Sri Lanka J. Aquat. Sci. 5 *(2000)* 105-129

Comparative Study on the Economics of Large and Small Scale Marine Fishing Operations in Sri Lanka

H.D. WIMALASENA* and K. RUPAMOORTHY

National Aquatic Resources Research and Development Agency, Crow Island, Colombo 15, Sri Lanka

*Corresponding author (E-mail: nara@itmin.com)

Abstract

The fishing units operating in the marine waters of Sri Lanka have been generally categorized into two types namely off-shore/deep sea fishing units and coastal fishing units. Large scale fishing operations comprise multi-day boats and small scale fishing operations comprise FRP boats, traditional motorized as well as non-motorized crafts. Craft-wise and location-wise earnings and expenditure were analyzed on the basis of crew share and owner's income. Average monthly net income of a multi-day boat owner was about Rs. 24,445. Whereas for FRP boats, motorized traditional crafts, non-motorized traditional *oru* and *theppam* this was about Rs. 9,228, 5,329, 1,389, and 4,413 respectively. Income of a crew member of a multi-day boat was about Rs. 12,750 per month. This was Rs. 5,494, 3,478, 694 and 1,471 of FRP boat, motorized traditional craft, non-motorized traditional *oru* and *theppam* respectively. Generally, crew income of small scale fishing crafts except FRP boats, was bellow the level of national per capita income. Income of a crew member of non-motorized *oru* was bellow the poverty line. Analysis of boat length/engine horse power in relation to fuel consumption, margin per day and return to capital indicates that the most profitable combination was 38 feet/54 h.p. combination where margin per day and return on capital were Rs. 11,100 and 48% respectively. A FRP boat annually earns Rs. 14,589.50 as resource rent (pure profit) from the fishery. All other crafts suffered a pure loss. Social conditions such as ownership of a permanent house, sanitary facilities were higher among multi-day boat owners than among small scale craft owners. Also, small scale fishermen were used to take loans for consumption needs.

Introduction

Marine fisheries of Sri Lanka are classified as coastal and offshore/deep sea fisheries. Coastal fisheries exploit resources up to 40 km from the shore and offshore/deep sea fisheries exploit resources beyond 40 km from the shore. Large scale fishing operations comprise multi-day boats with the inception of off-shore/deep-sea fishery in 1980s (Dayaratne & Maldeniya 1998). According to fisheries census in 1996, 1098 multi-day boats operated in that year (Anon. 1998). These multi-day boats target mainly at the yellow fin, big eye, and skipjack tuna stocks which are highly migratory. Shark also is another target species. Fifty percent of the landings composed of sharks, bill fish and small tuna varieties such as *kanakawa* and frigate tuna (Sanders & Siripala 1997).

Although fisheries sector's contribution to GNP is less than 3%, it plays an important role in providing employment to more than 350,000 people in fishing and allied activities (Anon. 1999). Fish contributes for 59.8% of the animal protein and 18.1% of Sri Lanka's total protein intake (Anon. 1998). In 1999 coastal and offshore/deep sea fishery sectors contributed 166,700 and 63,500 mt respectively to the total fish production. Furthermore, during the past two decades there is a growing trend in export of fish and fishery products. The total export earnings from fish and fishery products exceeded Rs. 6,750 million in 1998 (Anon. 1999).

