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FACTORS AFFECTING FISHING VOYAGE EXPENSES AND EFFICIENCY

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Abstract

Fishing voyage cost elements are identified and analysed. Each cost element is related to one of the following basic design and operational items; voyage production, engine power, number of crew and cost of fishing gear.

Fishing voyage efficiency is given as the proportion of voyage profit to voyage revenue. The variation of voyage expenses and efficiency with the various voyage parameters are analysed.

It is concluded that crew share and fish catching rate are the most significant factors affecting voyage expenditures and efficiency. All measures should therefore be taken to reduce crew share and increase fish catching rate so as to improve the economics of coastal fishing.

Introduction

The economy of coastal fishing depends on the annual revenues and expenditures. All efforts should be directed to increase revenues and reduce expenditures. The variation of the latter results mainly from the fluctuations of voyage expenses.

Fishing voyage expenses are composed mainly of the costs of fuel oil, lubricating oil, ice, provisions, maintenance and repair of fishing gear, commission and crew costs.

This paper is an attempt to analyse voyage cost items and relate each cost item to one or more of the basic design and operational parameters of coastal fishing vessels. The analysis of these cost items should help to identify and thus control those factors causing a pronounced increase in the total voyage expenditures. The reduction and control of these cost items should improve the economy of coastal fishing.

I. Items of Fishing Voyage Expenses

These expenses are composed of the following items:

1. Fuel Oil Expenses e_{fo}

Fuel oil expenses depend on :

- Specific fuel consumption, b_f in kg/HP/hour
- MCR of main engine, P_B
- Utilisation factors, K, giving the average power used over a specified period of time
- Number of fishing days/voyage, m days

- Fuel price, c_f, \$/tonne of fuel

Thus, $e_{fo} = b_f \cdot P_B \cdot K \cdot m \cdot c_f \cdot 24 \cdot 10^{-3}$ \$

The utilisation factor K could be determined from the power utilization curve, see Fig. (1).

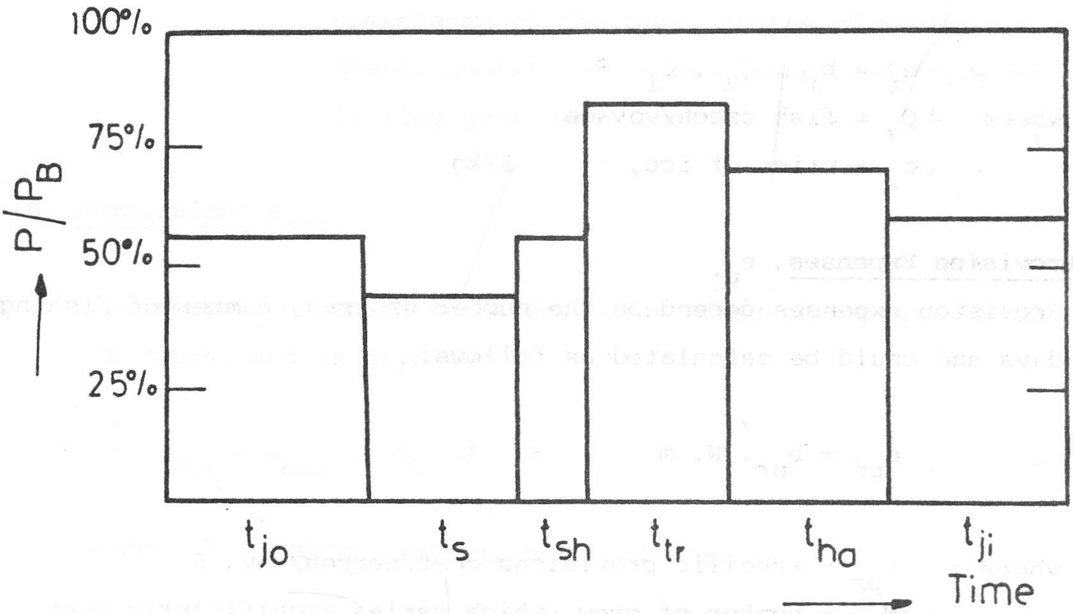

Fig.(1): Engine Power Utilisation Per Voyage

2. Lubricating Oil Expenses, e_{lo}

Lubricating oil expenses can be calculated in a similar way as fuel oil expenses, i.e.:

$$e_{lo} = b_1 \cdot P_B \cdot K \cdot m \cdot c_1 \cdot 24 \cdot 10^{-3} \ \$$$

where: b_1, c_1 represent specific lub. oil consumption and lub. oil price respectively.

3. **Ice Expenses**, e_i

Ice expenses vary between summer and winter. The consumption in summer is 50 % more than the consumption in winter.

Assuming the average specific consumption is b_i kg of ice/kg of fish, the ice consumption becomes:

$$e_i = b_i \cdot Q_v \cdot c_i \quad \$$$

where Q_v = fish catch/voyage

c_i = price of ice, $/kg

4. **Provision Expenses**, e_{pr}

Provision expenses depend on the number of crew, number of fishing days and could be calculated as follows:

$$e_{pr} = b_{pr} \cdot N \cdot m \quad \$$$

where : b_{pr} = specific provisions cost/person/day, $

N = number of crew, which varies significantly with the fishing method used.

5. **Fishing Gear Expenses** e_{fg}

These expenses are associated with the normal wear and tear of fishing gear (nets, ropes, floats, sinkers, wires, otter boards, etc.), accidental loss of fishing gear, accidental tear of fishing gear, etc.

Assuming that b_{fg} represents an average value of fishing gear consumption per voyage, then fishing gear expenses is given by:

$$e_{fg} = b_{fg} \cdot C_{fg}$$

where: C_{fg} = Price of fishing gear used/vessel

b_{fg} = Rate of consumption of fishing gear/ voyage. It depends on the nature of fishing grounds, competancy of the crew, degree of mechanisation on board, quality of fishing gear used, type of fishing gear used, etc.

6. **Commission:** e_{com}

Commission expenses represent a specified percentage of the value of catch, and is given by:

$$e_{com} = b_{com} \cdot Q_v \cdot C$$

where: C = average selling price of fish/kg

7. **Crew Share,** e_{cr}

The crew costs could be either fixed salaries or sharing in the value of the catch. It is possible also to have a combined system composed of a fixed salary and a part depending on the production.

i. **Monthly salaries**

The voyage crew cost based on monthly salaries is given by :

$$e_{cr} = \frac{12}{n} \sum_{j=1}^{v} N_j \cdot b_j$$

where: N_j = number of crew of group "j"

b_j = monthly salary of group "j"

n = number of voyages/year

This system, however, does not have any incentive to increase production and, therefore, is not recommended to be used for fishing vessels.

ii. **Sharing in the catch**

This system is an internationally well recognised system and is based on allowing the crew to have a certain proportion of the catch. This proportion varies from country to country and depends on the fishing method used, number of crew, degree of mechanisation, size of vessel, etc. It should also vary with the amount of catch, increasing with the catch and having a low value with reduced catch.

The cost of crew share per voyage, therefore, is given by:

$$e_{cr} = \alpha_{cr} \cdot (Q_v . C - e_{op})$$

where : e_{op} = voyage operational expenses

α_{cr} = proportion of crew share

C = average price of catch

Q_v = voyage production

Voyage production could be evaluated as follows (1) :

$$Q_v = \phi \,.m.h_c \;(1 - \lambda.t_j/m)$$

where: ϕ = a factor taking account of non-production time
λ = voyage prolongation factor
t_j = voyage time
m = No. of fishing days/voyage

II. Total Fishing Voyage Expenses

The total fishing voyage expenses is given by:

$$E_v = \sum_{j=1}^{7} e_j, \; j = cr, com, fg, pr, i, l_o, f_o$$

These cost items could be related to one of the basic design, operational and economic parameters such as: engine power, fish production, number of crew, etc., as follows:

$$E_v = \sum_{j=1}^{5} \alpha_j . X_j, \; X_j = R_v, mP_B, Q_v, mN, C_{FG}$$

where:

α_j = coefficients to be determined from the analysis of available data (j = 1,2,... 5)

R_v = voyage revenue

Fig. (2) shows the variation of voyage expenses with volume of catch for a given voyage time, proportion of crew share, and average fish price. It is evident from this curve that the proportion of travelling time to voyage time has a significant effect on voyage expenses.

