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Published Papers (1988-1993)

on Fishing Vessels Design and Economics

by

Prof. Dr. M. A. Shama

1- "Factors Affecting Productivity of Coastal Fishing Vessel", AEJ, April, (Egypt-1988), Shama, M. A., (100%)

2- "Factors Affecting Fishing Voyage Expenses and Efficiency", AEJ, April, (Egypt-1988) , Shama, M. A., (100%)

3- "Operational Cost Analysis of Coastal Fishing Vessel", AEJ, July, (Egypt-988), Shama, M. A., (100%)

4- "An Economic Evaluation Model for the Egyptian Coastal Fishing Vessel", AEJ, July, (Egypt-1989). Shama, M. A., (100%)

5- "Investment Decisions on Coastal Long Liners", AEJ, October,. (Egypt-1989), Shama, M. A. (100%)

6- "Appraisal of Fishing Vessel Economics Using Risk Analysis", AEJ, Jan., (Egypt-1990), Shama, M. A., 100%)

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INVESTMENT DECISIONS ON COASTAL LONG LINERS

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Abstract

The main factors affecting Annual Costs and Revenues of coastal long liners are indentified and examined. The profit index and profitability factor are suggested as suitable measures of vessel profitability. The variation of the profit index and the profitability factor with the main cost and revenue parameters are investigated. A procedure is presented for estimating the limiting value of the investment cost of a coastal long liner to operate in a particular fishing condition.

It is concluded that the determination of the optimum investment cost for coastal long liners is of paramount imortance particularly for fishing vessels operating in areas of limited productivity.

1. Introduction

The rational exploitation of our marine coastal resources should be directed, among other things, to stock preservation. The latter could be achieved by increasing the use of bottom long lining and reducing the use of bottom trawling, particularly for the exhausted fishing areas.

Long lining systems could be either manually or mechanically operated. Mechanical systems are designed to operate large number of baited hooks efficiently and safely.

This paper is based on the experience gained in Egypt from fitting an automated long lining system on a steel multipurpose coastal fishing vessel. The paper, however, does not expose the problems experienced nor the benefits gained from using this automated long lining system. The paper deals only with the economics as related to Revenues and Costs involved in the use of an automated long lining system on coastal fishing vessels (long liners).

Because of the high operational and capital costs of a long liner, the investment cost should be carefully estimated so as not to overinvest in a fishing condition of limited productivity nor to underinvest to an extent that may have an adverse effect on productivity. The main objective of this paper, therefore, is the establishment of a procedure suitable for estimating the limiting value of the investment cost of a coastal long liner so as to ensure a certain degree of profitability. The procedure is illustrated by a numerical example. It is necessary to point out that the figures given in the paper are only used for illustration and should not be used otherwise.

2. The Profit Rquation

The general form of the profit Equation is given by:

$$P = R - C_T$$

where: R = Average annual revenue

C_T = Average annual cost

This equation could be represented diagrammatically, for a particular fishing condition, by fig. (1).In order to maximise the Profit (P), it is necessary to maximise the Annual Revenue (R) and to minimise the Annual Expenditure (C_T). To achieve these objectives, it is necessary to examine and analyse the main factors affecting both Revenue and Expenditure.

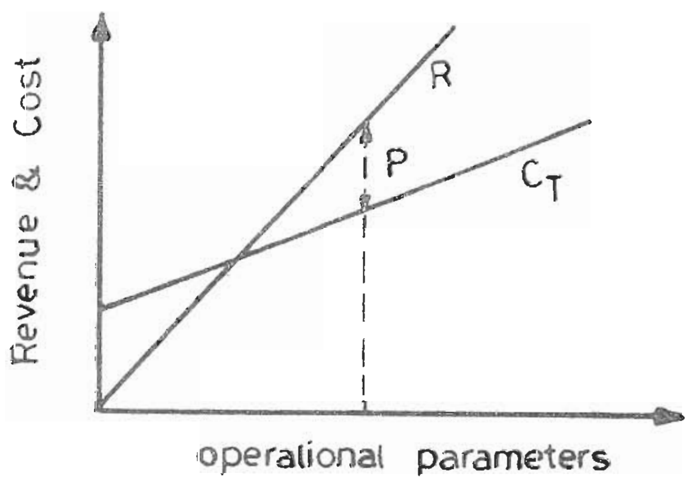

Fig.(1)