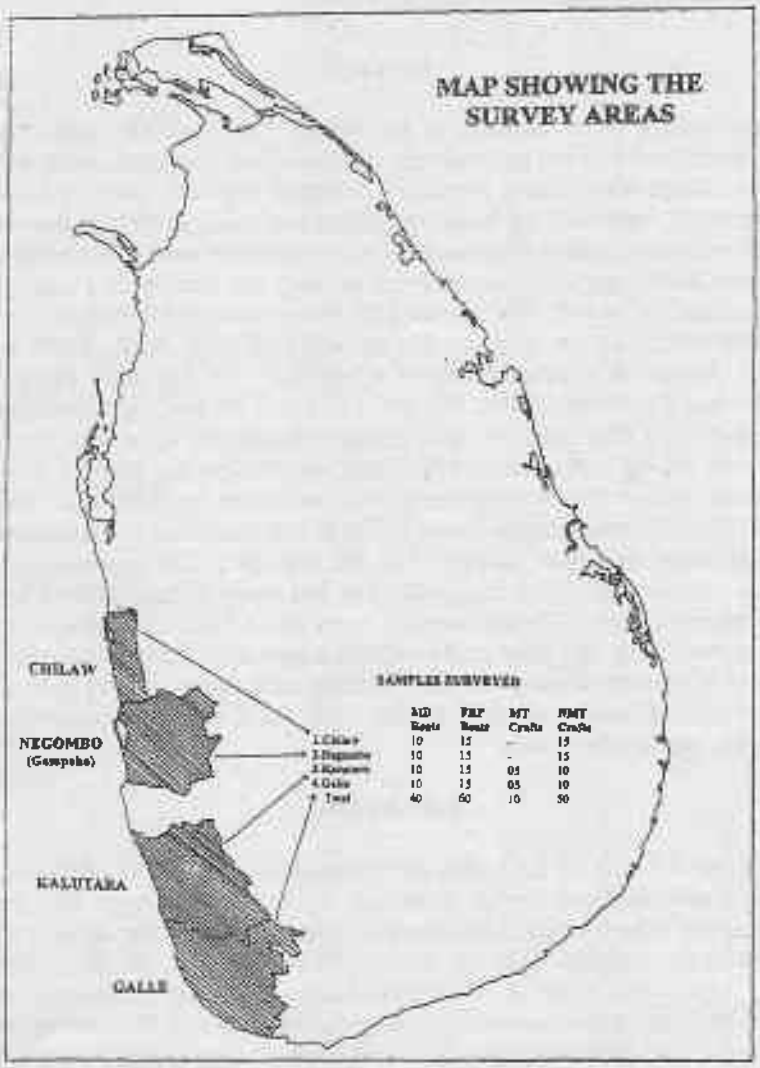

Figure 1. Map of Sri Lanka Showing the survey areas

Small scale fishermen exploit coastal fish resources in Sri Lanka. Mainly, FRP boats, motorized traditional crafts, non-motorised traditional *oru* and non-motorized *theppam* are the small scale fishing crafts used in the coastal fishery (Anon 1984). According to the resources surveys of R/V Dr. Fridtjof Nansen (1978-1980), fish resources in coastal waters have been exploited to its near optimum level (De Bruin *et al.* 1994). Therefore, exploitation of offshore/deep sea resources is an important alternative to enhance the fish production. To achieve this goal, the government has been granting investment concessions to the private sector for the development of offshore/deep sea fishery (Anon 1997).

Some biological data and information pertaining to Sri Lankan fisheries are available through the research activities carried out by the former Fisheries Research Station and at present by National Aquatic Resources Research and Development Agency. However, socio-economic data and information on fishing operations and the fishing community are meager. To formulate sound development programs and policies for fisheries sector and for sustainable management of fisheries resources, not only biological data but also socio-economic data and information on the fishing community are also important. Cost and earning studies help planners, researchers, administrators and other interested parties to plan fisheries development, and subsequently to improve the living conditions of the fishing community as a whole. Therefore, continuous, reliable and comparative data and information are very important.

The main objectives of the present study are as follows:

a) Examine and compare the economics of large and small scale fishing operations.
b) Examine the economic feasibility and viability of expanding large scale fishing operations.
c) Examine the means through which the small scale fishery operations could be improved.
d) Examine the economic and social conditions of the large scale and small scale fishing operators.

Materials and methods

The study has covered only a certain combination of gear operating in small scale fishery in the selected DFEO divisions. Therefore, these results may be applicable to those craft/gear combinations only. The small in-board fishing crafts of the E 26 type were not considered in this study.

This survey was conducted from March to December 1997 in four DFEO Divisions namely Chilaw, Negombo, Kalutara and Galle (Fig. 1). A total of 160 fishing units, both large and small scale were sampled. Forty fishing units from each DFEO divisions were selected at random. The study covered following craft/gear combination.

a. Multi-day boats with drift gillnet and long lines
b. FRP boats with drift gillnet
c. Motorized traditional crafts with drift gillnet and hand lines
d. Non-motorized traditional *oru* with drift gillnet
e. Non-motorized *theppams* with drift gillnet

The size of the sample was as follows

	Chilaw	Nego	Kalu	Galle	Total
Multi-day boats	10	10	10	10	40
FRP boats	15	15	15	15	60
Motorized traditional crafts	-	-	5	5	10
Non-motorized traditional *oru*	15	15	-	-	30
Non-motorized *theppam*	10	10	-	-	20

The data were collected through administering a pre-tested questionnaire (Annexure I)

For the calculation of annual production for multi-day boats, FRP boats and motorized traditional crafts, 240 sea days have been taken per year. In case of non-motorized traditional *oru* and *theppam* (log rafts), this is taken as 150 sea days per year. This is because according to survey multi-day boats, FRP boats and motorized traditional crafts operate about 20 days per month and non-motorized traditional *oru* and *theppam* operate about 12.5 days per month

The total amount of money obtained by the sale of catch was considered as revenue from fishing. The running cost includes cost of fuel and oil, food and water ice and bait. Devisable income from fishing that is shared among crew and owner was estimated by deducting running cost from the revenue

The total cost of fishing operation is the sum of the variable cost and the fixed cost. Variable cost or operational cost is the sum of running cost and the crew share. The gross income was derived by deducting the operational cost or variable cost from revenue. Deduction of fixed costs from gross income resulted the net income. Fixed cost comprised repair and maintenance cost, insurance and boat registration fee and interest on investment as well as depreciation to hull, engine and fishing gear. Repair and maintenance cost was calculated as follows based on historical cost of each item.