III. Fishing Voyage Efficiency

The efficiency of a fishing voyage could be measured by relating the profit to the revenue as follows:

$$\eta_v = \frac{\text{Profit}}{\text{Revenue}} = P_v / R_v$$

where: $P_v = R_v - E_v$

Thus, $\eta_v = 1 - \sum_{j=1}^{5} \alpha_j \cdot Y_j$

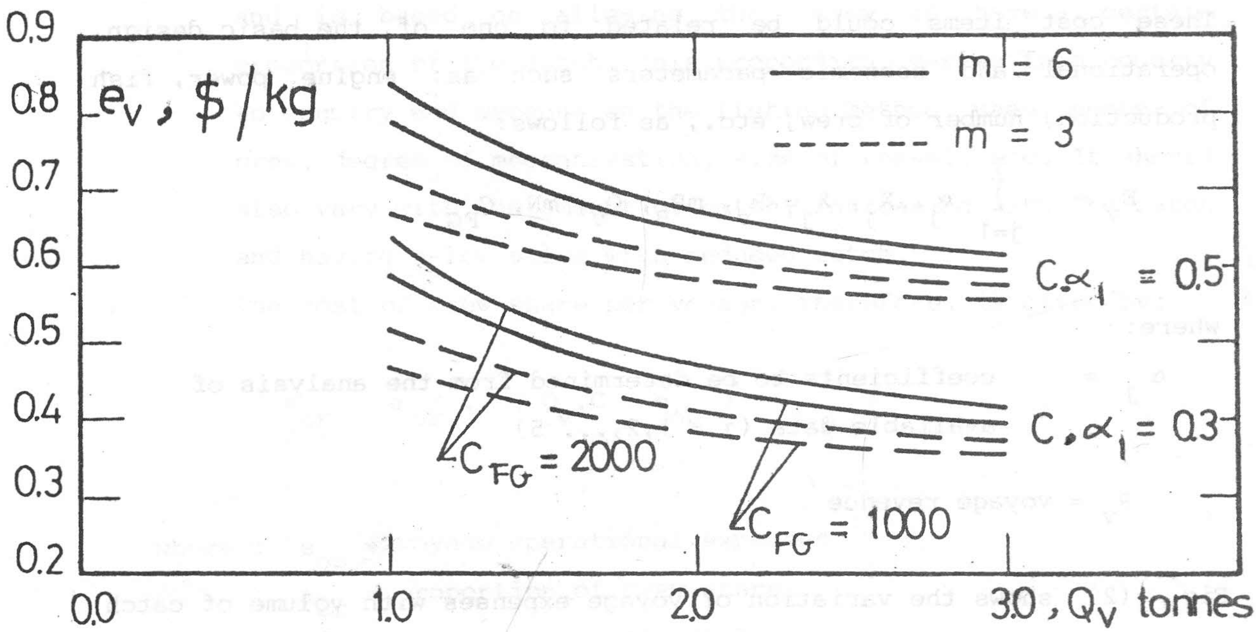

Fig (2) Variation of Voyage Expenses.

$$Y_j = (1 \;, mP_B/R_v, \; 1/C, \; mN/R_v, \; C_{FG}/R_v)$$

Substituting for Q_v, η_v becomes:

$$\eta_v = 1 - \alpha_1 - \frac{\alpha_3}{C} - \frac{\psi}{mch_c} (\alpha_2 . mP_B + \alpha_4 . mN + \alpha_5 \quad C_{FG})$$

This equation could be used to examine the variation of η_v with the main design and operational parameters, as given in Table (1).

