

# AN ECONOMIC EVALUATION OF RING SEINE FISHERY ALONG KERALA COAST

R. Sathiadhas, K.K.P. Panikkar and K.P. Salini

Central Marine Fisheries Research Institute, Cochin - 14.

## INTRODUCTION

The intensive mechanisation phase dominated in Kerala fisheries during the seventies not only led to the increase in shrimp and fish production but also marginalized the traditional sector. The traditional sector went for rapid motorization of artisanal fleets during the eighties mainly to overcome this marginalisation. In this context, ring seine is the most important gear widely used by motorized fleets along the Kerala coast. It is known as "Ringuvala or Kudukkuvala or Rani vala" at different regions along the coast. At present, the traditional *Koruvala* (thanguvala) and *Kollivala* widely adopted earlier has almost been replaced by this new gear. More than 40 per cent of the total marine fish landing of the State is accounted for ring seine during the last few years. Considering the pre-eminent position of ring seines in the fish economy of Kerala State, the present study was carried out with the following specific objectives.

- To assess the contribution of ring seine fishery in the gross marine fish production of the State.
- To bring out the comparative catch and revenue of ring seine units vis-a-vis the other gears operated by motorized craft and
- To study the economics of ring seine operations

## MATERIAL AND METHODS

Both primary and secondary data were collected and utilized for the present study. The secondary data pertaining to the catch trend and fish landings by different craft-gear combinations with species-composition were collected from the National Marine Living Resources Data Centre (NMLRDC) of Central Marine Fisheries Research Institute (CMFRI). The primary data collection was carried out on three stages during 1990-92. In the first phase a preliminary investigation on ring seine fishery of Kerala coast had been carried out from Neendakara in Kollam district to Manjeswar in Kasargod district. There are certain distinct differences in the pattern of operation, costs and earnings of ring seine units in the southern and northern regions of Kerala coast. Based on the preliminary investigation, two prominent ring seine centre such as Punnapra in Alappuzha district to represent the southern region and Puthiangadi in Kozhikode district to represent the northern region were selected for indepth study.

To collect the costs and earnings data of ring seine units, two types of schedules were prepared and pretested. Information on the initial investment, ownership pattern, labour participation and crew share, average number of annual fishing trips, source of finance for investment and other economic parameters of all the ring seine units operating at the selected centres was collected in schedule I

in the second phase during January to March 1991.

Schedule II deals with the daily operational costs and earnings of sample fishing units to be collected atleast 10 sample days per month continuously for one year. The third phase of data collection was carried out at Punnapra and Puthiangadi centres during April 1991 to March 1992.

Local enumerators hailing from fishermen community were entrusted the work of data collection after imparting adequate training to them.

## RESULTS AND DISCUSSION

### Craft and Gear

Ring Seine is an encircling net almost similar to a mini-purse seine. It is simply a technologically improved version of the traditional boat seine (thanguvala) of Kerala coast. Ring seine was first introduced along the Kerala coast in the Alappuzha region during 1985. The large and medium sized plank built canoes locally called as "Chundan vallam" and dugout canoes are used for the operation of this gear. There is no difference, in the pattern of operation by these two categories of canoes except in the size of the net. The plank canoes use bigger size (length and breadth) of nets depending upon its accommodation capacity. There is also considerable variation between region in the number of craft used for a ring seine unit.

In the Alappuzha and Kollam regions a single canoe is uniformly used for ring seine operations while in Ernakulam and north, an additional canoe accompanies the operating unit as a "Carrier boat" mainly to transport the catches to the shore. The ring seine unit

at Cannanore and Kasaragod region is known as "Rani vala" and it requires four canoes for operation, two for actual fishing and the other two for ferrying the catches. Hence the introduction of ring seine has not resulted in substantial increase in new investment as two of the old *Kollivala* units have been joined together to form a new *Ranivala* unit.

The propulsion is usually by out-board engines of 25 H.P. capacity. However, in certain cases, two engines are also used in a single unit. These are necessitated by the total load of the large gear, 20-30 crew members and bulky catch.

