A study on Economics of Different Fishing Techniques along Kerala Coast with Special Reference to Fuel Efficiency

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Level of non-renewable energy utilisation by different mechanised and motorised craft-gear combinations engaged in inshore marine fishing along Kerala coast has been worked out. Fuel cost and its impact on the profitability and the fuel efficiency of different fishing units have been analysed in this paper.

The study revealed that fuel efficiency is maximum for purse seiners among the mechanised fishing craft and boat seine with country craft fitted with 7 hp outboard engine among different motorised craft-gear combinations. Though the fuel expenditure per trip is maximum for purse seine, it is minimum to produce one kg of fish. Among motorised craft, the oil expenditure per trip is minimum for gill net operation but per kg of fish it is higher than that of boat seine operation.

Marine fishing is capital intensive mainly due to the increased tempo of mechanisation as well as the motorisation of country craft. Fishing along our inshore waters is transforming from a subsistance level to a cash crop operation and now the fishermen are very much conscious about their profit margin. Since there are a number of technological options for the fishermen in their fishing venture, it is essential to study the economics of such techniques which will help them in their investment dicisions.

Since all types of fishing operations either with inboard or outboard engines use fuel energy either for propulsion or for gear operation, it is all the more essential to study the operating costs of these units with the emphasis on oil expenditure. In view of the present foreign exchange crisis which is to a certain extent the offshoot of fuel crisis, a proper evaluation of fuel utilisation in any sector, is of utmost importance.

An attempt is made in this paper for such an evaluation in coastal marine fishing sector.

Materials and Methods

The study covered the three major fishing techniques categorised under mechanised fishing, such as purse-seiners, trawlers and gillnetters and the major artisanal fishing units using outboard engines for propulsion, such as 1) boat-seine-plank built boats with 12 HP OBE. 2) boat-seine-plank built boat with 7HP OBE. 3) gillnet-plank built-boat with 7 HP, OBE 4) hook and line- catamaran with 7 HP OBE 5) hooks and line canoe with 7 HP OBE and 6) ring-seine with 2 engines of 12 HP

For mechanised fishing units, data were collected from selected units of purse-seiners, trawlers and gillnetters operating at Cochin Fisheries Harbour during 1989-90 and for motorised units from selected centres of Quilon and Ernakulam districts of Kerala State. The information on catch, revenue, quantity and value of fuel used, wages, auction charges, level of investment and boat/gear characteristics was collected by direct observation and interview during the period 1989-90 covering all fishing seasons.

The purse-seiners, included in the sample are mostly of size 12.8m with 110-120 HP engines, trawlers 9.8-10.9m with 60-68 HP engines and mechanised gillnetters 8.5m with 40 - 45 HP.

Results and Discussions

Cost and earnings of mechanised units

The cost of fishing using any type of fishing unit can be classified into two distinct parts. One is the operating cost which is incurred only when the vessel is under operation. The other is the fixed cost which is to be incurred even if there is no operation. For marine fishing units the major components of operating cost are wages, fuel cost, auction charges, cost of ice. jetty rent and repairing and maintencance charges. The fixed cost consists of interest on investment, depreciation of capital assets and insurance.

Among the major mechanised fishing units covered under the study (Table 1) the cost of fishing per trip is maximum for purse seiner and minimum for gillnetter. Based on the performance of these units during 1989-90, the operating cost per unit per day of a purse seiner is at Rs.4387, of which about 50% was contributed by labour cost and 30% by fuel cost.

For trawlers the average operating cost unit/day worked out to Rs.1885. Major component of operating cost of trawlers was fuel cost (52%) and wages contributed to 33%. For mechanised gillnetters the operating cost/unit/day of operation came about Rs.662 consisting of wages, 40% and fuel cost 36%.

However, the cost of production per kg of fish was minimum for purse-seiner (Rs 2.76) and maximum for trawler (Rs.7,10) and for gillnet it was Rs.6.83/-.

The annual net profit of different vessels are worked on the basis of 120 fishing days in a year

Economics of motorised units

Among the different types of motorised fishing units covered under the study (Table 2), the catch as well as revenue per day of operation were maximum for ring-seine operating plank built boat using 2 outboard engines of 12 H.P. each and minimum for catamaran operating hook and line with 7 HP, OBE.