Table (1): Variation of η_v with t_j/m, h_c, α_1 and C

$t_{j/m}$	h_c	η_v					
		$\alpha_1 = 0.25$ C, $			$\alpha_1 = 0.4$ C, $		
		0.5	1	2	0.5	1	2
0.05	15	0.383	0.566	0.658	0.233	0.416	0.508
	25	0.53	0.64	0.695	0.38	0.49	0.545
0.2	15	0.306	0.527	0.639	0.156	0.378	0.489
	25	0.483	0.617	0.683	0.334	0.467	0.533

The values given in Table (1) are based on the following data:

$\psi = 18.46$ $\lambda = 1.1$

$m = 6$ $e_{fg} = 50$

The variation of voyage efficiency with average fish price for given values of t_j/m, α_1 and two values of h_c is shown in Fig. (3).

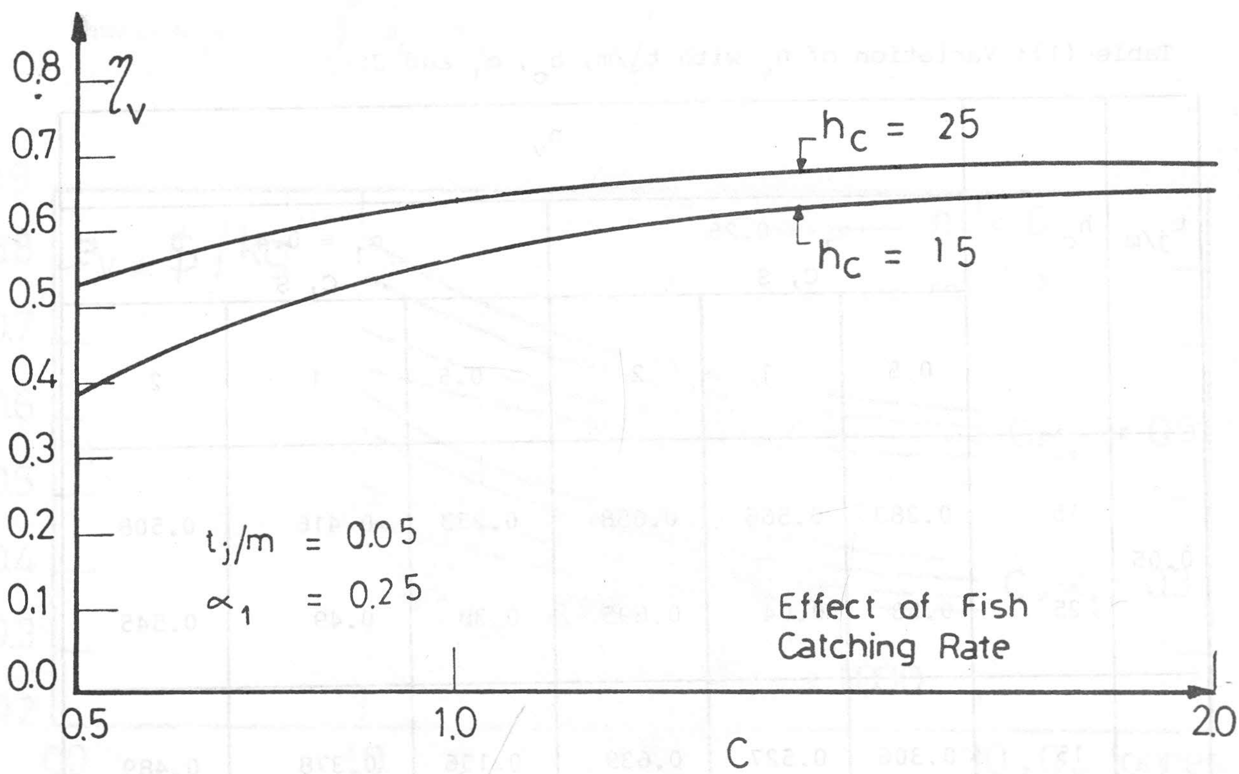

Fig.(3) Voyage Efficiency vs. Fish Price.