Ring seine is made of long wall of netting with head rope and foot rope. The length of the net which was 400 m initially is now even more than 900 m in some parts of the state. Usually the net has four mesh sizes. Along the head rope and foot rope side, it has larger meshes of 4.5 and 6.5 cm respectively with a breadth of 18 cm. These are followed on either side by another piece of net of about 80 cm breadth with a mesh size of 1.8 cm. The rest of the net is of uniform mesh of either 0.7 cm or 2.5 cm. The head rope is provided with both aluminium and synthetic floats. The foot rope has lead weights at about 20 cm intervals. In addition to this, rings made of brass with about 8 cm diameter are tied to the foot rope at varying intervals. Another rope "purse line" passes through these rings.

The technique adopted in the operation of this net is that the fish is surrounded both vertically and horizontally. After indentifying or locating a moving shoal the craft increases its speed to go ahead of the shoal, drops one end of the net and then swiftly pays out the rest so as to encircle the shoal. The bottom

**Table 2. Estimated species-wise annual marine fish landings (in tonnes) by Ringscines in Kerala (1990 & 1991)**

Sl. No.	Name of fish	1990		1991	
		Catch	Percentage	Catch	Percentage
1.	Oil sardines	128430	50	92197	40.7
2.	Other sardines	9992	4	18259	8.0
3.	White baits	12474	5	5394	2.4
4.	Thyrssa	3390	1	12509	5.52
5.	Croakers	1917	0.7	328	0.10
6.	Carangids	28377	11	48751	21.54
7.	Silverbellics	451	0.2	641	0.28
8.	Indian Mackerel	50601	19	36595	16.17
9.	Tunnies	11777	4.6	187	0.08
10.	Perches	1099	0.5	2066	1.0
11.	Penacid prawns	6622	3	7228	3.19
12.	Others	2723	1	2175	1.0
Total		257853	100	226330	100.0

**Table 3. Estimated marine fish landings by motorized units in Kerala**

Year	Ringscines	Boatseines	Landings of motorized units (tonnes)	
			Others	Total
1986	22498 (12)	118433 (64)	45431 (24)	186392
1987	31558 (28)	48416 (43)	31752 (29)	111726
1988	81886 (36)	87802 (38)	60391 (26)	230079
1989	270903 (71)	51477 (13)	61424 (16)	383804
1990	257853 (66)	42162 (11)	88609 (23)	388624
1991	226330 (74)	24973 (8)	53893 (18)	305196

Fig. in parenthesis indicates percentages to the total landings of motorised units.

motorized units. During 1986 ring seine catches were hardly 12 per cent of the total catch of the motorized units as against 64 per cent by boat seines and 24 per cent by others like gillnets and hooks and lines. The situation has now completely been changed as most of the boat seines have been replaced by ring seines. At present about 74 per cent of the catch of motorized units are accounted for the ring seines as against 8 per cent for boat seines and 18 per cent for others.

The overall average catch and revenue per trip for motorized units operating ring seines, gillnets, and hooks and lines along Kerala coast have been worked out (Table 4). The average catch per trip of a ring seine worked out at 800 kg realizing gross revenue of about Rs. 4,000. Similarly for gillnet units average catch came about 66 kg realizing a gross revenue of Rs. 626 and hooks and lines with 54 kg earning Rs. 480 per trip. Penacid prawns contributed substantially to the

of the net is then closed by pulling the rope passing through the rings. This prevents the escape of the trapped fish. The gear is operated up to a depth of 45 m (Sivadas and Balasubramaniam 1989).

### Production trend

The gross annual marine fish landings of Kerala State along with the contribution of ring seine units are given in Table 1. The

contributed by the ring seine fishery. The species-wise distribution of total marine fish landings by ring seine units during 1990 and 1991 is given in Table 2.