The net income per day of operation ranged from Rs.23/- for catamaran unit with hook and line to Rs.943/- for ring seine with 2 OBE of 12 H.P. Since most of these motorised units are owned by the fishermen who operate it, under a clear cut sharing system it is more meaningful to work out the fishing surplus for these units by deducting all fishing costs except wages from the revenue.

Net income including wges per day of operation worked out at Rs.3118/- for ring seine distributed to 28 workers, Rs.657/- for boat seine with 12 HP engine for 16 workers, and Rs.547/- for canoe operating hook and line with 7 HP engine shared by 3 to 5 workers.

Among the motorised units, catamaran as well as canoes operating hook and line using 7 HP outboard engines are less labour intensive and mostly within the financial means of the ordinary fishermen. So also the gillnetters are mostly owned by fishermen in the lower income group.

All the outboard units including the capital intensive ring seine are mostly shared by the workers and the revenue is also shared accordingly. Net income for boat-seiners operating with 12 HP and 7 HP engines was higher than that of gillnets and hooks and lines. But the initial investment for boat seiners is much higher.

Comparative economic efficiency

A set of key economic indicaters have been worked out on the basis of the economic performance of mechanised and motorised fishing units along Kerala coast during 1989-90 and presented in Table 3. These units varied widely not only in its level for investment but also to a certain extent in catch composition, method of operation, fuel utilisation and size of crew. The key economic indicators help the developmental authorities for policy decisions and planning in marine fishing sector.

Table 1. *Average cost and earnings per day of operation of different mechanised fishing units at Cochin Fishing Harbour (1989-90)*

		Purse seiners	Trawlers	Gillnetters Mechanised
A.	Initial investment,Rs.	10,70,000	3,40,000	1,60,000
B.	Catch, kg	2,500	341	135
C.	Revenue, Rs.	8,500	2,933	1,080
D.	Operating cost			
	Fuel	1,320	990	240
	Auction	425	147	54
	Wages	2,195	627	262
	Ice	-	-	20
	Jetty rent	30	10	6
	Repairing	417	111	80
	Total operating cost,	Rs. 4,387	1,885	662
E.	Fixed cost,			
	Depreciation	1,067	200	89
	Interest	1,337	283	141
	Insurance	100	50	30
	Total fixed cost	Rs. 2,504	533	260
F.	Total cost,	Rs. 6,891	2,418	922
G.	Net profit,	Rs. 1,609	515	158
H.	Fishing days/year	120	180	170
I.	Annual profit,	Rs. 1,93,080	92,700	26,860

Among the mechanised fishing units purse seiner earns maximum net income as compared to trawler and gillnetter. Cost of fishing per kg of fish is minimum and revenue per rupee of operating cost is maximum for purse-seiner. However, the rate of returns to capital is maximum for trawlers. Returns to labour is also higher for trawlers. Though the purse seiners get higher net income, its investment requirement is beyond the financial means of those fishermen who are really engaged in fishing.

Among mechanised units, only gillnetter is owned by fishing workers. Returns to labour in gillnet is higher than that of purse-seiner.

Among motorised fishing units, ring seine earns maximum profit. Its initial investment is much higher than all other types of motorised country craft. Most of the ring seine units are operated from plank built boats with 2 outboard engines of 12 HP each with 30 workers engaged in the operation. Since the ownership of most of the country craft is shared by workers themselves, the fishing income of a worker is the sum of the net profit and wages. Owners of boat-seine units get higher income than those of gillnet, catamaran and hook and line units. But the investment requirement for the latter is comparatively low so that the ordinary fishermen could afford it. The canoe with 7 HP OBE operating hook and line gets a higher returns to its capital and also the returns to labour. Its pay back period also is minimum. It is interesting to note that for all these fishing units inspite of the wide variation in investment, level of catch, revenue and costs, the revenue earned per rupee of operating cost does not show much variation.

It varied only within Rs.1.17 for catamaran operating hook and line to Rs.1.93 for purse-seiner. Returns to labour among the motorised units is maximum for canoe-hook and line unit.

