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on Fishing Vessels Design and Economics

by

Prof. Dr. M. A. Shama

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FACTORS AFFECTING PRODUCTIVITY OF COASTAL TRAWLERS

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Abstract

The main factors affecting a trawling fishing cycle are identified and discussed. A simplified expression relating fish catching time to voyage time is given. The main parameters affecting annual production of coastal fishing vessels are analysed.

It is concluded that inspite of the limited productivity of our coastal waters, the annual production of coastal trawlers could be significantly improved by increasing exploitation time and fish catching rate.

Introduction

Over 70% of the Earth on which we live is covered by the oceans and seas. Protecting, cultivating and harvesting the sea's resources without disrupting the balance of nature is one of the essential keys to solving the food shortage now confronting the Earth's peoples and particularly in the developing countries.

It is expected that the world's population will almost double by around the year 2025. This gives a clear warning that the food shortage, by then, may be rather acute and in some areas of the world will be catastrophic. According to FAO estimates, about 11% of the world's total population are suffering from starvation.

The Egyptian coastal fishing resources represent an essential element of the National Food Resources. The rational exploitation of these resources should solve part of the current acute problem of food shortage. Therefore, all measures should be taken to improve fishing vessel productivity. This could be realised by identifying and analysing the main factors affecting the productivity of fishing vessels. The latter could be examined by studying the main parameters affecting a fishing voyage cycle.

1. Fishing Voyage Cycle

A trawling fishing voyage cycle is composed of the following events, (See Figs. (1,2)).

- i. Travelling to fishing grounds.
- ii. Searching for good fishing grounds.

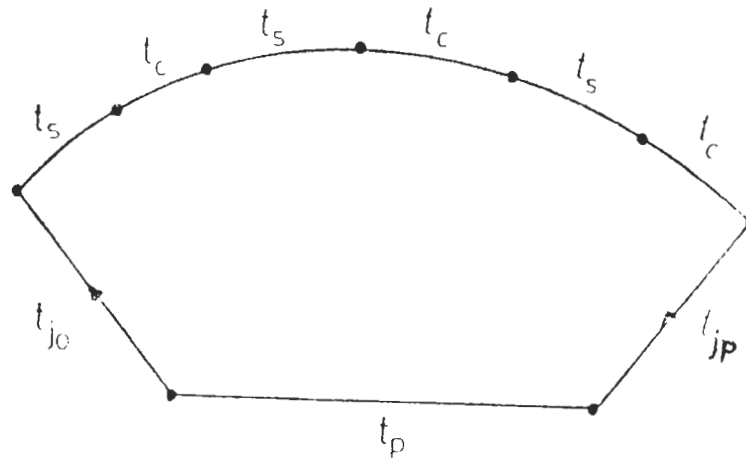


Fig.(1) FISHING VOYAGE ELEMENTS.

