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Energy Efficiency with Reference to Energy Yield of Trawlers

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Energy yield of fishing trawlers fitted with Ashok Leyland Marine (ALM) diesel engines was studied. Trawlers were classified based on the engine horsepower and, the energy yield of five engine models was worked out. The energy yield was close to unity for trawlers with ALM 370, ALM 400 and ALM 402 engines, but for those with ALM 680 engines it was the lowest at 0.66 kg catch per litre of fuel consumed. The energy yield was highest for trawlers with 30 HP engine.

Key words: Energy yield, trawlers

Energy conservation and fuel saving are priority areas particularly because of the increasing price of oil and that it is a major input for fishing. Many fishing nations have carried out studies on fuel saving in fisheries. Norway launched a major energy saving programme in 1980. Fuel consumption per kg fish landed with respect to different fishing methods has been assessed. Purse seining for schooling fish is very efficient in this respect. Offshore trawling for groundfish is the highest fuel consuming operation. In the late seventies most Norwegian trawlers consumed one kg fuel per kg of fish landed. At that time trawling consumed about three times as much fuel as long lining and three to four times as much as in coastal fishing. Inshore fishing at that time consumed about 0.1 kg of fuel per kg fish caught. Expressed in terms of landed fish per man hour, the trawlers are twice as efficient as longliners and three times more so than the coastal fishing (Endal, 1988).

The comparative economic efficiency of purse seiners, trawlers and gill netters operating along the Kerala coast during 1982-86 has been studied (Panicker *et. al.*, 1990). Fuel efficiency with reference to energy yield of these three types of vessels indicated that the quantity of fish produced per litre fuel consumed was highest for purse seiners at 12 kg/l, followed by the gill netters at 3.1 kg/l and the least for trawlers at 2.3 kg/l. In another study on the economics of different fishing techniques with special reference to fuel efficiency (Panicker *et. al.*, 1991), the level of non-renewable energy utilisation by different mechanised and motorised craft-gear combinations engaged in inshore fishing along the Kerala coast has been worked out for the period 1989-90. The fuel efficiency worked out with respect to energy yield was 11.4 kg/l for purse sciners, 3.4 kg/l for gill netters and 2 kg/l for trawlers.

The trawling fleet of Kerala has been classified into three types, small, medium and deep-sea trawlers. Studies of economics of operation showed that fuel consumption

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of fishing trawlers are influenced by the horsepower of the engine (John, 1996). The medium trawlers were classified into six groups based on the engine horsepower and an analysis was done to quantify the energy yield of the trawlers.

Materials and Methods

In order to study the energy efficiency of medium trawlers, economic and operational analyses of 22 medium trawlers (John, 1996) have been utilised. The data were collected between 1992 and 1994. Data on the catch and fuel consumption were collected through direct observations and through interviews at the Cochin Fisheries Harbour. The trawlers were classified based on engine models and the energy yield has been worked out. Total catch and total fuel consumption for two years have been taken as an average. Energy yield is the kg of catch per litre of fuel consumed. The energy yield calculated is presented in Table 1. Engine type, engine horse power, average length of trawlers (ft/m), total average fuel consumption per year, total average catch (kg/yr), and catch per litre of fuel are considered in arriving at the energy yield.

Table 1. Energy yield of medium trawlers according to the engine type

Engine Type	Maarna	Ruston	ALM 370	ALM 400 (wood)	ALM 400 (steel)	ALM 402	ALM 402	ALM 680
Engine HP	24	37.5	81	90	90	100	100	148
Average length of trawler, ft/m	28/8.5	28/8.5	32/9.75	38.5/11.7	45/13.7	49/14.9	52/15.85	43/13.1
Fuel consumption, l / year (average)	9427	11489	40420	49908	43636	55768	55690	62338
Total catch, kg/year	18264	45391	39672	35333	50545	59160	64944	41211
Catch per litre of fuel (energy yield), kg	1.94	3.95	0.98	0.71	1.16	1.06	1.17	0.66

Results and Discussion

For comparison, the average values of catch per litre of fuel consumed by Maarna and Ruston engines are taken. Values for trawlers fitted with ALM 400 and ALM 402 engines are taken as average. It can be observed from Table 1 that catch per litre of fuel consumed was higher at 1.94 and 3.95 kg respectively, for trawlers fitted with low horse power Maarna and Ruston engines but of the same length. In the case of trawlers with ALM engine, the energy yield is close to unity for ALM 370, ALM 400 and ALM 402, but for the ALM 680 it was the lowest at 0.66 kg/l. Further it can be seen that among the wooden and steel trawlers with ALM 400 engines, the steel trawlers performed better with regard to energy yield. Among the lowest powered trawlers Ruston engine was performing best while among the high powered trawlers those with ALM 370 (9.75 m), ALM 400 (steel 13.7m) and ALM 402 (14.9 m & 15.85 m) performed well. The energy efficiency of the medium trawlers with reference

to energy yield can be said to be highest for the trawlers with 30 HP engines and lowest for trawlers with 148 HP engines.

Panicker *et. al.* (1990) observed that the energy yield of trawlers operating from Cochin Fisheries Harbour during 1982-86 was around 2.3 kg per litre of fuel consumed. The sample units of trawlers surveyed in this study were 23 ft (9.75 m) with 65 HP (ALM 370) engine. In another study Panicker *et. al.* (1991) reported the energy yield of trawlers as 2 kg per litre of fuel. In this case all the sample units of trawlers were 32 ft (9.75 m) to 36 ft (10.97 m) OAL with 60 to 68 HP (ALM 370) engines. In the present study the energy yield calculated was only 0.98 kg per litre fuel for 32 ft (9.75 m) trawlers with ALM 370 engine. This shows that the total average catch over the years is on the decline with regard to these classes of trawlers. It can be seen from Table 1 that the trawlers of OAL above 45 ft (13.7 m) fitted with ALM 400 and ALM 402 engines perform better with regard to energy yield. Steel trawlers and wooden trawlers above 40 ft (12.19 m) with 90 HP and 100 HP give still better performance with regard to trawl fishing.

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