The estimated ring seine landings of Kerala coasts at 2.58 lakh tonnes during 1990 declined to 2.26 lakh tonnes in 1991. During this period Oil sardines contribution declined to about 41 per cent in 1991 from 50 per cent 1990. So also percentage contribution of

Table 1. Contribution of Ringseine units in the total marine fish landings of Kerala state (1986-91)

Year	Landings (tonnes)		
	Total	Ringseine	Percentage
1986	382791	22498	6
1987	303286	31558	10
1988	468808	81886	17
1989	647526	270903	42
1990	662890	257853	39
1991	564161	226330	40

estimated annual landings of the State during 1986 was 3.8 lakh tonnes in which ring seines contributed only about 6 per cent. A spurt in the total fish production was observed during 1989 and it was due to the increased availability of oil sardine and Mackerel along west coast and the multiplication of ring seine units. The peak landings by ring seine units was observed during 1989 constituting about 42 per cent of the total catch. The landings by ring seines are mostly comprised pelagic species like oil sardines, Mackerel, white baits and Penacid prawns. During 1989, of the total landings of Kerala about 70 per cent of the Oil sardines, 48 per cent of white baits 60 per cent of other clupeids, 72 per cent of Indian Mackerel and 27 per cent of penacid prawns were accounted for the ring seines. At present about 40 per cent of the gross marine fish landings of the State is

Mackerel landings declined from 19 in 1990 to 16 in 1991. Landings of carangids showed a phenomenal increase from 28 thousand tonnes during 1990 to 49 thousand tonnes during 1991.

### Catch and revenue of ring seine and other motorized units: An overview

Ring seines, Gillnets, Boat seines and hooks and lines are the major types of gears operated by motorized country craft along the Kerala coast. Better catch rates and monetary returns by ring seine in the initial phase led to the increase in its number and most of the boat seines have been also converted into ring seines. The estimated marine fish landings by motorized units from 1986 to 1991 is given in Table 3. In recent years (1988-91) more than 50 per cent of the total landings of Kerala coast were accounted for the

**Table 4. Catch & Revenue per trip of motorised units of ringseines, gillnets and hooks & lines in Kerala (1991)**

Sl. No.	Name of fish	Ringseines		Gillnets		Hooks & lines	
		Catch (kg)	Value (Rs)	Catch (kg)	Value (Rs)	Catch (kg)	Value (Rs)
1.	Oil sardines	331	1324	9	36	—	—
2.	Other sardines	65	195	—	—	—	—
3.	White baits	19	57	16	48	—	—
4.	Other clupeids	41	123	2	6	—	—
5.	Perches	7	56	—	—	—	—
6.	Carangids	175	560	4	23	8	80
7.	Indian Mackerel	131	1048	17	136	9	75
8.	Seer fish	—	—	14	350	2	50
9.	Tuna	—	—	3	24	34	272
10.	Penaeid prawns	26	650	—	—	—	—
11.	Others	1	3	1	3	1	3
Total		796	4016	66	626	54	480

ing income of ring seines. Seer fish and tuna are the major contributors to the revenue of gillnet and hook and line units respectively.

### Capital Investment

During 1986, the average initial investment of a ring seine unit was about Rs. 75,000/- and it increased to Rs. 1.1 lakh during 1988. However during 1991-92, the cost of a new unit was about Rs. 2.5 to 5 lakhs depending upon the size of craft and gear and H.P. and number of engines. This increase is not only attributed to the rise in cost price of implements but also to the increase in size of craft and gear, number and Horse power of engines. The average initial investment of ring seine units operating at Punnapra and Puthiangadi centres are given in Table 5. Some of these units are old and the resale value of the same at the observation time has been considered as the capital asset. All the units observed are using two engines for propulsion. The average initial investment of

a ring seine unit ranges from Rs. 2.3 lakhs at Puthiangadi region to Rs. 2.8 lakhs at Punnapra region during 1990-91.

### Fishing trips

The average annual fishing trips were 178 at Puthiangadi in Calicut region and 209 at Punnapra in Alappuzha region for ring seine units during 1991-92 (Table 6). Maximum number of fishing trips for ring seines were observed during the month of April both at Punnapra and Puthiangadi. On the basis of data collected from 10 selected centres the average number of fishing trips per annum for ring seine units along Kerala coast has been worked out at 160 per annum and some of these trips were found to be without any catch.

