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Fuel Consumption Pattern by the Mechanized Fishing Sector in Kerala

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Results of the study on the fuel utilization pattern in the mechanized fishing sector in Kerala are presented. Stratified random sampling revealed the fuel consumption of 97204 kl. by 3823 crafts, with an expenditure of Rs. 204 crores at the price level of 2002, during which only 55% of the fishing capacity was found utilized. The substantial fuel expenditure calls for optimum fuel utilization measures and appropriate management of fishing operations.

Keywords : Fuel consumption, mechanized fishing craft

The spread of mechanized fishing technology has completely transformed the fishing sector in India and the consumption of fuel has gone up as the number and size of mechanized crafts steadily increased over the years. Along with mechanized fishing the traditional sector also has been converting to motorization on a large scale where outboard engines of 8.00 hp to 40 hp are extensively used. Over 90% of the marine fish catch is presently accounted under mechanized and motorized fishing (Anon, 2000). The mechanized fishing boats of 28′ to 40′ LOA introduced in the sixties have mostly been replaced by larger boats of sizes upto 60′ LOA fitted with 126 hp marine engines. The large boats are designed for longer sea endurance and also for deep-sea fishing. The fishing industry in India is supported by 53684 mechanized and 44578 motorized crafts, of which Kerala's share is 8% and 39% respectively (Anon, 2001).

An earlier study conducted by CIFT (Unnithan *et al*, 2004) has revealed that 77% of the operating cost of fishing goes towards fuel, affecting the profitability of fishing itself. Presently, no reliable estimate on the quantity of fuel used and the pattern of fuel consumption by the fishing industry is available. In this background, it is imperative that current status of fuel consumption in the fishing industry is ascertained in detail for economic evaluation of fishing vessels and also to evolve suitable policy formulations.

The present study attempts to bring out the fuel utilization pattern by different class of mechanized fishing vessels and estimate the total quantity consumed by the fishing industry in Kerala state.

Materials & Methods

The study was carried out during 2002 in Kerala. For making a sampling frame for the study, the number of mechanised crafts based on size viz., small (below 40′ LOA), medium (40-48′ LOA) and large (above 48′ LOA), number of fishing days and trips per

craft per annum were collected. As the available data was not found up to date and reliable, a complete enumeration of the fishing crafts was carried out in the state level. For collecting the above information the trawl ban period of 15th June to 31st July was chosen so that actual counting of crafts could be possible when they are safely berthed at their respective jetties, adjacent water bodies or repair yards. For enumeration the coastal area of Kerala was divided into three zones viz. Kollam (Thiruvananthapuram and Kollam districts), Kochi (Alappuzha, Ernakulam and Thrissur) and Calicut (Malappuram, Kozhikode, Kannur and Kasargod). The physical counting of crafts (sick units excluded) was undertaken after careful planning and execution so that figures were available in time for each of the three regions. Information on the number of fishing days and trips by crafts of sizes of small, medium and large were collected simultaneously from the boat operators. Based on this preliminary data the distribution pattern of the fishing trips undertaken by different classes of crafts was arrived at. However the actual number of fishing trips made by the vessels during the year under study was collected in Cochin region as per secondary data available with the port authorities and officials in the mechanized craft landing centers including the Cochin and Munambam fisheries harbours. The fuel consumption data for each category of fishing vessels was collected from Ernakulam district of Kerala where about 30% of the fishing activity of the state is concentrated (Anon, 2003).

As the rate of fuel consumption was observed to vary considerably between boats of various sizes, the stratified random sampling techniques (Sukhatme and Sukhatme, 1970) was adopted for making the estimates. The boats were stratified into 3 strata of small (below 40'), medium (40-48') and large (above 48') based on vessel size. Data was randomly collected from each stratum by trained field staff based on a structured proforma to include fuel utilization, hp of the engine, average speed and rpm, area of operation, fishing time, duration, and trip cycle. Collection of data was performed from each stratum on every fifth day for a period of 10 months excluding the two months trawl ban period. A total of 4414 trips were covered for the study of which sampling ratio was 1% for the small class, 8% for the medium and 6% for the large class of vessels based on the population size. The actual quantity of fuel utilized per trip was taken as the fuel utilized for reaching the fishing ground and returning, and the fuel spent for fishing.