Hull and fittings	2%
Fishing gear	2%
Engine	5%

The amount for depreciation was determined by using the straight line method based on historical cost of assets taking the life span of each item as follows:-

Hull and fittings	16 years
Fishing gear	03 years
Engine	
Out-board	4 years
In-board	9 years

The opportunity cost of the capital is the income that can be derived by the most profitable investment, next to fishing. In the study, calculation of the opportunity cost was based on the interest rate paid on fixed deposit by state owned banks. This interest rate for 1997 was 15% (Anon. 1997). Resource rent was estimated by summing the boat owner's and crew's pure profits. Margin per day for different boat length/horse power combinations of multi-day boats was calculated by dividing the gross income by

number of days per fishing trip. Also. return on investment is the net income as a percentage of the capital investment.

Results and Discussion

Craft and gear

Drift gillnets and long lines were the prominent gear used in multi-day boats. Few troll lines were also used. Generally. gear composition of multi-day boats is 50 pieces of drift gillnets. 100 long lines baskets and 5-10 troll lines. Most multi-day boats were equipped with navigational instruments such as radio transmitters and satellite navigators. Some of the multi-day boats had winches for net hauling but others did not have them. Most multi-day boats sail for more than 36 hours before the operation starts. Generally. a fishing trip continues for 10 - 45 sea days. but 10 - 20 day trips were also usual. The length of multi-day boat varies is 34 - 55 feet. These are propelled by one or some times two in-board engines. The most popular sizes were from 35 to 38 feet. The horse power varies between 36 and 90. Among the engines in use. 37% was reconditioned engines. Most owners preferred reconditioned engines because of the lower price. However. they were less durable than the new engines.

The catch of these boats is preserved in ice. The drift gillnet and long lines were operated at dawn or dusk. The troll lines are operated while the boats were sailing. Average number of crew of a multi-day boat was five including the skipper.

FRP boats and motorized traditional crafts are powered by out-board engines with a h.p. ranging from 9 to 25. Two types of drift gillnet were used in these crafts. They were small mesh gillnet and small tuna gillnet. The mesh size of small gillnet vary from ½" to 2" and targeted mainly at Anchovies. Sardines and spotted sardinella (*Amblygaster sirm*). Small tuna gillnet fishing is targeted for small tuna varieties such as *kawakawa*. frigate tuna and bullet tuna etc. The mesh sizes of these gillnet vary from 3 ½" to 4". Gillnet fishing is carried out at dawn or dusk. After 1-2 hours of running. this fishing operation begins in coastal waters. Generally. the number of crew was two but some times it was three.

Generally non-motorized traditional *oru* and *theppam* are paddled by oars. However. some times the *oru* uses a sail. The average number of gillnet pieces per boat was 5 -12. These were small mesh gillnet targeted at anchovies. sardines and spotted sardinella. Their mesh size vary from ½" to 2". Some non-motorized traditional *oru* engage in hand line operation to catch mullet or rock fish. These crafts use fuel only for lighting purposes. This fishing operation takes place very close to the shore. Generally. they set sail at about 4 a.m. in the morning. After sailing for about an hour the operation begins. Hauling takes place about 1 to 2 hours at shooting time. This fishing operation was badly affected by rough sea conditions. In non-motorized traditional *oru*. two crew members engage in fishing. In the *theppam* only one person. usually the owner is engaged in the fishing operation.

Annual production and revenue

Table 1 shows the average annual revenue of different crafts. Except the non-motorized traditional *oru* and *theppam*. all the other crafts operate throughout the year. Generally. the average annual production of a non-motorized *theppam* was higher than the non-motorized traditional *oru*. One reason for such a higher production may be the better resource base. *Theppam* operates in the coastal waters of Negombo and Chilaw

The continental shelf in these areas is shallower than in the Kalutara and Galle areas Multi-day boat shows the highest annual production as well as the highest revenue.