### Ownership and crew share

Most of the ring seine units are jointly owned by fishermen groups. The share holders constitute both the operating and

**Table 5. Average initial investment of ring seine units (1990-91)**

Items	Punnapra (Rs)	Puthiangadi (Rs)	All Kerala (Rs)
1. Craft	62000	60000	60000
2. Engines	63600	63200	63500
3. Gears	142000	103000	126500
Total	267600	226200	250000

**Table 6. Monthly average fishing trips of ring seine units at Punnapra and Puthiangadi (1991-92)**

Month	Average fishing trips per unit	
	Punnapra	Puthiangadi
April	25	19
May	20	12
June	16	17
July	18	11
August	18	17
September	20	15
October	21	16
November	17	16
December	10	15
January	16	15
February	13	10
March	15	15
Total	209	178

non-operating fishermen. The non-operating share holders also are entitled equal wage share as the crew. The number of share holders attached with each unit ranges from 25 to 55 at different centres along the Kerala coast. The number of fishermen going for fishing ranges from 20 to 35 for different units. The remaining are either reserves or non-operating fishermen. The non-operating fishermen will be doing shore based work like cleaning the engine, repairing the net etc. In some units crew members do both fishing and shore based works on rotation.

Usually the auction commission, fuel

expenses, bata or food expenses of crew and other day to day operating expenditure except the repairing work of craft and gear are considered the common expenses of the unit. The net returns derived after meeting this common expenditure from the gross revenue is shared between the owner and crew members. The owners of craft and gear are entitled 40 per cent of the net returns and the balance shared among the crew members. Whenever the gross earnings from the fish catch is not sufficient to meet even the common expenses, the loss is temporarily shared by all crew members and adjusted

later when the catches are high. For joint ownership units, the surplus from fishing is kept as a common fund from which the repayment of loan, interest and repairing and maintenance expenditure are met.

### Cost and Revenue

The west coast fishery is characterised by wide seasonal variation in the level of catch of different varieties of fish and the price of even same varieties of fish. The Quarter-wise operational cost, species-wise catch and revenue for ring seines operating at Punnapra and Puthiangadi centres are worked out for the year 1991-92 and given in Table 7 & 8.

The gross earnings as well as revenue per trip for ring seines were maximum during April-June period as compared to other quarters both at Punnapra and Puthiangadi. Even though ring seine catches mainly consist of pelagic species and October-December quarter is the peak season for such species as seen from Table 7 & 8 for Punnapra and Puthiangadi respectively, the April-June quarter is the peak season for revenue per trip for both centres mainly because of the contribution of prawns to ring seines catches. At Punnapra even average quantity landed by a ring seine is more in this quarter as compared to October-December

Table 7. Seasonwise average operational costs & returns of a ringseine unit Punnapra (1991-92)

Items					Annual		
	April-June	July-Sept.	Oct.-Dec.	Jan.-Mar.	Total	per trip	
<b>I. Operational expenditure (Rs)</b>							
a. Auction charges	24888	20384	10992	8932	65196	312	
b. Fuel expenses	48373	46088	30000	38544	163005	780	
c. Labour share	254431	188944	91632	46464	581411	2782	
d. Bata	18117	16464	13344	12452	60377	289	
e. Repair & maintenance	610	2520	528	308	3966	19	
f. Others	1098	560	432	484	2574	12	
Total	347517	274960	146928	107184	876589	4194	
<b>II. Specieswise catch &amp; revenue (Q-quantity &amp; V-value)</b>							
	in Kgs	in Rs.					
1. White baits	Q	2867	23576	1104	44	27591	132
	V	15738	74816	3792	264	94610	453
2. Mackerel	Q	11895	34440	3024	4092	53451	256
	V	129198	139160	29376	62832	360566	1725
3. Oil sardines	Q	58133	10696	10800	2596	82225	393
	V	192516	50512	55440	20592	319060	1527
4. Prawns	Q	5185	2408	2544	1276	11413	55
	V	176290	94976	78720	42196	392182	1877
Others	Q	488	8400	4752	176	13816	66
	V	1830	41608	42528	1012	86978	416
III. Total catch (kg)		78568	79520	22224	8184	188496	902
IV. Gross revenue (Rs)		515572	401072	209856	126896	1253396	5997