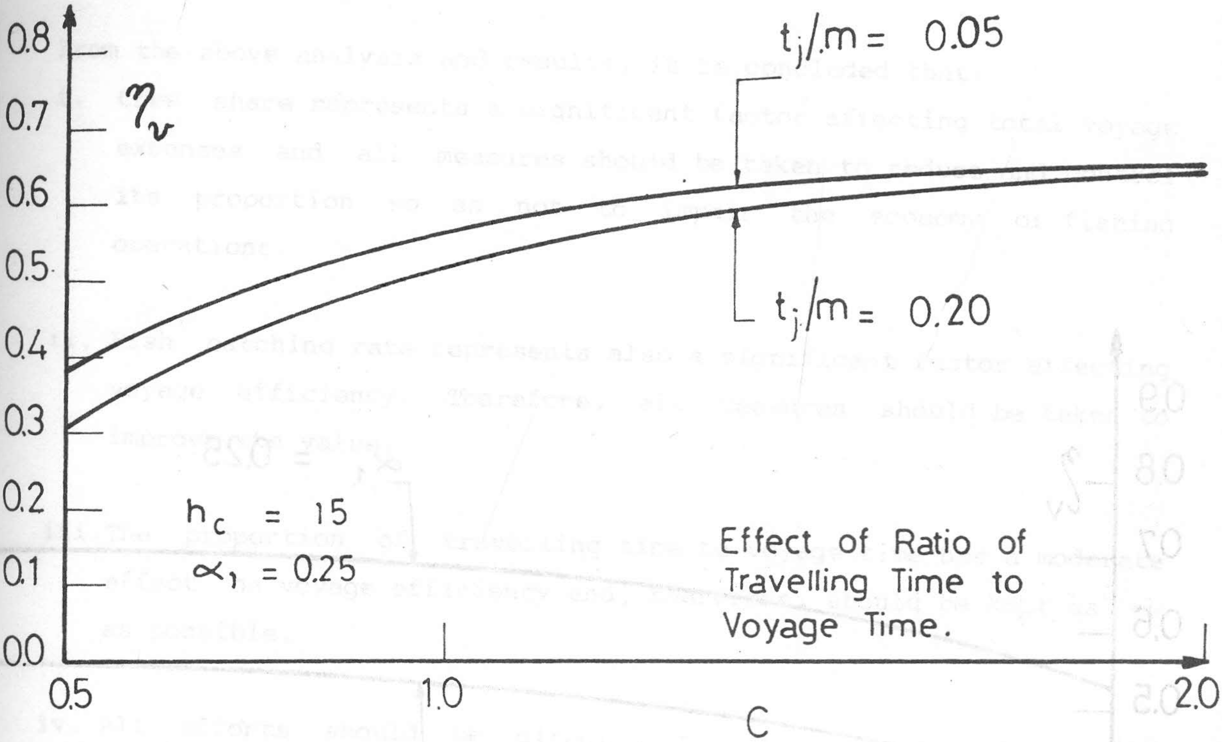

Fig. (4) Voyage Efficiency vs. Fish Price

Fig. (4) shows the variation of η_v with mean fish price for given values of h_c, α_1 and two values of t_j/m.

Fig. (5) shows the variation of η_v with mean fish price for given values of h_c, t_j/m and two values of α_1.