Table 1. Annual fish production and revenue per craft in 1997

Craft	Production (kg)	Revenue (Rs.)
Multi-day boat	35.164	2.250.500
FRP boat	9.580	479.000
Motorized traditional craft	7.100	355.000
Non-motorized traditional *oru*	800	41.000
Non-motorized *theppam*	2.000	100.000

Gross income

The gross income varies with the type of craft Table 2 indicates the average monthly gross income of different craft owners by DFEO divisions All type of crafts showed area-wise variation in gross income The variation between FRP boats and non-motorized *oru* is very clear Gross income is an indicator of short term viability. Multi-day boats and FRP boats earn considerable gross income from the fishing operation. *Theppam* operated in Chilaw area also generate high gross income Table 3 gives the gross income per trip of multi-day boats in the four DFEO divisions Generally, the average duration of a trip of a multi-day boat is 20 days Thirty day trips are also common among the larger multi-day boats and 8 -10 day trips are common among small (34'-36') multi-day boats Some larger multi-day boats recorded trips of 45 days duration Their average gross income per trip varies between Rs 50.000 and Rs 200.000 The longer trips (30 – 45 days) mostly operate beyond the EEZ The most suitable trip duration of a medium sized boat (36'-40') is 20 days

Table 2 Average monthly gross income (Rs) obtained by the owners of different types of crafts in the four DEFO Division

DFEO Division	Multi-day boat	FRP boat	Traditional Motorized craft	Non-motorized traditional *oru*	Non-motorized *theppam*
Chilaw	75.164	21.458	-	-	7.400
Negombo	64.626	13.016	-		2.507
Kalutara	50.262	8.595	-	2.334	-
Galle	55.641	9.091	8.922	3.033	-
Average	61.423	13.040	8.922	2.684	4.953

Table 3 Average gross income (Rs) of multi-day boats per trip

Trip- duration	Chilaw	Negombo	Kalutara	Galle
45 days	-	-	1.066.850	-
30 days	202.900	155.300	169.575	-
20 days	121.542	123.575	75.420	110.040
8-10 days	76.190	-	67.925	58.125

Net income

Table 4 gives net income or net economic profit of owners of different types of crafts in the four DFEO divisions studied. Multi-day boats in all four districts show long term viability of operation. Among small scale crafts FRP boats in Chilaw area earn the highest net income while net income of FRP boats in Kalutara area is fairly lower. This was even lower than the earning from the *theppam* in Chilaw area. However, the FRP boats operate all the year round. *Theppam* operate only in the off season. The average net income of all other crafts, except non-motorized traditional *oru* is higher than the national per capita income which was Rs. 4.000 per month, in 1997 (Anon. 1997). The non-motorized traditional *oru* owners earn only one-third of the national per capita income.

Table 4. Average monthly net income (Rs) obtained by the owners of different types of crafts in the five DFEO Divisions

Motorized traditional 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	-
Average	24.445	9.228	5.329	1.389	4.143

However, the net income of craft owners other than multi-day boat owners may be higher than the amounts given in the Table 4. This is because of the owner participation in the fishing operation is higher in small-scale fishery. The percentage of owner's involvement in fishing operation in multi-day boats, FRP boats, motorized traditional crafts, non-motorized traditional *oru* and *theppam* is 2.5%, 68.9%, 50.0%, 56.8% and 96.7% respectively (Table 5). This means that in small scale fishery, owners real net income comprises of owners net income plus a crew share. This is also an important

characteristic of small scale fishing. More and more small scale fishermen participate in fishing operation as a way of life rather than for profit.

Table 5. Information on net income, investment, and crew size of different types of crafts

Item	Multi-day	FRP boat	Motorized traditional craft	Non-motorized traditional *oru*	Non-motorized *theppam*
Investment/ Fishing unit (Rs.)	2,000,000	185,000	170,000	40,000	17,000
Average crew size	5	2	2	2	1
Owner participation in fishing (%)	2.5	68.9	50.0	56.8	96.7
Total divisible income/year (Rs.)	1,530,000	312,936	166,944	19,446	29,001
Income/ Crew/ year (Rs.)	153,000	78,234	41,736	4,861	14,500
Working owner net income / year (Rs.)	446,340	188,970	105,684	14,584	29,001
Non working owner net income/ year (Rs.)	293,340	110,736	63,948	9,723	14,500

Cost of production

Table 6 shows the average operational, fixed and the total cost per kg of fish in different types of fishing crafts. The cost of production appears to be correlated with the type of craft. With the increase of intensity in motorization, the cost of production increases. The lowest cost of production was in non-motorized traditional *oru* and *theppam*.