**Table 8. Seasonwise average operational costs & returns of a ringseine unit Puthiangadi (1991-92)**

Items		April-June	July-Sept.	Oct.-Dec.	Jan.-Mar.	Annual		
						Total	per trip	
<b>I. Operational expenditure (Rs)</b>								
a.	Auction charges	8112	6407	8648	7200	30367	171	
b.	Fuel expenses	20784	20382	23077	19000	83243	468	
c.	Labour share	70080	29541	55507	46000	201128	1130	
d.	Bata	6000	6794	7144	6000	25938	146	
e.	Repair & maintenance	912	4429	4559	3200	13100	74	
f.	Rent for carrier boat	13072	12377	29240	16280	61969	348	
g.	Ice	2928	2150	2679	1600	9357	52	
h.	Others	800	480	675	720	2675	15	
	<b>Total</b>	<b>122688</b>	<b>82560</b>	<b>122529</b>	<b>100000</b>	<b>427777</b>	<b>2404</b>	
<b>II. Specieswise catch &amp; revenue (Q-quantity &amp; V-value)</b>								
		in Kgs	in Rs.					
1.	Oil sardines	Q	4944	4042	12690	4800	26476	149
		V	19824	20210	62369	26000	128403	721
2.	White baits	Q	6432	4730	2585	2600	16347	92
		V	43824	21328	10575	10000	85727	482
3.	Mackerel	Q	3120	3483	12032	12000	30635	172
		V	30000	27864	72380	88000	218244	1226
4.	Prawns	Q	2400	344	282	—	3026	17
		V	63618	16555	10810	—	90533	509
	Others	Q	576	2236	—	80	2892	16
		V	3216	13244	—	1600	18060	101
III.	Total catch (kg)		17472	14835	27589	19480	79376	446
IV.	Gross revenue (Rs)		160032	99201	156134	125600	540967	3039

which can be attributed to the better monsoon fishery started in June. January-March is the lean season in Punnapra for ring seine and the operation is only at subsistence level. The frequency of operation is also very low whereas in Puthiangadi. July-September is the lean period because of the absence of monsoon fishing at this centre. It is almost a fishing holiday and the level of operation is very low. The varieties like Whitebaits, Mackerel, Sardines and Prawns are found to be available in all seasons while the Pomfrets, Flat fishes, Perches, Tuna, Carangids etc. are

found in considerable quantity only during July to December period. With regard to revenue, penaeid prawns contributes about 31 per cent, Oil sardines 29 per cent and Mackerel 25 per cent in the annual earnings of the ring seine units at Punnapra. The average prices realised per kg of fish caught in ring seine units at Punnapra was Rs. 6.56 per kg during April-June, Rs. 5.04 during July-September, Rs. 9.44 during October-December and Rs. 15.50 during January-March. It may be seen that the overall value realised per kg of fish during each season not



the estimated catch and effort data. The average annual operational cost of a ring seine unit works out about Rs. 8.7 lakhs at Punnapra, Rs. 4.28 lakhs at Puthiangadi and Rs. 4.7 lakhs for Kerala as a whole. The average annual catch of ring seine units worked out at 1889 tonnes at Punnapra, 79 tonnes at Puthiangadi and 127 tonnes for Kerala as a whole and the corresponding average annual revenue worked out at Rs. 12.5 lakhs, Rs. 5.4 lakhs and Rs. 6.4 lakhs respectively. Net operating income per annum to these units being Rs. 3.77 lakhs at Punnapra, Rs. 1.13 lakhs at Puthiangadi and Rs. 1.74 lakhs for all Kerala. The study indicates that the economic performance of ring seines operating at Punnapra in Alappuzha region is much better as the annual net profit works out at Rs. 2.82 lakhs here as against Rs. 0.35 lakhs at Puthiangadi and Rs. 0.86 lakhs for all Kerala. The units in Alappuzha coast not only catch higher quantity of Oil sardine and Mackerel but also considerable quantity of penaeid prawns especially due to "Chakara" (Monsoon) fishing.

#### **Economic efficiency parameters of ring seines**

A set of key indicators of economic efficiency of the ring seine units operating along the Kerala coast has been worked out and given in Table 10. The capital turn-over ratio is used to measure the rate at which income is generated by capital investment. Rate of return and payback period explains the economic feasibility of undertaking a particular investment. The returns to labour and their productivity per trip gives an idea about the allocative efficiency of labour.