3. Annual Revenue, R

The main factors offecting both Revenue and Expenditure for coastal Fishing vessels have been examined in References [1,2]. The methods presented in these references can not be used directly for the analysis of coastal long liners,as the parameters affecting both Revenues and Expenditures are not the same parameters affecting the economics of coastal long liners.

For Coastal long liners, the annual Revenue,R, depends mainly on the competancy of the crew, efficiency of the long lining system used, number of baited hooks, number of fishing days per year, average price per kg of the different species caught, etc.

Hence, $R = f(q, n, C, \ldots \text{etc.})$

where: q= number of fishing days/year

n= number of baited hooks/day

C = average selling price of fish per kg.

The variation of Revenue with the number of baited hooks is shown in fig.(2).

4. Annual Expenditure, C_T

The annual Expenditure ,C_T, could be subdivided into fixed and variable expenses. The Fixed exenses could be analysed using the method given in (2).

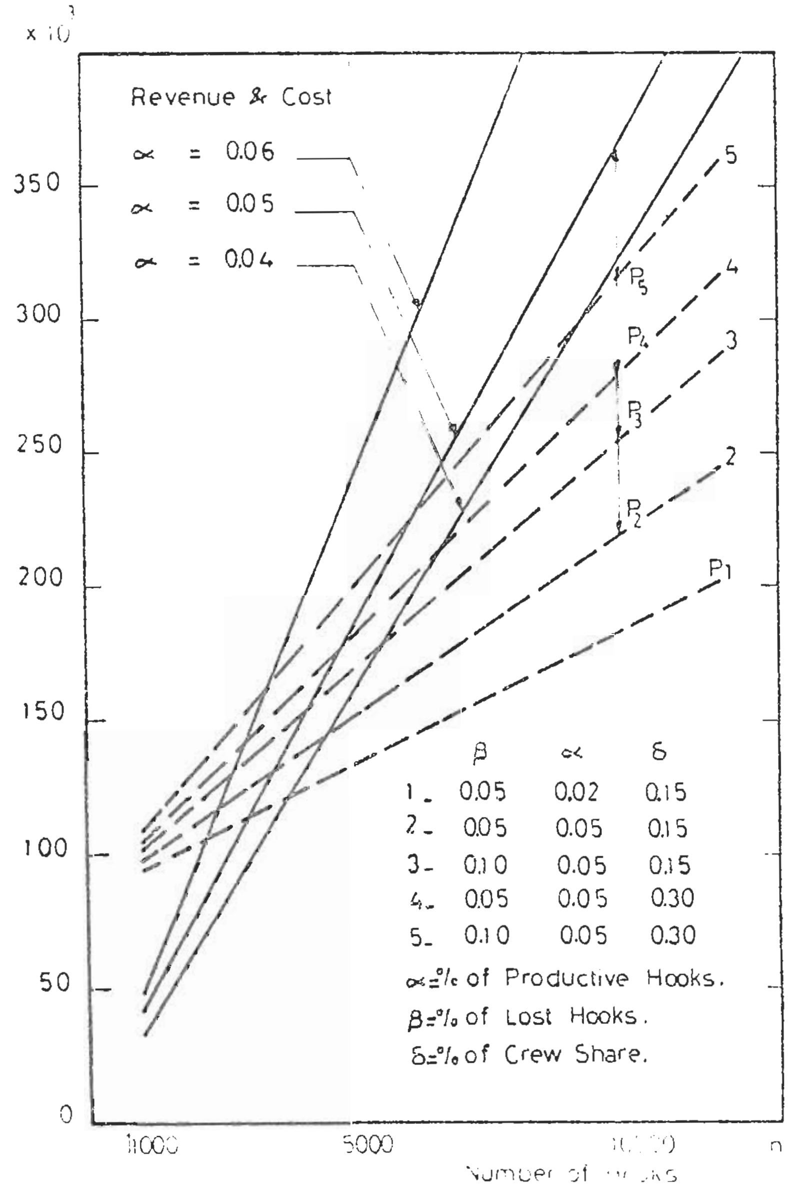

Fig.(2) Revenue and Cost Vis "n"