Table 6. Production cost of fish in different types of crafts (Rs./kg)

Craft	Fixed cost Rs./kg	Operational cost/kg (Rs)	Total cost Rs./kg
Multi-day boat	13.20	43.10	56.31
FRP boat	6.01	30.38	36.36
Motorized traditional craft	6.07	37.09	43.48
Non-motorized *oru*	8.55	12.79	21.34
Non-motorized *theppam*	2.52	7.74	10.32

Operational costs

If a fishing craft or gear remains without operation no operational cost incurs. Table 7 shows annual operational cost of different types of crafts. In motorized crafts such as multi-day boats, FRP boats and Motorized traditional crafts the crew share was below 50% of the operational cost. In non-motorized traditional *oru* and *theppam*, the crew share was 95% and 93% of the operational cost respectively.

Table 7. Annual operational cost of different types of crafts in Rs.

Craft	Fuel	Ice	Food	Crew share	Other cost	Total
Multi-day boat	362.572	108.581	107.217	765.000	172.514	1.515.884
FRP boat	96.950	5.225	22.200	156.468	10.212	291.055
Motorized Traditional craft	128.571	16.285	13.714	83.472	-	242.042
Non-motorized *oru*	510	-		9.722	-	10.232
Non-motorized *teppam*				14.500	982	15.432

With the intensity of motorization of fishing crafts, the cost component of fuel increases. Non-motorized traditional *oru* and *theppam* do not depend on fuel. In motorized traditional crafts, fuel contributes to 53% of the operational cost and 45% of the total cost respectively. This is one of the reasons that income from motorized traditional crafts is fairly low compared with that of FRP boats. Therefore, motorization of traditional crafts, especially through subsidy, should be re-considered.

Table 8 shows the labour cost as a percentage of total cost. According to the owners point of view, labour cost was a major component of variable cost. Naturally, the non-motorized crafts are labour intensive. On the other hand, the level of motorization clearly indicates the nature of capital intensity. Labour cost in non-motorized traditional *oru* and *theppam* incurs 57% and 70% of the total cost respectively. Due to high cost of labour, in non-motorized traditional *oru* and *theppam*, the owners also engage in the fishing operations.

Table 8. The labour cost in different types of crafts/gear

Type of craft/gear	Labour cost as a % of total cost (Rs)
Multi-day boats	38.63
FRP boat	44.90
Traditional motorized craft	29.27
Non-motorized traditional *oru*	56.92
theppam	70.24

Fixed costs

Fixed cost of fishing units incurs even if they are not engaged in fishing operations. Table 9 shows fixed cost component in production of one kg of fish. Multi-day boats incur the highest amount of fixed cost and the *theppam* the lowest. FRP boats and motorized traditional crafts incur almost the same fixed cost. Compared with others non-motorized traditional crafts, the *oru* do not indicate the cost effectiveness. This is because the fish production is very low compared to the capital investment.

Table 9. Fixed cost component in production of one kg of fish

Type of craft	Annual Fixed Cost (Rs)	Fixed cost-Rs kg
Mullti-day with drift net and long line	464.390	13.20
FRP with drift net	57.591	6.01
Traditional motorized with drift net and hand line	43.135	6.07
Traditional *oru* with drift net	6.847	8.55
theppam with drift net	5.159	2.52

Return on capital investment

Return on investment of multi-day boat was the lowest rate among all crafts(Table 10). The highest rate of return was enjoyed by non-motorized *theppam* and FRP boats. At the same time FRP boats extract pure profit or resource rent. Especially the FRP boats in Chilaw area earn the highest return through resource rent. One of the reasons for the lower rate of return on investment of multi-day boats is that they pay substantial amount of money as interest for the loan that they have borrowed from the banks. On an average, 56% of the multi-day boats have been purchased through bank or other type of loans. As such, some boat owners pay between Rs. 5,000 - 32,000 per month as interest. The rate of return is sometimes lower than the interest rate for fixed deposits of state banks. This also indicates that except in the case of own capital, investing in multi-day fishery is comparably risky in a short run. At times, some multi-day boat owners even experienced the shortage of working capital to engage in fishing operation.

Table 10. Profitability of different crafts

Craft	Resource rent (Rs.)	Return on capital (%)
Multi-day boat	-	14.80
FRP boat	14,589.50	58.74
Motorized traditional craft	-	37.41
Non-motorized traditional *oru*	-	24.30
Non-motorized *theppam*	-	163.36

Non-motorized traditional crafts and *theppam* are profitable because the rates of return is higher. Here the investment as well as the income are lower than the other crafts. Anyhow, these crafts are operating only in the off season (October to April), therefore the investment remains idle for 5 to 6 months during the monsoon (May to September) season.