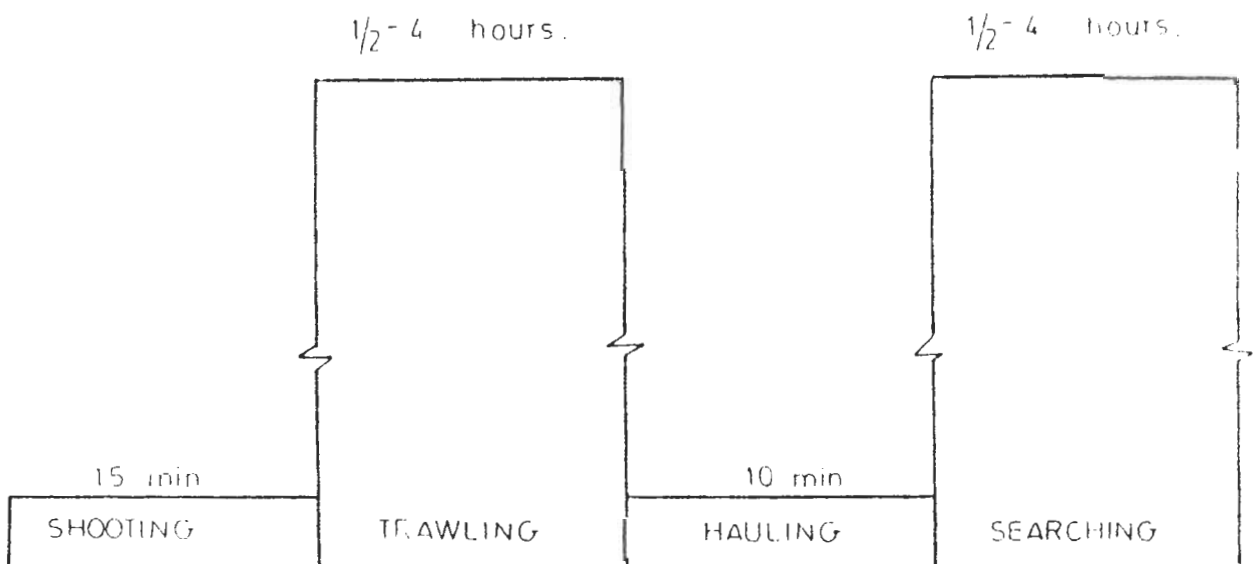


Fig.(2) FISHING CYCLE

- iii. Preparation for shooting nets.
- iv. Shooting of nets.
- v. Hauling.
- vi. Fishing gear handling.
- vii. Emptying of nets.
- viii. Sorting of fish.
- ix. Packing in fish trays.
- x. Repeating events (ii) to (ix).
- xi. Returning to fishing port.

The time required to execute each event depends on the competency of the skipper and crew, degree of mechanization, degree of automation, effectiveness of fish detection equipment, quality and power of fishing equipment, engine power, effectiveness of deck arrangement, type of fishing grounds and effectiveness of fishing gear.

It is possible to represent the total voyage time by the following simplified equation, (See Fig. (1)).

$$t_v = \sum_{k=1}^n t_k \quad (1)$$

where : k = stands for: port, travelling, search, etc.

From equation (1), it is possible to derive the following equation, which relates catching time to voyage time:

$$t_c = \frac{t_v - \alpha t_j}{\gamma} \quad (2)$$

where: γ = coefficient of prolongation of voyage

α = a factor to take account of non-catching time

However, the total voyage time depends mainly on the method used for fish preservation. If fish is preserved in crushed ice, then there is an upper limit for the total voyage time dictated by the required quality of the preserved fresh fish.

2. Main Factors Affecting Annual Production

The annual production of a fishing vessel is influenced by several factors of which the following are the most important:

a. Fish catching rate (h_c)

Fish catching rate depends on several factors, among them are the seasonal fluctuations, pattern of migration, method of catching, etc.

The average catching rate in kg/hour for the different seasons could be estimated as follows:

$$h_c = \sum_{j=1}^r x_j \cdot h_j$$

where : x_j = proportion of time of the period "j"

h_j = catching rate of the period "j"

For multi-purpose fishing, (trawling, purse-seining and long lining), the average fish catching rate could be estimated as follows:

$$h_c = h_T \cdot t_T + h_P \cdot t_P + h_L \cdot t_L$$

where : h_j , t_j = fish catching rate and corresponding proportion
of time of fishing method "j", $j = T, P, L$,
(Trawling, Purse-seining and Long Lining).

It is evident that " h_c " depends on the competency of skipper, condition of engine and trawling winch, effectiveness of fishing gear, etc. However, there is an upper limit for fish catching rate dictated by the available fish stock, number of operating fishing vessels, etc.

b- Exploitation Time, t_e

Analysis of available data indicates that the exploitation time " t_e " depends on ship age, i.e. hull and engine conditions, number of bad weather days, efficiency of skipper and crew, effectiveness of maintenance strategies, production incentives, etc. However, there is an upper limit for the exploitation time of coastal vessels operating in the Mediterranean Sea. This upper limit is dictated mainly by the well known bad weather spells, number of crew rest days, maintenance and repair work, etc.

c- Outward and Inward Travelling Time, t_j

Travelling time " t_j " depends on the distance from port to fishing grounds and ship speed, and is given by:

$$t_j = \frac{2S}{V}$$

where: S = distance of fishing grounds from port

V = average ship speed

3. Variation of Annual Production With Different Parameters

The main parameters considered to affect the annual production of a fishing vessel are:

- i. Ratio of travelling time to voyage time (β)
- ii. Fish catching rate (h_c)
- iii. Exploitation time (t_e)

Fig. (3) shows the variation of annual production for the following conditions:

a. Variation of Q with when:

- 1. $t_e = 200$ days
 $\alpha = 110$ %
 $\gamma = 130$ %
 $h_c = 15, 25, 35$ kg/h.
- 2. $t_e = 240$ days
 $\alpha = 110$ %
 $\gamma = 120$ %
 $h_c = 15, 25, 35$ kg/h.

b. Variation of Q with t_e when

- $\alpha = 110$ %
- $\gamma = 120$ %
- $h_c = 15, 25, 35$ kg/h.