The fixed expenses, E_F, includes : Depreciation, Cost of capial, Insurance and Overhead Expenses, and could be related to the Investment Cost, C_s of the ship as follows:(2):

$$E_F = \alpha_F \cdot C_s$$

where: C_s = Price of ship

The variable Expenses, E_v, includes: Fuel Oil, Lubricating Oil, Crew Share and Victualling, Maintenance, Repair and Spare Parts, Hooks, Baits and Fishing Boxes, etc.

Hence, $E_v = f(P, R, C_s, n, q, \ldots \text{ etc})$

where: P = Engine Power

The variation of the Daily Costs of Hooks and Bait with the proportion of Productive Hooks could be represented by the cost index η_{HB}. Fig (3) shows the variation of η_{HB} with α , where: α = Proportion of Productive Hooks , η_{HB} = daily cost of hooks and bait/ daily revenue.

i.e. $\eta_{HB} = u/\alpha.w$

whee: u = cost of Hooks and Bait/Fish price

w = average weight per fish caught

α = proportion of Productive Hooks

The annual Expenditure, C_T, therefore, is given by:

$$C_T = E_F + E_v$$

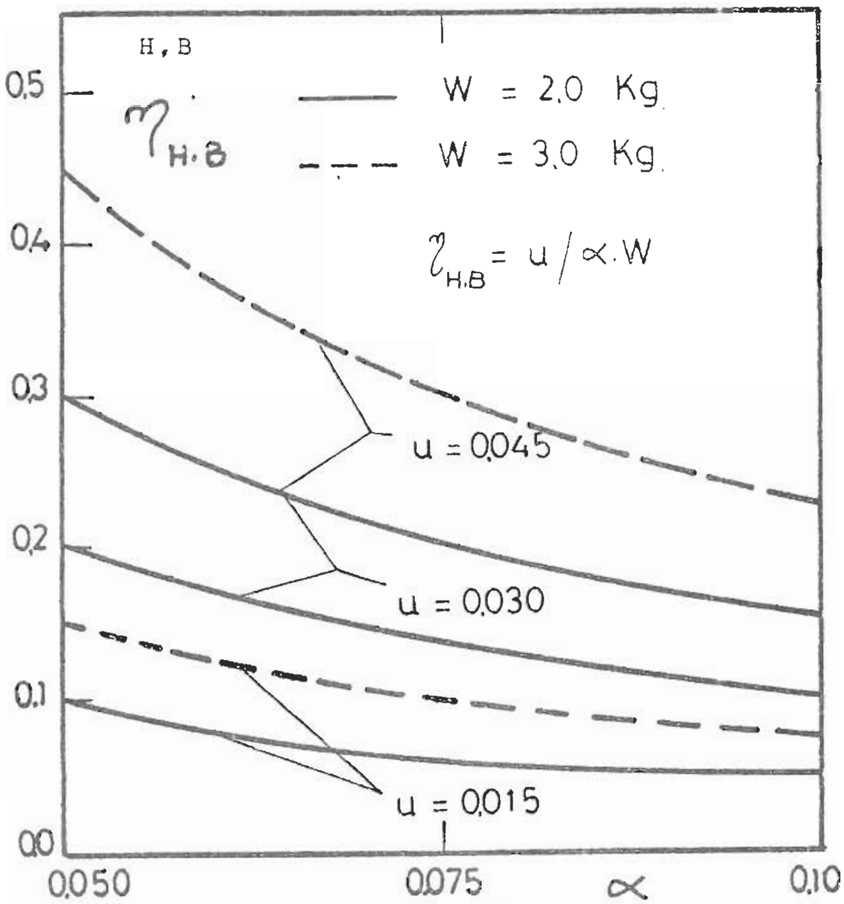

Fig.(3):Variation of $\eta_{H.B}$ with α

Substituting for the various cost elements of E_F and E_V, the following equation could be obtained:

$$C_T = \alpha_1 . q.n. + \alpha_2 . C_s + \alpha_3 .P.q.$$

where: α_i, (i= 1,2,3) = are factors to be determined from the analysis of available data from similar ships.