Productivity (profitability) of labour and capital

Profitability can be expressed in terms of productivity. Fishing units with higher productivity enjoy higher profitability. Productivity of labour and capital of different crafts is shown in Table 11. Productivity of capital is indicated by total revenue from fishing and labour productivity is indicated by the contribution to total revenue by each crew member. With motorization, productivity of capital as well as labour increased. Among non-motorized crafts, *theppam* was more productive than non-motorized *oru*. The highest productive craft was multi-day boat and lowest productive craft was non-motorized *oru*.

Table 11. Capital and labour productivity of different crafts in Rs.

Craft	Capital	Capital/Crew member	Capital productivity	Labour productivity
Multi-day boat	2,000,000	400,000	2,250,500	450,100
FRP boat	190,000	95,000	479,000	239,500
Motorized traditional craft	170,000	85,000	355,000	177,500
Non-motorized *oru*	40,000	20,000	40,000	20,000
Non-motorized *theppam*	17,000	17,000	100,000	100,000

Profitable combination for multi-day boat

The operation of off-shore /deep-sea fishing depends on several factors. Of these one of the most important factors is the profitability in the long run to survive as a business enterprise. The table 12 indicates the relationship of four variables, such as boat length/horse power, fuel cost, margin per day and return on capital. This shows that the small multi-day boats with less horse power or larger multi-day boats with high horse power except for 50/70 combination do not attain a high profitability (except 50/70). Boats of thirty eight feet long and 54 horse power combination. Generally, boats of 36 -40 length coupled with 50-56 h.p. engine combination is more suitable to operate within our EEZ for 20 days trip. But, fishing operation beyond the EEZ need larger boats with higher engine horse power. In the study, it was also observed that there is a dearth of trained crew members to operate tuna long line fishing effectively. This also affects the revenue of multi-day boat fishing operations.

Sharing system and crew remuneration

In Sri Lanka, large scale as well as small-scale fishing follow a sharing system for crew remuneration from divisible income. Generally, the owner and the crew base this on an accepted norm. Fifty percent of the divisible income goes to the crew as share in multi-day fishery. FRP boats and motorized traditional crafts operating drift gillnets also share 50% of their devisible income among crew. While motorized traditional crafts operating for hand line fishery with live bait, share 6/13 of the devisable income among the crew. Non-motorized traditional *oru* owners adopt two methods. One is 3/5 and the other is 1/3 of their devisable income as share. Calculation of devisable income varies from craft to craft. Generally, in multi-day fishery cost of fuel and oil, food and water, ice, bait and marketing expenses are deducted before sharing. In addition to the above, 5%- 10% is deducted for repair and maintenance of the crafts. Deduction

method of this 5% -10% also varies among the owners. Some multi-day owners deduct this amount from the total revenue. and this is called "Top System". Other owners follow the "Bottom System" in which 5% or 10% is deducted from the gross revenue. Due to the lack of uniformity in the system. crew members income also varies In Beruwala and Galle area no repair and maintenance cost is deducted from the revenue Sometimes for multi-day boats. a supply system prevails to provide items such as fuel. ice and water For this service 5% is deducted from the revenue According to the system that prevails in Chilaw and Negombo area. the repair and maintenance cost is shared by both the crew and the owner In addition to baring the risk this is a heavy burden on the crew

Table 12. Fuel cost. margin per day and return on capital for different length and Horse power combination for multi- day boats

Boat Length & HP combination	Fuel cost per day (Rs.)	Margin per day (Rs.)	Return on capital (%)
34/39	1.027	5.399	13.4
34/42	750	4.528	45.7
34/45	1.000	3.448	12.8
34/56	1.883	5.460	8.8
35/36	600	5.213	4.5
35/39	730	5.042	10.5
36.5/39	1.400	5.687	2.9
37/56	1.400	6.553	24.1
38/54	1.500	11.100	48.0
38/56	2.000	10.063	25.5
38/65	2.400	4.325	10.6
40/54	1.500	9.523	20.9
40/90	4.700	6.781	2.8
50/70	4.000	16.453	20.8

As a practice in the single day fishery only the cost of fuel food ice and bait is deducted before sharing and no reservation is made for repair and maintenance cost. The highest average crew income was reported in multi-day boats (Table 13). However crew income of FRP boats in Chilaw area is substantially high But in Kalutara this area was very low Average income considerably different from that of FRP boats and motorized traditional crafts Generally. crew income of small scale fishing crafts. except in FRP boats. was bellow the average national per capita income (Rs 48.000 per year) The poorest income group was the crew of the non-motorized traditional *Oru*. Their monthly income was bellow the poverty line The income of a multi-day boat crew member was higher than the income of a owner of a FRP boat This is an indication for the possibility of a shift from ownership of small crafts to fishing labour

Table 13 Monthly cash income of crew by craft type and DFEO Divisions in Rs

DFEO Division	Multi-day boat	FRP boat	Traditional motorized craft	Non-motorized *oru*	Non-motorized *theppam*
Chilaw	13.585	10.729	-	-	3.228
Negombo	12.099	6.507	-	-	915
Kalutara	14.190	4.297	-	631	-
Galle	11.128	4.545	3.478	758	-
Average	12.750	5.494	3.478	694	1.471

In addition to cash income, the crew members also benefit from non cash income. The total remuneration includes cash as well as non cash benefit such as food received during the fishing operation. Table 14 shows the per capita crew remuneration of different crafts. Non-cash benefit was highest in multi-day boats because of the nature of fishing operation. Annual income and per capita remuneration remain the same in non-motorized traditional *oru* and *theppam*.