The formula used for the estimation was:

$$\sum^{h} \hat{Q}_h = \sum^{h} \left(\frac{N_h}{n_h} \times \sum_{i=1}^{n_h} q_{hi} \right)$$ where Q_h is the estimated fuel consumption; n_h is the number of trips sampled and the N_h is the total number of trips in the h^{th} stratum, q_{hi} is the fuel consumption of the i^{th} observation in the h^{th} stratum. The summation is taken over h strata for pooling the fuel consumption to obtain estimate at the district and state levels. The variance of estimates was worked out by calculating

$$V\left(\hat{Q}_h\right) = \frac{N_h\left(N_h - n_h\right)}{n_h} \times \frac{1}{n_h - 1}\left[\sum_{i=1}^{n_h} q^2_{hi} - \frac{\left(\sum^{n_h} q_{hi}\right)^2}{n_h}\right]$$

The percentage error of pooled estimate is

$$SE = \frac{\sqrt{\sum^{h} V\left(\hat{Q}_h\right)}}{\sum \hat{Q}_h} \times 100$$ summation running over all strata at the respective levels.

The estimates of the fuel consumption made for each stratum were pooled for making the final estimates. This was also followed by the corresponding standard errors.

Results and Discussion

The first stage stratification of the vessels was based on the vessel size. The size wise information was collected through the enumeration of the boats and is furnished in Table 1 for Ernakulam district and Kerala state. The area of operation of the vessels were found to be on the West coast. As revealed by the table it may be observed that there has been an appreciable increase in the number of larger boats which operate for multi-day fishing spanning a period of 2 to 10 days per trip and totaling about 280 fishing days a year. The small class of vessels are generally fitted with ALM 370 engine with a maximum of 70 hp. The medium size vessels are fitted with engines of about 100 hp (ALM 400 and 402) whereas the large vessels use engines mostly of 126 hp (ALM 412). The small crafts of below 40′ were observed to be slowly vanishing from the fishing activities as a result of poor economic returns. Data compiled also indicated that about 15 h of fishing operations is conducted daily on an average and night trawling operation is generally not practiced.

Based on the analysis of the data collected, on an average one l litre of fuel can generate the power of 5 hp in medium and larger vessels. In the vessels with turbo charged engines the Sfc (Specific fuel consumption) is reported to be low owing to its efficiency. It was observed that the present trend was to go for large vessels, as vessels of higher hp have more sea endurance. The medium class of vessels are observed to make a trip of average 5 days whereas the larger class of vessels generally make a trip of 7 fishing days.

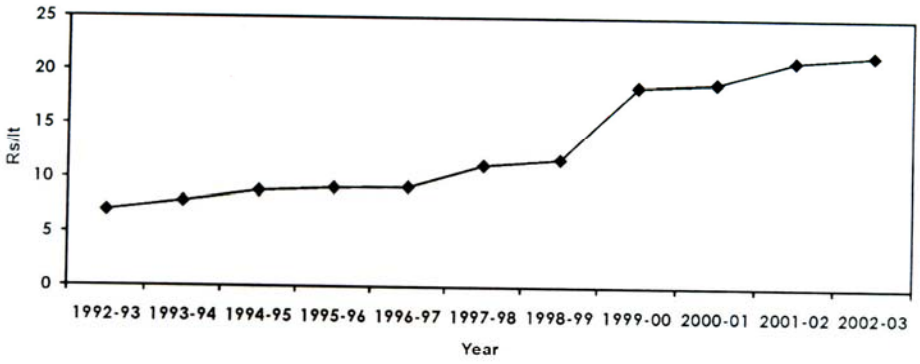

Fig. 1. Price of fuel (1992-2003)

Table 1. Number of craft and ideal number of trips for each category of craft

Vessel class (LOA)	Number of craft-Ernakulam	Number of craft-Kerala	Ideal number of trips per annum
Below 40′	484	1498	180
40-48′	265	912	80
Above 48′	736	1413	40
Total	1485	3823	

According to information collected from boat operators the small class of boats perform 180 days of operation whereas the larger types of boats engage in fishing operation for 280 days per annum in an ideal fishing season. In terms of trips this is equivalent to 180 (1 day trip), 80 (3 - 5 trip days) and 40 (5 - 7 trip days) trips for small, medium and large vessels respectively (Table 1).