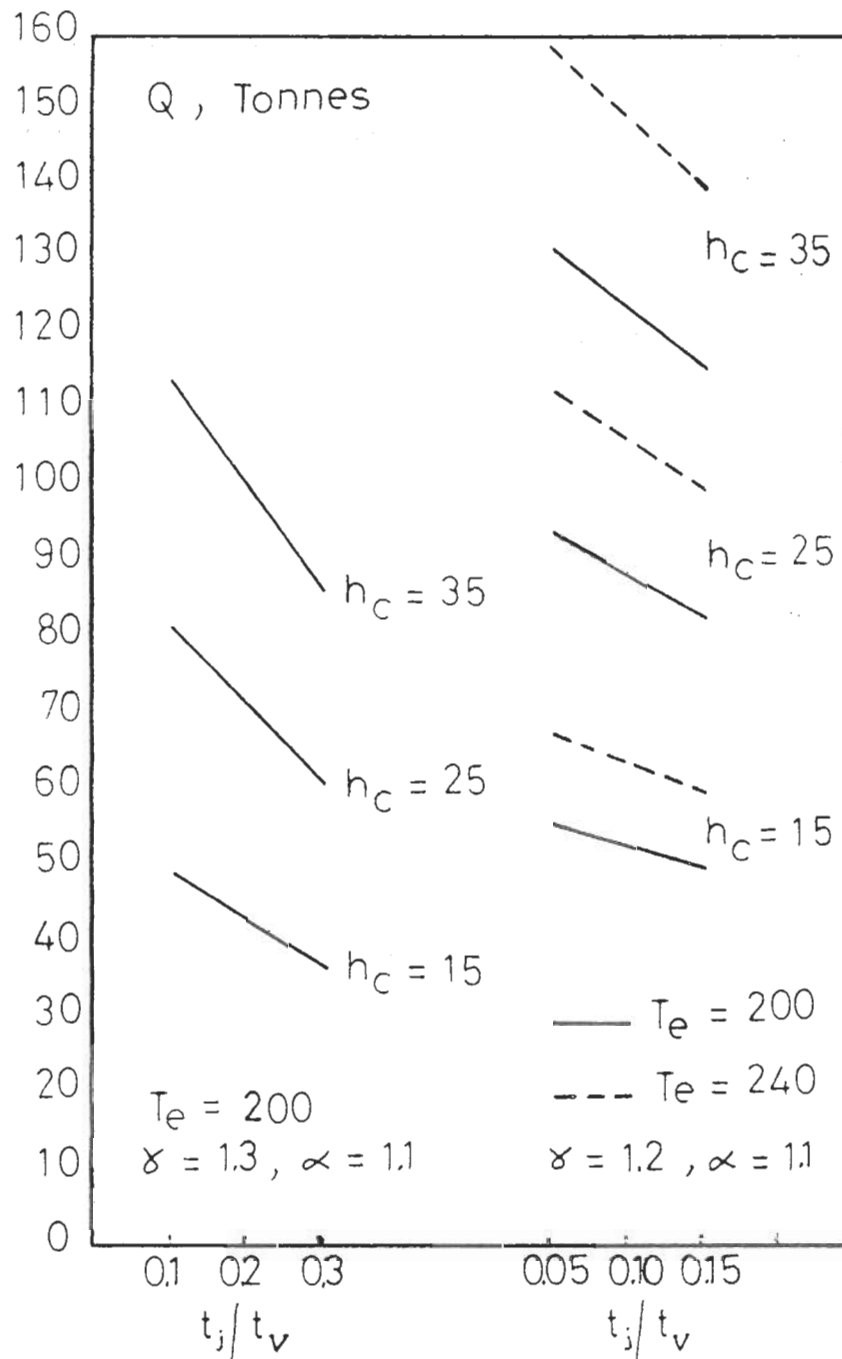


Fig.(3) Effect on Q of Different Parameters

From Fig. (3), it is evident that the annual fish production of coastal fishing vessels could be significantly improved by:

- i. increasing exploitation time
- ii. increasing fish catching rate
- iii. reducing the coefficients α , β and γ .

4. Concluding Remarks

From the foregoing analysis and data collected from operating coastal fleet, it is evident that:

- a. Fishing vessel productivity could be significantly improved by:
 - i. Increasing exploitation time and fish catching rate.
 - ii. Reducing non-catching time and ratio of travelling time to voyage time.
- b. Research work is very much needed to examine quantitatively those parameters affecting vessel productivity.