Fuel efficiency

Key indicators of fuel efficiency are worked out and given in Table 4 for

Table 2. *Average cost and earning per day of operation*

Type of gear	B.S. 12 HP	B.S 7 HP	G.N 7 HP	H&L 7HP Cata maran	H&L 7 HP Canoe	Ring seine 2 Engines 12 HP
A. Initial investment Rs.	85,000	78,000	58,000	25,000	37,000	3,33,000
B. Catch, kg	520	430	95	60	145	990
C. Revenue, Rs.	1,040	860	608	492	856	4,700
D. Operating cost,						
Fuel	154	95	77	77	112	840
Auction	52	43	30	25	42	235
Wages	500	433	301	293	443	2,175
Maintenance	45	35	30	13	21	80
Other expenses	15	15	11	18	80	-
Total, Rs.	766	621	449	426	699	3,330
E. Fixed cost,						
Interest	58	53	40	17	25	250
Depreciation	59	53	39	26	28	117
Total, Rs.	117	106	79	43	53	427
F. Total cost, Rs.	883	727	258	463	752	3,757
G. Net profit, Rs.	157	133	80	23	104	943
H. Net income, Rs.	657	566	381	316	547	3,118
I. No. of fishing days/year	220	220	220	220	220	220
J. Annual net profit	34,540	29,260	17,600	5,060	22,880	2,07,460

B.S. 12 HP - Boat seine operating with plank built boat fitted with 12 HP motor
B.S. 7 HP - Boat seine operating with plank built boat fitted with 7 HP engine
G.N 7 HP - Gill net plank built boat fitted with 7 HP motor
H & L 7 HP catamaran - Catamaran operating hook & line with 7 HP
H & L 7 HP Canoe - Canoe operating H & L with 7 HP engine
Ring seine - Plank built boat 2 motors with 12 HP ring seine

mechanised units using diesel energy and in Table 5 for motorised units using kerosene. For calculation of fuel cost, diesel price is taken uniformaly at Rs.6/ltr. For kerosene, the motorised units get certain quantity at ration price, but they have to purchase some quantity in open market. On the basis of actual cost incurred by the sample units, the average price is estimated at Rs.3.5 per litre.

Among the mechanised units, purse seiner caught 11.4 kg for one litre of diesel whereas trawler caught 2 kg and gillnetter 3.4 kg. In terms of value also, purse-seiner earned Rs.38.75 as against Rs.18/- by trawler and Rs.27/- by gillnetter. Though the purse-seiner on an average utilised 220 litres per trip which is much higher than 165 litres for trawler and 40 litres for gillnetters, the fuel efficiency in terms of maximum quantity and value of production per litre of fuel is much higher for purse seiner.

Among the motorised units, fuel cost per trip is maximum for ring- seine unit and minimum for gillnet and hook and line-catamaran units. However, the quantity and value of fish produced per litre of fuel (kerosene) is maximum for boat seine operating with 7 HP motor. Returns to fuel and revenue per rupee of fuel cost are also maximum for this unit. But there is not much variation in the revenue per rupee cost on fuel. It varied from Rs.7/- for ring seine to Rs.10/- for boat seine with 7 HP engine.

All the motorised units use motor only for propulsion. Except for ring seine, the

Table 3. *Key economic indicators*

Type of unit	P.S	T.N	M.G.N	B.S 12 HP	B.S. 7 HP	GN 7 HP	Catamaran H&L 7 HP	Canoe H&L 7 HP	Ring Seine
1. Catch per day of operation, kg	2,500	341	135	520	430	95	60	145	990
2. Revenue per day of operation, Rs.	8,500	2,933	1,080	1,040	860	608	492	856	4,700
3. Average price realised per kg	3.40	8.60	8.00	2.00	2.00	6.40	8.20	5.90	4.75
4. Operating cost per day/trip of operation, Rs.	4,387	1,885	662	766	621	449	426	699	3,330
5. Operating cost per kg of fish	1.76	5.53	4.90	1.47	1.44	4.73	7.00	4.82	3.36
6. Operating cost Revenue rate	1.93	1.56	1.63	1.18	1.39	1.35	1.17	1.22	1.41
7. Total cost per day/trip Rs.	6,891	2,418	992	883	727	528	469	752	3,757
8. Total cost per kg of fish, Rs.	2.76	7.10	6.83	1.70	1.70	5.56	7.82	5.19	3.79
9. Net income per day of operation	1,609	515	158	157	133	80	23	104	943
10. Number of fishing days in a year	120	180	170	220	220	220	220	220	230
11. Labour cost per kg of fish	1.84	0.88	1.94	0.96	1.10	3.17	4.88	3.06	2.20
12. Returns to labour Rs. per day	135	228	140	44	38	127	105	182	111
13. Return to capital (rate of returns in percentage)	33	42	31	56	53	46	35	76	79
14. Pay back period (years)	3.3	2.5	3.86	1.8	1.9	2.2	2.3	1.3	1.4

quantity of fuel required for one trip is less than 40 litres. 40 litres are required when 12 HP engine is used. If only 7 HP motor is used, all the major gear can be operated with country craft using 20-30 litres of kerosene. Now-a-days among the traditional fishermen, the tendency is to go for engines with higher HP which will help only to increase the speed. In all the craft-gear combinations fitted with outboard motors along Kerala coast, except ring-seine, no other unit requires an engine having more than 7 HP. As seen from the Table 5 boat seine with 7 HP is superior to Boat-seine with 12 HP in its fuel efficiency.

