.52	795.88	866.40
17 - 22' OBM/BSN	75.47	1 219.70	1 295.17

Table 26. Profitability indicators of fishing.

Craft-gear combination	Gross profit (Rs)	Net profit (Rs)
Large pelagic		
17 - 22'OBM/DN	369.35	225.89
TR OBM/RN	3 479.42	3 307.71
Small pelagic		
17 - 22'OBM/DN	314.58	238.36
TR OBM/DN	305.23	230.78
Demersal		
17 - 22'OBM/HL	246.22	204.72
17 - 22' OBM/BLL	1 002.55	945.64
17 - 22' OBM/BTN	228.13	157.61
17 - 22' OBM/BSN	557.13	483.66

Table 27. Crew size and sharing system between boat owner and crew by craft-gear combination.

Craft-gear combination	Crew size	Sharing system	
		Boat owner	Crew
Large pelagic			
17 - 22' OBM/DN	2.3	1/2	1/2
TR OBM/RN	7.6	1/3	2/3
Small pelagic			
17 - 22' OBM/DN	2	1/2	1/2
TR OBM/DN	2	1/2	1/2
Demersal			
17 - 22' OBM/HL	4	1/5	4/5
17 - 22' OBM/BLL	2	1/2	1/2
17 - 22' OBM/BTN	2	1/2	1/2
17 - 22' OBM/BSN	2	1/2	1/2

Table 28. Income distribution between boat owners and crew members.

Craft-gear combination	Net revenue (Rs)	Net income (Rs)	
		Boat owner	Crew
Large pelagic			
17 - 22' OBM/DN	1 106.25	829.69	212.74
TR OBM/RN	6 565.32	2 764.31	575.91
Small pelagic			
17 - 22' OBM/DN	533.91	400.44	133.48
TR OBM/DN	453.93	340.45	113.48
Demersal			
17 - 22' OBM/HL	1 243.00	497.20	248.60
17 - 22' OBM/BLL	1 639.74	1 229.80	409.94
17 - 22' OBM/BTN	687.64	515.73	171.91
17 - 22' OBM/BSN	1 392.42	1 044.33	348.11

Generally, the boat owners are engaged in fishing. They earn a crew share in addition to the capital share. The number of crew engaged in different fisheries and the sharing system is summarized in Table 27.

The income distribution between boat owner and crew is listed in Table 28.

Pure Economic Profit Opportunity Cost of Fishing

The pure economic profit from the fishery was estimated by deducting the opportunity cost of labor and capital from the income earned by the owners and crew. The opportunity cost of

an owner's capital is the income that could be derived from the most profitable investment next to fishing. The opportunity cost of capital investment was computed using the prevailing interest rate for fixed deposit of 12% in 1999, multiplied by total investment.

In coastal fisheries, in most instances, the boat owner also functions as a crew-member. The owner gets the pure profits share of labor. The opportunity cost of the owner's labor is the income foregone by managing his fishing gear instead of working in another job. The average skilled labor wage rate was Rs225·day⁻¹, (US\$3.18 at 1 US\$ = 70.77 Rs in 1999; source: oanda.com) in 1999.

Table 29. Estimated pure profit of boat owners and crew per day.

Craft-gear combination	Pure profit (Rs)		Resource rent (Rs)
	Boat owner	Crew member	
Large pelagic			
17 - 22' OBM/DN	510.04	32.74	542.78
TR OBM/RN	2 422.14	395.91	2 818.05
Small pelagic			
17 - 22' OBM/DN	104.99	46.52	58.47
TR OBM/DN	29.50	66.5	96.00
Demersal			
17 - 22' OBM/HL	139.25	48.60	187.85
17 - 22' OBM/BLL	868.80	209.94	1 078.74
17 - 22' OBM/BTN	28.19	28.09	56.28
17 - 22' OBM/BSN	674.15	148.11	822.20

Resource rent is a kind of 'wage' for some fixed resource which is necessary for and valuable in a transaction e.g. use of boat.

The pure profit of boat owner = Net income - opportunity cost of capital + opportunity cost of labor.

The opportunity cost of crew labor was calculated from the average wage of unskilled labor of Rs180·day⁻¹.

The pure profit of a crewmember = Net income - opportunity cost of labor.

The estimated pure profit of fishing is given in Table 29.

Conclusion

Coastal fisheries play a dominant role in the total fish production and employment of Sri Lanka. Though Sri Lanka is endowed with an extensive sea area and fishing has been a chief source of livelihood of coastal communities since time immemorial, fishing has not been able to adequately harness the resources of the sea for the well-being of the country. Coastal fisheries typically are the employer of last resort due to the open access nature of the fisheries. Many social and economic conflicts arise due to the over-supply of labor. Even though the government has invested millions of rupees in the fishery sector over the years, problems of poverty in coastal fishing communities are particularly serious, especially among those engaged in traditional fishing operations. Exploitation by middlepersons is one of their problems.

Consideration of a wide range of data and information is necessary to examine the social and economic dimensions of coastal fisheries. In Sri Lanka, such data are distinctly limited with respect to catches and landing. The collected data are also unreliable. On this account, a comprehensive database comprising the data collected periodically by the DFEO Division as the basis on the socioeconomic profile of coastal fisheries is essential for the formulation of practical fisheries policies. Piecemeal measures based on scanty irregular data could scarcely effect any sustainable development in the fisheries sector.

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