The net operating income per trip worked out at Rs. 1,803 for the units at Punnapra, Rs. 635 at Puthiangadi and Rs. 1,085 for all Kerala.

The average price realized per kg of ring seine catch worked out at Rs. 6.65 at Punnapra, Rs. 6.80 at Puthiangadi and Rs. 5.05 for all Kerala as against the production cost per kg of Rs. 5.15, Rs. 6.37 and Rs. 4.37 respectively. The quantity of fish produced by ring seines per litre of fuel works out at 5.2 kg at Punnapra, 4.3 kg at Puthiangadi and 5.9 kg for all Kerala, the fuel cost per kg of fish being Rs. 0.85, Rs. 1.05 and Rs. 0.76 respectively.

The capital turn-over ratio of ring seines is calculated at 470 per cent at Punnapra 240 per cent at Puthiangadi and 260 per cent for all over Kerala. Rate of return on capital is also found to be very high at Punnapra with 120 per cent as against 30 per cent at Puthiangadi and 49 per cent for all Kerala. The pay back period is estimated at 0.8 years for the units at Punnapra 2.9 years at Puthiangadi and 1.8 years for the units operating in the entire Kerala coast.

Economic efficiency parameters clearly indicate that the ring seines operating along Kerala coast are highly profitable during 1991. However the profitability, catch rates, gross earnings and rate of return are comparatively very high in the Alappuzha region of Kerala coast. The demonstrated techno-economic viability and high returns of ring seines in this belt in the initial phase hence paved the way for the uncontrolled growth of ring seines along Kerala coast. Now there is a declining trend in the catch rates as well as earnings of ring seiners.

Table 10. Key economic indicators for ring seine fishing units

Items	Punnapra	Puthiangadi	All Kerala
1. Average annual fishing trips	209	178	160
2. Average catch per trip (kg)	902	446	796
3. Gross revenue per trip (Rs)	5997	3039	4016
4. Average operating cost per trip (Rs)	4194	2404	2931
5. Net operating income per trip (Rs)	1803	635	1085
6. Average value realised per kg of fish (Rs)	6.65	6.80	5.05
7. Quantity of fish produced per manday (kg)	22.55	11.15	19.90
8. Value of production per manday (Rs)	149.96	75.82	100.50
9. Average remuneration received by a labourer per manday (Rs)	77	32	46.00
10. Average fuel cost per trip (Rs)	780	468	607
11. Quantity of fish produced per litre of fuel (kg)	5.2	4.3	5.9
12. Fuel cost per kg of fish (Rs)	0.86	1.05	0.76
13. Operating cost per kg of fish (Rs)	4.65	5.39	3.68
14. Average (total) cost per trip (Rs)	4647	2843	3480
15. Break even price per kg of fish (Rs)	5.15	6.37	4.37
16. Capital-turn over ratio	1 : 4.7	1 : 2.4	1 : 2.6
17. Rate of return on capital (%)	120	30	49
18. Pay back period (yrs.)	0.8	2.9	1.8

Average production per men day works out at 22.55 kg at Punnapra, 11.15 kg at Puthiangadi and 19.90 kg for all Kerala, the value received being Rs. 150, Rs. 76 and Rs. 101 respectively. The average wages received per man day by a fishing labour in ring seine works out at Rs. 77 at Punnapra, Rs. 32 at Puthiangadi and Rs. 46 for all Kerala. Thus the gross annual earnings of a crew worked out at Rs. 16,000 at Punnapra, Rs. 5,700 at Puthiangadi and Rs. 7,360 for all Kerala. Although ring seine units at Puthiangadi in Calicut region generally shown sustainable income, some of them especially inefficient ones are operating only at subsistence level. Hence further deversification in the motorized sector especially of ring seine units is inevitable in the long run for its sustenance.