The variation of Annual Cost, C_T, with "n", for different fishing conditions, is shown in fig.(2). Fig.(4) shows the variation of C_T/qn for certain fishing conditions.

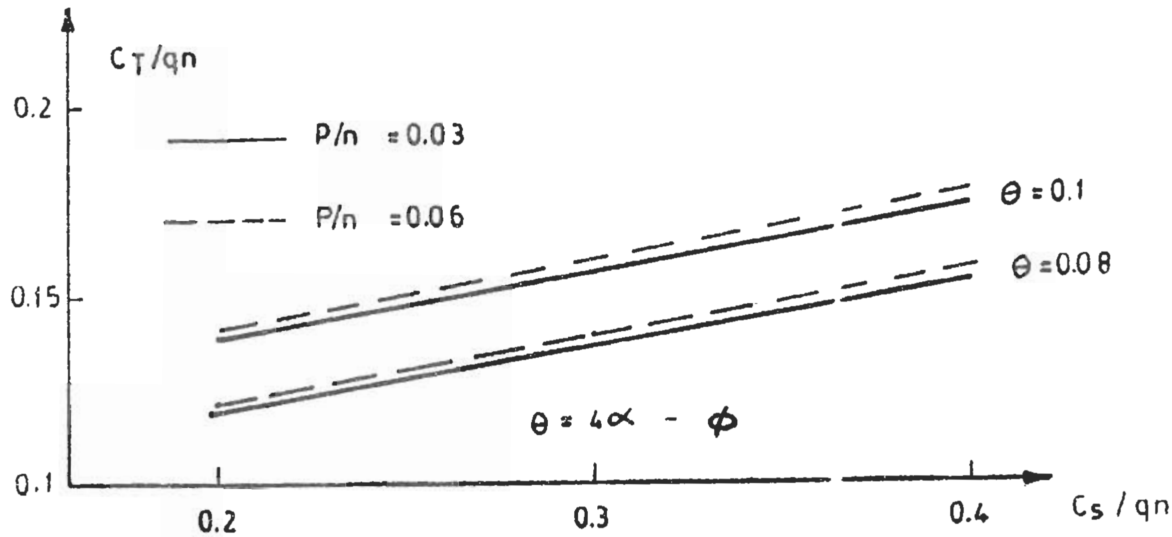

Fig. (4) Variation of C_T/qn with C_S/qn

5.Measure of Profitability

The measure of profitability of coastal fishing vessels (3) cannot be used directly for coastal long liners. Also, the economical models commonly used for coastal fishing vessels are not applicable for long liners because the variables affecting the economics of both types are not identical.

Profitability of long liners could be measured either by:

i- Profit Index, η

or

ii- Profitability Factor, γ

where: $\eta = P/C_s$

$\gamma = R/C_T$

i- The Profit Index

This index relates the Annual Profit to the Investment Cost and therefore should be maximised. It could be used as an effective measure for comparing alternative projects of long liners.