Table 4. *Key indicators of fuel efficiency of mechanised units*

		Purse-seine	Trawl	Gillnet
1.	Quantity of fuel (Diesel) required for one trip(litres)	220	165	40
2.	Fuel cost per trip,Rs.	1320	990	240
3.	Quantity of fish produced per litre, kg	11.4	2.1	3.4
4.	Value of fish per litre, Rs.	38.75	18.06	27.20
5.	Fuel required (ltr.) to produce 100 kgs of fish	8.80	48.40	29.60
6.	Revenue per 1 rupee fuel cost	6.5	3.0	4.53
7.	Returns to fuel, Rs.	13.3	9.12	9.95

Utilisation of fuel energy

In the marine fishing sector, for inshore fishing the fuel energy is mostly utilised by small trawlers. It is estimated that at present about 15000 trawlers are in operation along our coast. One trawler on an average operates 180 days in a year. The average fuel requirement for one day's operation is estimated at 150 litres per trawler. Hence, the average annual cost of fuel by all trawlers is estimated at Rs.243/- crores and the total fuel expenditure for all types of units may be around Rs.350 crores. The export earnings from marine products during the previous financial year was Rs.860/- crores. Even if one- third of this is considered as the contribution of culture fishery, the export earnings from the marine fishing sector is much higher than the fuel expenditure. Moreover, a major portion of fuel cost in rupee terms is contributed only by excise duty. Hence, in terms of dollar, the expenditure on fuel utilised for marine fishing is more than compensated by the exports of marine products.

Table 5. *Key indicators of fuel efficiency of motorized units*

	B.S 12 HP	B.S 7 HP	G.N 7 HP	H&L Catamaran 7 HP	H&L Canoe 7 HP	Ring- seine 12 HP 2 engines
1. Quantity of fuel (Kerosene) required for one trip (ltr.)	40	25	20	20	30	200
2. Fuel cost per trip, Rs.	154	95	77	77	112	840
3. Quantity of fish produced per lit.kg	13	17	5	3	5	5
4. Value of fish per ltr., Rs.	26	34	30	25	29	24
5. Fuel required to produce 100 kg of fish., ltr,	8	6	21	33	21	20
6. Revenue per rupee fuel cost, Rs.	7.40	10.00	8.60	7.10	8.30	7.00
7. Returns to fuel,Rs.	7.78	9.12	7.85	5.00	7.21	8.92

Conclusion

In the mechanised sector of inshore fishing, fuel efficiency is maximum for purse-seiners as compared to small trawlers and gillnetters and it is minimum for trawlers. However, purse- seining has become a capital intensive enterprise and is far beyond the financial means of ordinary fishermen

Among the motorised units, except for ring seine, there is not much variation in fuel utilisation. Returns to fuel and the revenue worked out for cost of one rupee on fuel indicated that all these units do not show considerable variation in fuel efficiency and also that for all of them returns to fuel is much more than its aquisition cost.

All the economic and fuel efficiency indicators have been worked out on the basis of performacne of these nine different craft gear combinations in Kerala, using either diesel or kerosene during the period 1989-90 which happened to be economically a better period. All units are running on profit and could earn a fishing surplus. For all the units, earnings by fuel utilisation is much higher than its expenditure.

The total fuel expenditure for marine fishing indicates all the craft gear combinations use fuel efficiently so that the returns from fuel is higher than its cost, that too inspite of the continuous increase in fuel price.

Authors are thankful to Dr. P.S.B.R.James, Director, Central Marine Fisheries Research Institute, Cochin and Dr. A.Regunathan, Head, Fishery Economics & Extension Division for their encouragement in the preparation of the paper. Thanks are also due to Mrs.K P Salini for the collection and tabulation of data and Shri. R.C. Shenoi for secretarial assistance.