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Fishing gear and fishing power of beam trawlers.

by

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INTRODUCTION.

The possible factors governing fishing power might be grouped in the following categories : vessel characteristics, gear characteristics and crew characteristics (Parrish and Keir, 1959). At present there is very little published information on the effect of gear on fishing power. A preliminary approach was made for Belgian beam trawlers fishing on sole and the results of the investigations are presented in this paper.

MATERIAL and METHODS.

The statistical material covers the period april-june 1969 and 31 ships operating in rectangle 102 (region IVc) are involved.

The data were abtained from the auctions regarding the catches and from the skippers' logbooks concerning the fishing area and hours fishing.

As independant variables were used :

- The brake horse power as mentioned in the ship's certificate.

- The factor fishing gear, i. e. the weight in kg of the two beams, the shoes, the nets, the groundrope chains and the tickler chains.

The weight was obtained through a questionnaire, but controls were carried out by means of a mechanical dynamometer and by calculating the weight per unit length of the chains and beams.

The gear consists of twin beam trawls towed over port and starboardside of the vessel.

The length of the beams varies between 4 and 7 m.

The length of the groundrope depends mostly on the judgment of the fisherman. For a beam of 6 m the net has a groundrope of approximately 8 m.

A number of heavy tickler chains (12 kg/m) are rigged in front of the groundrope. These chains are combined with lighter tickler chains (4 kg/m) to form a chain carpet.

- The swept area : the area swept in m^2 per hour fishing was obtained by multiplying the towing speed (fideward) - as given by the skippers -, with the length of the two beams.

The dependent variable was the relative fishing power. This power was calculated by the method described by Gulland (1956) : the relative fishing power for a number of standard ships was calculated and the fishing power of other ships was obtained by reference to these former standard ships.

These variables allow to compute a correlation-matrix, partial correlation coefficients and regressions.

To calculate the regressions and correlations, data of individual ships have been used, i. e. individual estimates of fishing power, engine power, total weight of the gear and swept area.

Finally, it must be mentioned that all estimates were tested on significance.

RESULTS.

1. Table 1(a) as well as table 1(b) show that the three parameters are significantly correlated with the fishing power.

The lowest correlation is noted between swept area and fishing power.

The highest correlation coefficient is obtained between the weight of the fishing gear and the fishing power (R = 0, 729 in a linear relation and R = 0, 794 in a non-linear relation).

2. In order to tow the two nets with a number of heavy tickler chains in front of the groundrope, sufficient engine power is needed (Hovart and Michielsen, 1970).

Table 1 shows that the variables engine power and weight of the gear are interrelated, so that when calculating a multiple regression, the regression coefficients cannot be estimated with accuracy.

3. From tables 2(a) and (b) wich give the partial correlation coefficients, it can be noted that if the swept area only is considered, non significant and small correlation coefficients are obtained. The same is true if engine power is considered without its normal corolary of gear weight.

This weight of the gear, however, is always significantly correlated with fishing power, especially if its natural counterpart, large engine power is linked to it (Ry 2. 3 = 0. 727).

4. Regressions are given in tables 3(a) and (b).

The estimates are significant, but none of the regressions give a direct proportionality between fishing power and engine power, weight of the gear or swept area.

SUMMARY.

1. The relationship between fishing power and some gear characteristics have been studied for Belgian beam trawlers fishing for sole in a small part of region IVc.

2. A high and significant correlation has been found between fishing power and weight of the gear.

3. None of the regressions indicate a direct proportionality.

REFERENCES.

Parrish (B. B.) and Keir (R. S.), 1959 - The measurement of fishing power and its relation to the characteristics of vessels - Ann. Proc., ICNAF, vol. 9, 106-112.

Gulland (J. A.), 1956 - On the fishery effort in English demersal fisheries - Fish. Invest. ser. II. vol. 20, number 5.

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Table 1 (a) - Correlation-matrix (linear relation)

(ss = significant $p < 0,01$; s = significant $p < 0,05$)

	1	2	3	4
1	1	0,837 (ss)	0,705 (ss)	0,701 (ss)
2		1	0,686 (ss)	0,729 (ss)
3			1	0,445 (s)
4				1

1 = engine power
2 = weight gear
3 = swept area
4 = fishing power

Table 1 (b) - Correlation-matrix (non-linear relation)

(ss = significant $p < 0,01$; s = significant $p < 0,05$)

	1	2	3	4
1	1	0,811 (ss)	0,670 (ss)	0,725 (ss)
2		1	0,668 (ss)	0,794 (ss)
3			1	0,477 (ss)
4				1

1 = log engine power
2 = log weight gear
3 = log swept area
4 = log fishing power

Table 2 (a) - Partial correlation coefficients (linear relation)

(ss = significant $p < 0{,}01$; s = significant $p < 0{,}05$)

Ry 1.2	=	0,244
Ry 2.1	=	0,362 (s)
Ry 1.3	=	0,610 (ss)
Ry 3.1	=	0,097
Ry 2.3	=	0,649 (ss)
Ry 3.2	=	0,110
Ry 1.23	=	0,298
Ry 2.13	=	0,401
Ry 3.12	=	0,207

(y = fishing power ; 1 = engine power ; 2 = weight gear ; 3 = swept area)

Table 2 (b) - Partial correlation coefficients (non-linear relation)

(ss = significant $p < 0,01$; s = significant $p < 0,05$)

Ry 1.2	=	0,228
Ry 2.1	=	0,511 (ss)
Ry 1.3	=	0,622 (ss)
Ry 3.1	=	0,018
Ry 2.3	=	0,727 (ss)
Ry 3.2	=	0,119
Ry 1.23	=	0,277
Ry 2.13	=	0,539 (ss)
Ry 3.12	=	0,200

(y = log fishing power ; 1 = log engine power ; 2 = log weight gear ; 3 = log swept area)

Table 3 (a) - Regressions (linear relation)

(ss = significant $p < 0{,}01$; s = significant $p < 0{,}05$)

FP =	0,89167 + 0,00642 EP (0,00121)(ss) t = 5,300	R = 0,701 (F = 28,088)(ss)
FP =	0,60415 + 0,00096 WG (0,00017)(ss) t = 5,727	R = 0,729 (F = 32,797)(ss)
FP =	1,04011 + 0,00002 SA (0,00001)(s) t = 2,677	R = 0,445 (F = 7,165)(s)

EP = engine power

WG = weight gear

SA = swept area

Table 3 (b) - Regressions (non-linear relation)

(ss = significant $p < 0{,}01$; s = significant $p < 0{,}05$)

$$\log FP = -1{,}16374 + 0{,}64884 \log EP \quad R = 0{,}725$$
(0,11441)(ss) (F = 32,162)(ss)
t = 5,671

$$\log FP = -2{,}13067 + 0{,}76542 \log WG \quad R = 0{,}794$$
(0,10887)(ss) (F = 49,428)(ss)
t = 7,031

$$\log FP = -2{,}62527 + 0{,}62265 \log SA \quad R = 0{,}477$$
(0,21316)(ss) (F = 8,533)(ss)
t = 2,921

EP = engine power

WG = weight gear

SA = swept area