However it has been observed that the maximum fishing capacity of the boats are not expended in some seasons owing to fluctuations in catch and poor returns. On the basis of the actual number of trips performed by vessels during 2002, the number of trips by small, medium and large vessels for Ernakulam was worked out to be 47966, 12182 and 15989 and for Kerala 148458, 41924 and 30696 respectively (Table 2).

As given in the table, an average of 195 L of fuel per day is utilized by small type of vessels. The medium class of vessels consume 766 L per trip of 3 to 5 days and larger vessels consume 1200 L per trip of 5 to 7 days.

The estimate gives the consumption pattern of 9394 kL, 9336 kL and 18752 kL for small, medium and large vessels respectively, in Ernakulam district. The consumption in Kerala state was 29074 kL by small, 32129 kL by medium and 36001 kL by large vessels. Thus the consumption of fuel by the mechanised fishing industry in Ernakulam was estimated at 37482 kL and the corresponding figure in Kerala state as a whole was 97204 kL during the year 2002. The standard errors worked out are within the reasonable limits indicating the reliability of the estimates.

Attempt was made to estimate the consumption of fuel based on two stage stratification, the second strata being the duration of trip days. The estimate was thus made based on class of vessels as well as on trip days. The compilation of data on the basis of the second stage units based on trip days for medium and large vessels (40-48′ and above 48′) revealed the following distribution pattern (Table 4). However, the pooled estimate showed similar pattern as indicated in the single stage stratification and hence the second stage stratification was not considered. Hence the result of the first stage sampling is only provided in the paper.

Table 2. Ideal and actual number of trips for each category of craft

Vessel Class (LOA)	Ideal number of trips - Ernakulam	Actual number of trips - Ernakulam	Ideal number of trips - Kerala	Actual number of trips - Kerala
Below 40′	87120	47966	269640	148458
40-48′	21200	12182	72960	41924
Above 48′	29440	15989	56520	30696

Table 3. Estimated fuel consumption for different classes of mechanized craft in Ernakulam district & Kerala state

	below 40	40-48	Above 48	Pooled
Estimate of fuel used (kL)-Ernakulam district	9394	9336	18752	37482
SE (%)	0.13	0.94	0.98	0.54
Estimate of fuel used (kL)-Kerala state	29074	32129	36001	97204
SE (%)	0.13	0.94	0.98	0.54

As already indicated, the study has revealed that only 55% of the fishing capacity was actually utilized during the year under study. It has been noted that the vessels remain only for a few days at sea in lean fishing season or remain idle in jetties during certain other times due to uneconomic fishing and hence the reduction in the utilized fishing capacity. The demand of fuel by the industry at 100 % fishing capacity utilization will be 68148 kL for Ernakulam district and 1767735 kL for Kerala state.

The domestic fuel price for the past ten years is furnished in Fig. 1 indicating a price rise of 209% during the past decade and an annual price rise of 18.5% during the past five years ending 2002-03. At price levels of 2002 the total expenditure on fuel by the mechanized fishing industry in the works out to Rs 204.13 crores which is highly substantial. Considering the fact that the fuel cost is the major component in the operational cost of the mechanized vessels a substantial rise in the fuel cost will adversely affect the economic viability of the fishing vessels and hence there is an urgency of attaining fuel efficiency by suitable means.

Table 4. Percentage distribution pattern of fishing trips based on number of days by medium and large class of vessels

Vessel Class (LOA)	1-2 days	3-5 days	Above 5 days
40-48'	20.39	74.24	5.37
Above 48'	8.37	55.95	35.68

The cost of fuel has been rising steadily and the decrease in fishing capacity utilization that was observed during the study can be attributed to the increasing fuel cost coupled with low returns, especially during the lean season. In this scenario the future of the industry will depend on appropriate technological and managerial interventions like development of new-generation, fuel efficient fishing vessels, fuel saving fishing techniques and optimization of the mechanized fishing fleet.

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