Table 14 Annual crew remuneration in rupees(Rs.)

Craft	Annual cash income	Imputed value of food	Annual crew remuneration
Multi-day	153.000	21.443	174.443
FRP boat	78.234	11.100	89.334
Motorized traditional craft	41.736	6.857	48.593
Non-motorized *oru*	4.861	-	4.861
Non-motorized *theppam*	14.316	-	14.316

Career development through fishing

The investigation shows that there is historical background in the career development of the fishermen. Through this study 5 models of career pathways were identified (Annexure II). These models reveal the development steps taken place with the motorization and modernization of fishery in Sri Lanka. To own a multi-day boat the owners were engaged in fishing for more than 30 years. In most cases, the multi-day boat owners have begun their career as a *theppam* owner.

The government introduced the 3.5 ton boats in mid 1950 s' through hire purchase and subsidy scheme. This is an important milestone in the development of the off-shore fishery. These boat owners have not obtained any proper training in fishing. They almost entirely depend on the traditional experience gained from their forefathers. After 1980's, investors including those who are outside the fishing community have been attracted by the off-shore/ deep-sea fishery. Therefore, training for crew members has now become very important.

Social status of craft owners

The social conditions of craft owners reflect their economic status through certain indicators. The social conditions of the multi-day boat owners were much better than the other groups. Most of these owners were educated. All of them were able to read and write (Table 15). All these craft owners have permanent houses with good sanitary facility. They do not get any consumption loan from outside.

The social conditions of FRP boat owners are also satisfactory. Most of them are also educated. All of them have the ability to read and write. 87% of them have permanent houses. Of the total houses, only 85% has latrine facilities. Eight percent of them get consumption loans.

95% of the owners of motorized traditional crafts were able to read and write. Of this group 65% have permanent houses and 80% have latrine facilities. 32% of the owners used to get consumption loans.

The non-motorized traditional craft owners (*oru* and *theppam*) were the poorest among all four groups. In this group, 45% has no permanent houses and 43% has no latrine facilities. Furthermore, 51% used to get consumption loans during the monsoon season.

Table 15. Social status of craft owners as a percentage

Craft type	Average age	Literacy	Owned house	Sanitary facility	Depends on loans
Multi-Day boat	45	100	100	100	0
FRP boat	37	100	87	85	8
Motorized Traditional craft	45	95	65	80	32
Traditional	37	95.4	55	57	51

Conclusions and recommendations

Although the coastal fishing plays an important role in the fishing industry of the country, during the past few years the income of the fishermen from this sub-sector has been on a decline.

During the past fifteen years, multi-day boat fishing operations gradually increased. However, only about 25% of the total fish landing comes from the off-shore/ deep-sea fishery. Of the total of about 26,000 fishing boats in the country only about 1098 are multi-day boats which engage in off-shore /deep-sea fishery. Multi-day boat fishery also faced problems due to heavy capital investment and increase in operational expenditure. Moreover, there is no proper estimation of the resources potential. Therefore, proper assessment of these fishery resources is vital to develop a large scale multi-day boat fishery in the country.

Average net income of multi-day boat crew is higher than the income of the FRP boat owners. If multi-day fishery expands, a labour shift could take place from small scale fishery to multi-day fishery. This may reduce the excess strain on coastal resources. At present there are some disparities in the share system. Measures should be taken to establish uniform and fair share system between the crew members and the boat owners.

b. To increase the total fish production of the country, exploitation of off-shore/deep-sea fish resources should be encouraged. At present, only about 38% of the total fish landings comes from off-shore/deep-sea fishery. Multi-day boats earn higher gross income from fishing but approximately 15% of gross income goes for interest payment of the borrowed capital. Generally, the owners who invested their own money earn an average monthly net income of Rs. 34,000. In addition, most of the multi-day boat owners face problems in relation to operational costs. In the case of investment of borrowed capital, the owners have to face risk in the short run. Now, around 35% of the boat owner comes from non-fishery related background or outside the fishing community. This situation may be good but some encouragement should be given for the fishing community to get involved in this fishery. In addition, the revenue from multi-day boats could be substantially increased if the quality of fish is improved. In 1997, of the total export of fish and fishery products 58% (by value) was frozen fish. The quality of the produce could be enhanced by improving the preservation facilities in these boats. Refrigeration facility should be encouraged in the multi- day boats to preserve the fish catch.