Substituting for P and C_s, the Profit Index is given by:

$$\eta = \alpha_4 \cdot \frac{q.n}{C_s} - \alpha_2 - \alpha_3 \cdot \frac{\dot{P}.q}{C_s}$$

where: α_4 = a factor to be determined from available data. Fig.(5) shows the variation of η with $q.n/C_s$ for different values of φ and P/n, where φ is a factor dependent on the proportion of crew share and proportion of Productive Hooks, see fig(6)

ii- Profitability Factor

This factor relates directly the Annual Revenue to the Annual Expenditure. Therefore, it could be used to estimate the minimum

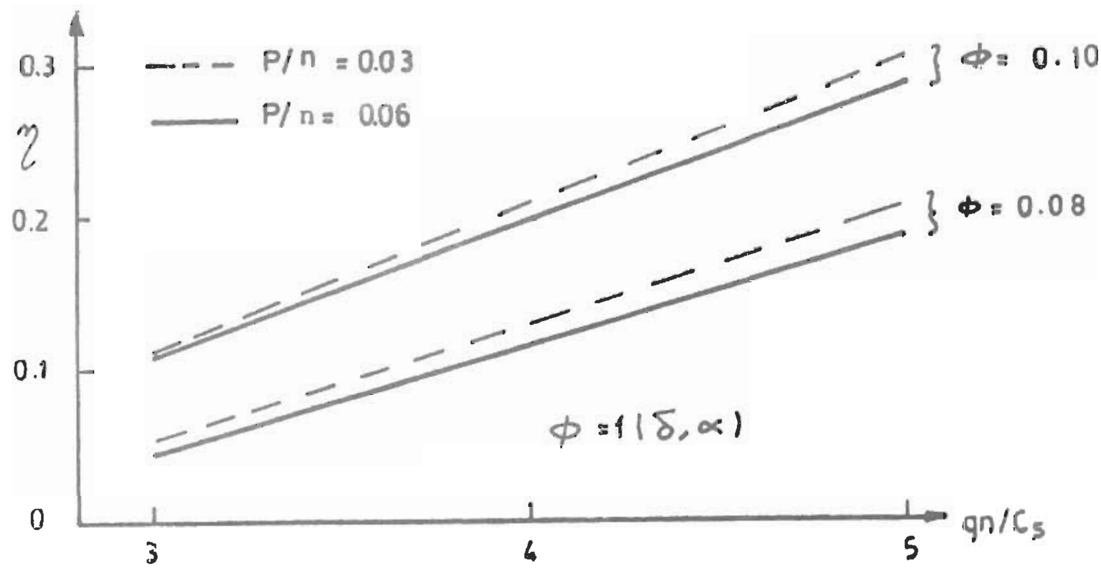

Fig. (5) Variation of η With gn/C_S

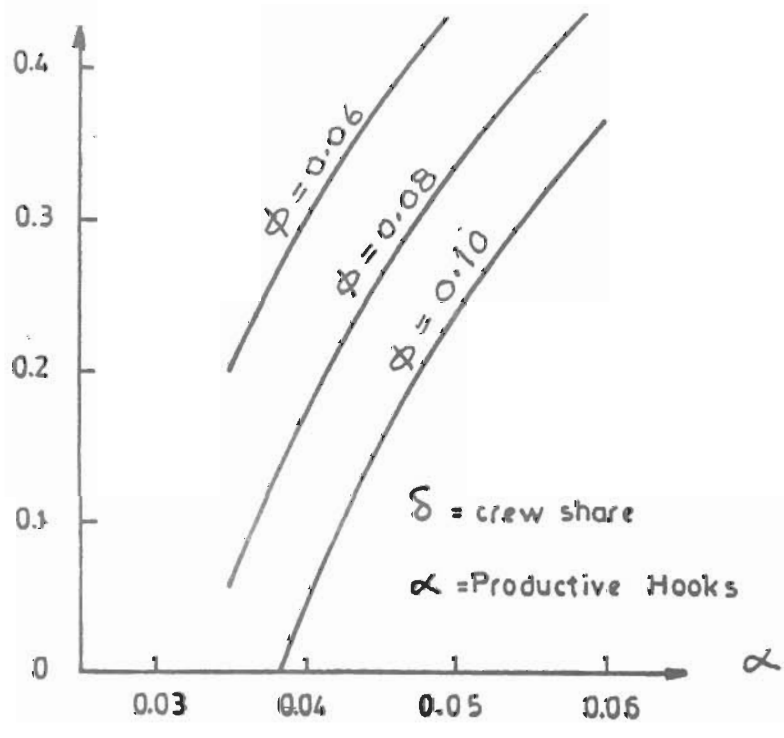

Fig. (6) Variation of Ø With α & δ

Annual Revenue required to cover a known, or predicted, total Annual Expenditure. The magnitude of this factor depends on the proportion of Productive Hooks, Vessel Price, Engine Power, etc.