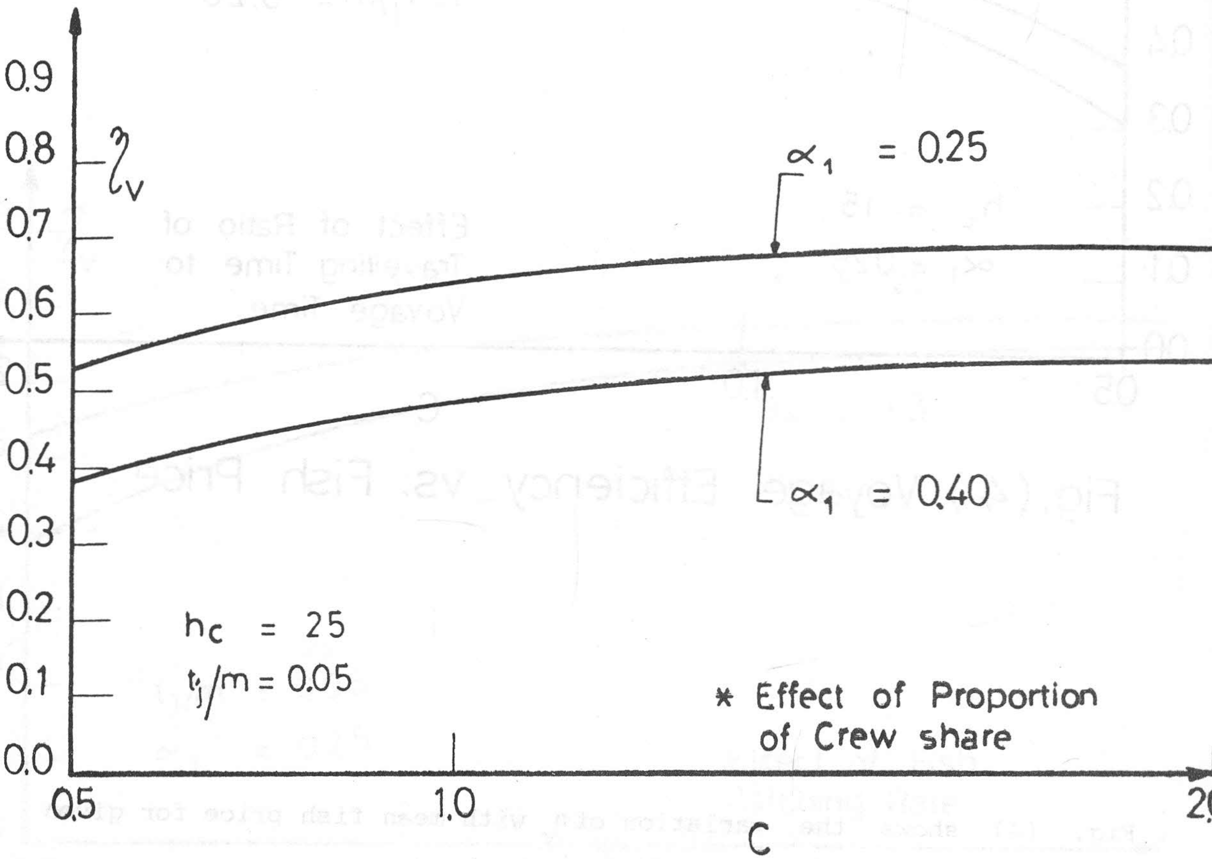

Fig.(5) Voyage Efficiency vs. Fish Price.

V. Conclusions

From the above analysis and results, it is concluded that:

i. Crew share represents a significant factor affecting total voyage expenses and all measures should be taken to reduce and control its proportion so as not to impair the economy of fishing operations.

ii. Fish catching rate represents also a significant factor affecting voyage efficiency. Therefore, all measures should be taken to improve its value.

iii. The proportion of travelling time to voyage time has a moderate effect on voyage efficiency and, therefore, should be kept as low as possible.

iv. All efforts should be directed to reduce number of crew and improve their competency by introducing intensive training programs and increasing the degree of mechanisation and automation on board fishing vessels so as to reduce total voyage expenses, increase production and improve the economy of coastal fishing.

VI. REFERENCES

1. M.A. Shama, "Factors Affecting Productivity of Coastal Trawlers", Alexandria Engineering Journal, Vol. 27 No. 4, April , 1989.