## CONCLUSION

Currently the operation of ring seine is the most effective labour-intensive fishing practice prevalent along the Kerala coast. Majority of the active fishermen working in traditional marine fishing sector of the state are involved in this fishery. The marginalization of traditional sector due to intensive mechanised fishing has been stalled to a larger extent by the introduction of ring seines. Further the spirit of co-operative fishing among traditional fisherfolk has been developed as the ring seine operation is a joint venture and the ownership of almost every unit has been shared by 30-40 fishermen. The average per capita investment of an active fisherman of a ring seine unit comes

about only Rs. 6,000 which is perhaps not much higher than many of the existing fishing techniques. However, many fishermen are underemployed in ring seine units as the number of share holders are much more than the required number of crew for its operation. The average annual earnings of a crew in ring seines of Kerala coast during 1991-92 works out at Rs. 7,360. The annual earnings of a crew at Puthiangadi in Kozhikode region are as low as Rs. 5,700 although the units are running on sustainable profit. The less efficient ring seine units are not competitive enough to fetch sufficient catch to provide adequate earnings to the crew. Hence the number of ring seine units and the active fishermen depending on them is likely to decrease in the near future. In this context further diversification of fishing techniques in the motorized sector is highly essential for its survival.

#### ACKNOWLEDGEMENTS

Authors are thankful to Dr. P.S.B.R. James, Director, CMFRI for his constant encouragement in carrying out this study and Dr. A. Regunathan, Head, Fishery Economics and Extension Division for critically going through the manuscript. The services rendered by Shri. K. Soman, v.S. Gopalan and A.Y. Jacob, Technical staff stationed at Calicut and Alappuzha centres of CMFRI for coordinating data collection has been gratefully acknowledged.

#### REFERENCES

- Anon 1991. Techno-Economic analysis of motorization of fishing units - A cost and earnings study along the lower South - West coast of India. *Fisheries Research Cell P.C.O. and SIFFS*, Trivandrum, Kerala.
- Balan, K., K.K.P. Panikkar, T. Jacob, Joseph Andrews and V. Rajendran 1989. Motorization of country craft in Kerala - An Impact study. *CMFRI special publication*, 45: 1-74.
- James, P.S.B.R., K.N. Kurup and N.G.K. Pillai 1991. A review of present status of Marine Fisheries of Kerala. *Mar. Fish. Infor. Ser. T & E Ser.*, 114 : 1 - 8.
- Kurien, John and T.R.T. Achari 1988. Fisheries development policies and the fishermen's struggle in Kerala. *Social action*, 38: 15 - 36.
- Noble, A. and V.A. Narayanankutty 1978. Economics of indigenous fishing units at Cochin - a case study. *CMFRI Special Publication 4 (1978)* : 1 - 24.
- Panayotlu, T. 1985. Production technology and economic efficiency: A conceptual frame work. *Small scale fisheries in Asia: Socio-economic analysis and policy*. IDRC 299 c: PP. 95 - 100.
- Panikkar, K.K.P., R. Sathiadhas and T. Jacob 1990. Comparative economic efficiency of different types of mechanised fishing units operating along Kerala coast. *J. Mar. Bio. Asso. India*, 32 (1 & 2) : 97 - 106.
- Sathiadas, R. and G. Venkataraman 1981. Impact of mechanised fishing on the Socio-economic conditions of the fishermen of Sakthikulangara, Neeindakara, Kerala. *Mar. Fish. Infor. Serv. T & E Sr.* 29: 1 -18.
- Sathiadas, R. and K.K.P. Panikkar, 1988. Socio-economics of small-scale fishermen with emphasis on costs and earnings of traditional fishing units along Trivandrum coast, Kerala. A case study. *Sea Food Export Journal*, 20 (11) : 21 - 36.
- Sivadas, M. and K.K. Balasubramanian, 1989. Introduction of 'Ringuvala' along Calicut coast with a note on its general impact. *Mar. Fish. Infor. ser T & E. Ser.* 8 -10.
- Sivasubramaniam, K. 1991. The days of the Kattamarans are numbered. *Bay of Bengal News No.* 42 June 1991. PP 12 - 15.
- Subba Rao, N. 1985. some parameters of fisheries development with special reference to Andhra Pradesh. *Sea Food Export Journal*. 18 (16) : 5 -12.