Hence, $\gamma = f(\alpha, C_s, P, \ldots \text{ etc})$.

Fig. (7) shows the variation of γ with C_s/qn for certain values of α, θ and P/n.

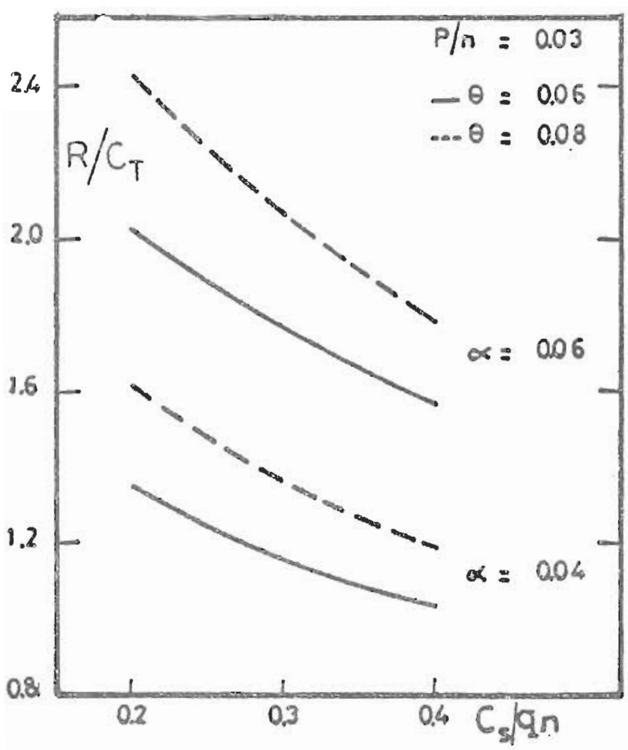

Fig.(7):Variation of R/C_T with C_s/qn.

6- Determination of The Investment Cost C_s

Over-investing in a coastal Long Liner may have a deleterious effect on the annual expenditures and the Profit Index. Similarly, underinvesting in a Long Liner may impair the annual Revenue and the Profit Index. Therefore, it is necessary to determine the optimum value of the Investment Cost for the particular fishing condition. This optimum investment Cost should yield a favourable value for the Profit Index.

The determination of the optimum investment cost should be based on the following main points:

i- Proper analysis of all cost elements
ii- The assessment of a proper value for the crew share
iii- The assessment of a prop r value for the number of Hooks.

The determination of the appropriate value of "C_s" to satisfy a certain fishing condition and desired value of the Profit Index, could be achieved by using fig.(8). From this figure, the value of C_s/qn could be determined for particular values of P/n and φ. The limiting value of C_s could be then determined after selecting suitable values for n and q.

Alternatively, the limting value of C_s could be determined from Fig.(7) by using the desired values of γ ,α ,θ and P/n.

The procedure for determining the limiting value of the investment cost for a coastal long liner could be illustrated by the following example:

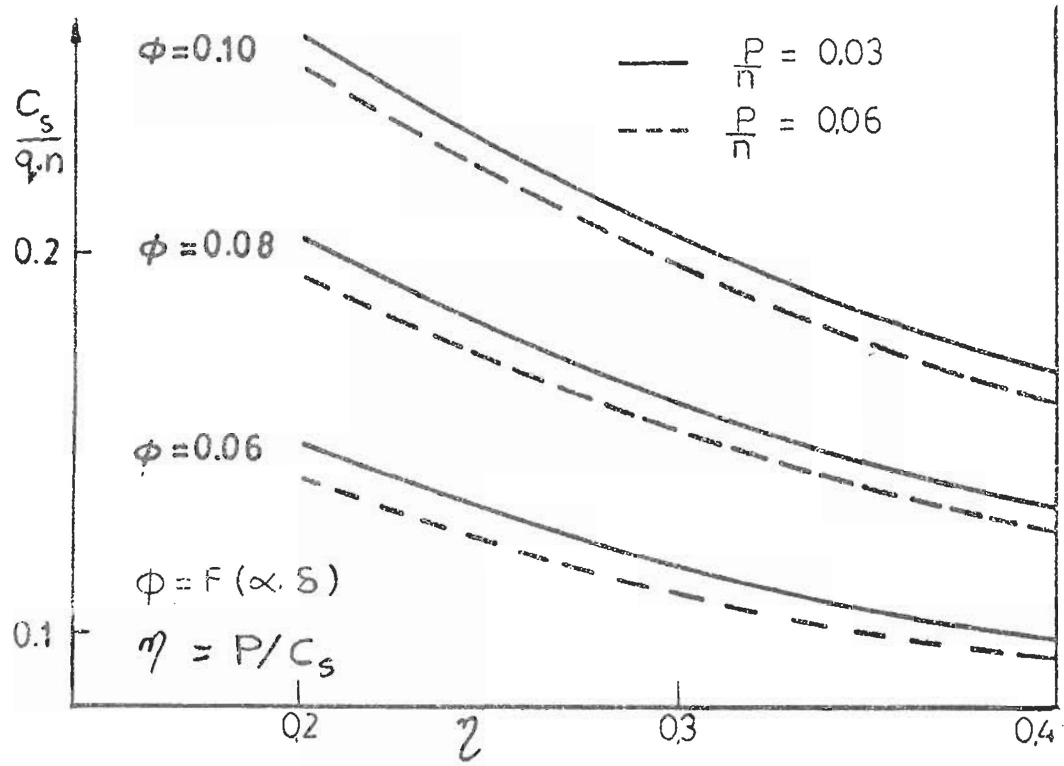

Fig. (8)

EX. It is required to determine the limiting value of the investment cost for the following fishing condition of a coastal long liner:

$n = 10{,}000$, $\alpha = 0.05$, $\delta = 24$ %

$P = 300$ HP , $q = 250$ days, $\eta = 25$ %

Then , $P/n = 0.03$, $\varphi = 0.10$

From Fig. (7), $C_s/qn = 0.227$

Then , $C_s \leq$ EL 567,500

This means that the investment cost of the coastal long liner should not exceed EL 567,500.

7. Conclusions

The main conclusions drawn up from this investigation could be summarised as follows:

1- The total annual cost of a coastal long liner is significantly influenced by the proportion of crew share, costs of hooks and bait, and the investment cost.
2- The degree of mechanisation and automation of a coastal long liner should be carefully examined as it has a direct effect on the Investment cost.
3- Over or under investing in coastal long liners could have a deleterious effect on the profitability of the vessel.
4- The procedure given in this paper could be used to estimate the limiting value of the required investment cost for a long liner to operate under a particular fishing condition, and to give the required profitability.
5- Research work is very much needed to:

i- Improve the factors promoting efficiency and productivity of coastal long liners;
ii- Study the main factors imparing operational costs, particularly maintenance and repair costs, crew share, etc.
iii- Introduce the appropriate degree of mechanisation and automation so as to reduce the number of crew to the minimum competent number required for the safe and efficient operation of the vessel as a coastal long liner.

5- References

[1] M.A.,Shama, "Factors Affecting Fishing Voyage Expenses And

Efficiency", Alex.Eng. Journal (AEJ) Vol.28 No 2, April,1989
[2] M.A. Shama, "Operational Cost Analysis For Coastal Fishing Vessels",Alex. Eng. Journal (AEJ), Vol.28, No 3, July, 1989
[3] M.A. Shama,"An Economic Evaluation Model for the Egyptian Coastal Fishing Vessels", Alex. Eng.Journal (AEJ), Vol. 28,No 3, July, 1989.