In multi-day fishery, medium sized boat (36' - 40') coupled with 50-56 h p engine is the most profitable specially within the EEZ. The most profitable trip duration for a medium sized boat is 20 days. Larger boats with better fish preservation facilities may be suitable to operate in international waters. In addition, experience shows that there is a need for training multi-day crew members to increase both quality and quantity of the catch. Information shows that about 80% of the off-shore/deep-sea fish production at present comes from the gillnet. Therefore, the long line gear usage, which existed long ago, should be again encouraged. However, this fishing faces the bait problem, but that problem should be solved. As an immediate solution bait could be imported without tax. In the long run local production should be encouraged. Also, the quality of fish caught by long-line method is much better than the gillnet method. Financial assistance as well as proper training may encourage boat owners to operate long lines fishing.

The average production cost per kg of fish in multi-day boat is Rs. 56.31. This production cost could be reduced through increasing productivity, improving the efficiency of labour and exchange of information among fishing boats about fishing grounds. More than this the quality of fish should be improved by adopting better handling and preservation methods which increase the earnings very much.

At present about 37% of in-board engines are reconditioned ones, and the fuel cost as well as repair and maintenance cost of these are fairly high compared with new ones. Therefore, measures should be taken to discourage the usage of reconditioned engines. It was also revealed during the survey, that there is shortage of engine spare parts and monopolistic situation in this trade. Further the, also adversely affects the smooth running of the fishing operations.

c. The motorization of traditional crafts should be limited because of their inefficiency and poor performance compared to modern fishing boats. Also, increase in the number of FRP boats should be done cautiously. In Chilaw area, the income from this fishing operation is higher than in other areas most probably because of the resource rent.

The net income of the owners of non-motorized traditional *oru* is below the national per capita income and the earnings of the crew members of the same fishing operation remains below the poverty line. Furthermore, during the monsoon season they do not go for fishing. If they can engage in other income earning activities during the monsoon season, this their income could be increased. Therefore, government as well as non-governmental organizations should come forward to improve the economic and social conditions of this group. Sometimes, this labour could be shifted to other sectors of the marine fishery so that they could get better incomes.

d. There are more than 150,000 fishermen engaged in fishing, producing about 230,200 tons of fish in the country (Anon. 1999). This shows that the average production per fishermen is around 1.5 tons per year. In order to manage and conserve the existing, but limited, marine fishery resources the rapid growth of our fisher folk population has to be addressed.

Non-motorized fishing boats are vulnerable to monsoon conditions and the income of some categories of these boats are declining. Their living condition is also poor. Low investment capacity, poor access to credit and traditional convictions have limited the opportunity to diversify the coastal fishermen to more profitable fishing or other activities. Furthermore, beneficiaries participation in planning and implementation is also very important for sustainable fisheries development. All types of gear used in fishing should be licensed so that some control on their fishing effort would be made possible.

Fisheries co-operatives can play vital role in the development of the fishery industry and the economic and social well being of the fishing community. This development should take place without any political interference. The development and prosperity of an industry depends on the well being of the people involved in it. Social as well as economic infrastructure facilities are very poor in fishing villages. There are many causes for this state of affairs. Therefore, the authorities must take necessary action to solve these problems.

References

Anon. 1997.
Economic progress of Independence of Sri Lanka. Central Bank of Sri Lanka. 295 p.

Anon. 1998.
Sri Lanka fisheries Year Book. 1997. National aquatic Resources Research and Development Agency. 81 p.

Anon. 1999.
Sri Lanka Fisheries Year Book 1998.
National aquatic Resources Research and Development Agency. 56 p.

Dayaratne P. & Maldeniya, R., 1998.
Recent trends in the tuna fisheries of Sri lanka. IPTP collective volume No. 9. Indo-Pacific Tuna Development Programme.

De Bruin H. P., Russel. B.C., & Bogush. A., 1994.
The Marine Fishery Resources of Sri Lanka. FAO Publications.

Rupamoorthy K. 1993.
Economics of multi-day boat operation. APAP programme. Department of National Planning.

Sanders M.J. & Siripala. P.A.N., 1997.
Bio economic analysis of the Sri Lankan offshore fishery for large pelagics. Upanathi. The journal of the Sri Lankan association of the economists. Vol. 8. No. 1. 43-57