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THE IMPROVEMENT OF PELAGIC TRAWL TECHNIQUE FOR CUTTERS

by

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Abstract

In connection with the development of resistance reduced pelagic trawls in the deep sea fishery in this paper the problems and possible applications to cutter fishery are described.
As a result of investigations new pelagic trawls for cutters are presented which now are introduced into commercial cutter fishery.
Advantages are lesser resistance than usual rope trawls and lesser material expenses.

1. Introduction

The development of pelagic trawls with reduced resistance was forced along in the national and international inshore fishery and high-sea fishery in the last few years. Their aim is to spare fuel by reducing the resistance. For this there are usually three principal ways relating to an absolute or relative economy.

1. Absolute economy of fuel with the same size of the trawl and with the same trawling speed.
2. The increase of the opening of trawls with the same consumption of fuel and the same trawling speed (a relative economy of energy over a greater fishing volume and therefore a possible higher catch).
3. The increase of trawling speed with the same size of trawl and the momentary consumption of energy (a relative economy of energy over a greater fishing volume and therefore a possible higher catch.

Depending on the predominating conditions one will use one of the three ways or a combination of them practically. The finished initiation of rope trawls into the cutter fishery of the GDR for all types of cutters has been treated fully the second way ingeniously from the mid seventies to the end of the seventies according to the proportion of the fishing grounds. Therefore it as effective aim remains to lower the concumption of energy per catch unit on the bigger cutter types by an absolute economy of fuel and to influence this code number on cutters with lower productivity by a bigger catch positively.

Such a higher catch is thinkable then if very agile and flying concentrations of fish are to be fished like during the herring season in spring.

2. Ways for solution and progress of treatment

In the deep-sea fishery the development of trawls with reduced resistance lead from rope trawls to trawls with extremly long rope section and to trawls with big hexagonal meshes. The portion of the great meshes respectively the rope portion was lengthened extremely.
Therefore two third of the length of the trawl consist of ropes and hexagonal meshes. In the cutter fishery this portion amounted maximum one third of the length of the trawl up to present. An analysis of all pelagic rope trawls used in the GDR showed, that the ring with the mesh opening a=100 mm moves about 10 metres in the vertical extension of the trawl. This approximately corresponds to super trawlers (3600 hp) and cutters (300 hp)(s. figure 1).
Whereas the ropes and big hexagonal meshes in the forenet cause an efficient frightening effect on the fish it is necessary, that the narrow mesh material of the trawl prevents the escape of fish.
Therefore it wasn't possible to widen the part of the ropes as much as you want. The opening height of cutter trawls is often smaller than the height of super trawler nets in the beginning of the mesh. It was developed a trawl with ropes and hexagonal meshes as a first new variant out of the standard trawl in the cutter fishery (s. figure 2a,b).
In the further progress of treatment arised from the hexagonal trawl the so called frightening-rope trawl (s. figure 2c).
The portion of ropes amounts to 50 per cent of the length of trawl. In spring 1984 the first trawl with hexagonal meshes had been used in the fishery effectively. The charge took place without bigger problems and the aims were fulfilled. But there were great difficulties to repair the net on deck. Already with middle damages it was impossible to repair the trawl on the cutter. This circumstance was decisive for development of the frightening-rope trawl.
The bounded frightening-ropes should cause the same

frightening effect as the continuous cross connections of the hexagonal trawl. They are no carrying elements. If one frightening rope breaks it won't cause greater effects. And if a rope breaks, it will be held by the frightening ropes. This net is to be produced essentially easier. One can also repair it on deck of a cutter. The frightening-rope trawl had been used for the first time in autumn 1984. After difficulties in the beginning (the first ring of the net a= 400 mm was too weak) this net proved it's worth very well. It will be used in the whole cutter fleet. Technical trials had been carried out close to the commercial fishing trips in 1984 and 1985.
The standard rope trawl, the hexagonal trawl and the frightening-rope trawl were tested on a fixed measuring distance also. Thereby were done measurements of consumption of fuel particularly. Further on one measured the resistance of the net and one found out the geometric parameter of the net. Therefore we can support and corroborate the valuation of the practical work by extensive measurements.

3. Hitherto existing results

The valuations were carried out after a lot of hauls with the hexagonal trawl (47 hauls) and with the frightening-rope trawl (24 Hauls).
The catch comparison took place with the standard rope trawl in each case. During the technical trials were also pulled comparisons with the standard rope trawl.
As a result of all researches we could state, that there are only little differences between the hexagonal trawl and the frightening-rope trawl concerning catches.
As only the frightening-rope trawl is suitable for cutters because of the possibiliy to repair it on the ship the following statements restrict to this net.

3.1. Towing resistance

Resistance of the trawl was found out by means of underwater

dynamographs. The results are shown in figure3. One can state, that the resistance could be reduced by 25 per cent.

3.2. Trawling speed

An increase of trawling speed of 0,3 -0,5 knots had been estimated and found out by the shipmasters of the cutters already during the commercial trips.
Differences of speed of 0,4 knots could be measured at the trials on the measuring distance (figure 4).
Estimated counts of the resistance found out also show a possible increase of the speed of approximately 0,4 knots with regard to a reduced tow-rope pull at higher speed.
This increase of the speed is attainable with the frightening-rope trawl in comparison with the standard rope trawl under the same conditions.

3.3. Consumption of fuel

To economize fuel directly will take place, if the reduction of the resistance doesn't change into an increase of speed.
In using of the frightening-rope trawl the rate of revolutions of the main engine are reduced so that one could nearly attain the same speed as with the standard rope trawl.
The comparison of the results was complicated because the measuring apparatus only operated in low wind forces reliably. On the other hand conditions like wind, sea and drift changed permanently.
Therefore there had been pointed out to economize fuel between 15 and 20 per cent during the trials. That's why the planned economy of six per cent for the used cutters could be kept as sure,s.figure 4.

3.4. Comparison of catches

For the charge in the praxis one used the reduction of resistance for increasing speed as a matter of principle.

The results are shown in figure 5. Here is a comparison very complicated too. It could be estimated, that there was attained a minimum higher catch of five per cent by a higher trawling speed.
The higher trawling speed was especially succesful on more agile herring.

4. Analysis and conclusions

The so called frightening-rope trawl have proved their worth within the nearly two-year lasting test time.
They will be initiated on the 26.5-meter-cutter type.
The nets are 10 per cent cheaper at the same parameters. This results from the economy of material and working hours.
An increase of speed of 0,4 knots can be attained ,whereby one can obtain an increase of catch of at least five per cent.This implies an indirect reduction of fuel, because the number of catch ground-days can be reduced by this.
It is possible to reduce fuel up to 2,5 litre per hour at the same speed and at the same catch, this means six per cent. Statements about the increase of catch and about the reduction of fuel can be taken for granted on a 26.5 meter cutter.
The attained results can be taken over for cutters B403 and HZ 400 in their present design at once (570 hp or 420 hp).
Trawls of the same type were also developed for smaller cutters (17 meters, 24 meters). This trawls have been used for the first time in 1986.
The successfully used hexagonal trawl in the high-sea fishery in some countries are not admitted in the cutter fishery. Tests had to be stopped, because the problem of repairing was estimated too difficult.
The development of the frightening-rope trawl gives also ships of smaller size the possibility to use trawls with reduced resistance.

Further possibilities for the optimum of the number of frightening ropes and the distances between them have to be found out.
The nets are inserted for herring and sprat.
They are not suitable for the pelagic catch of codfish.

References

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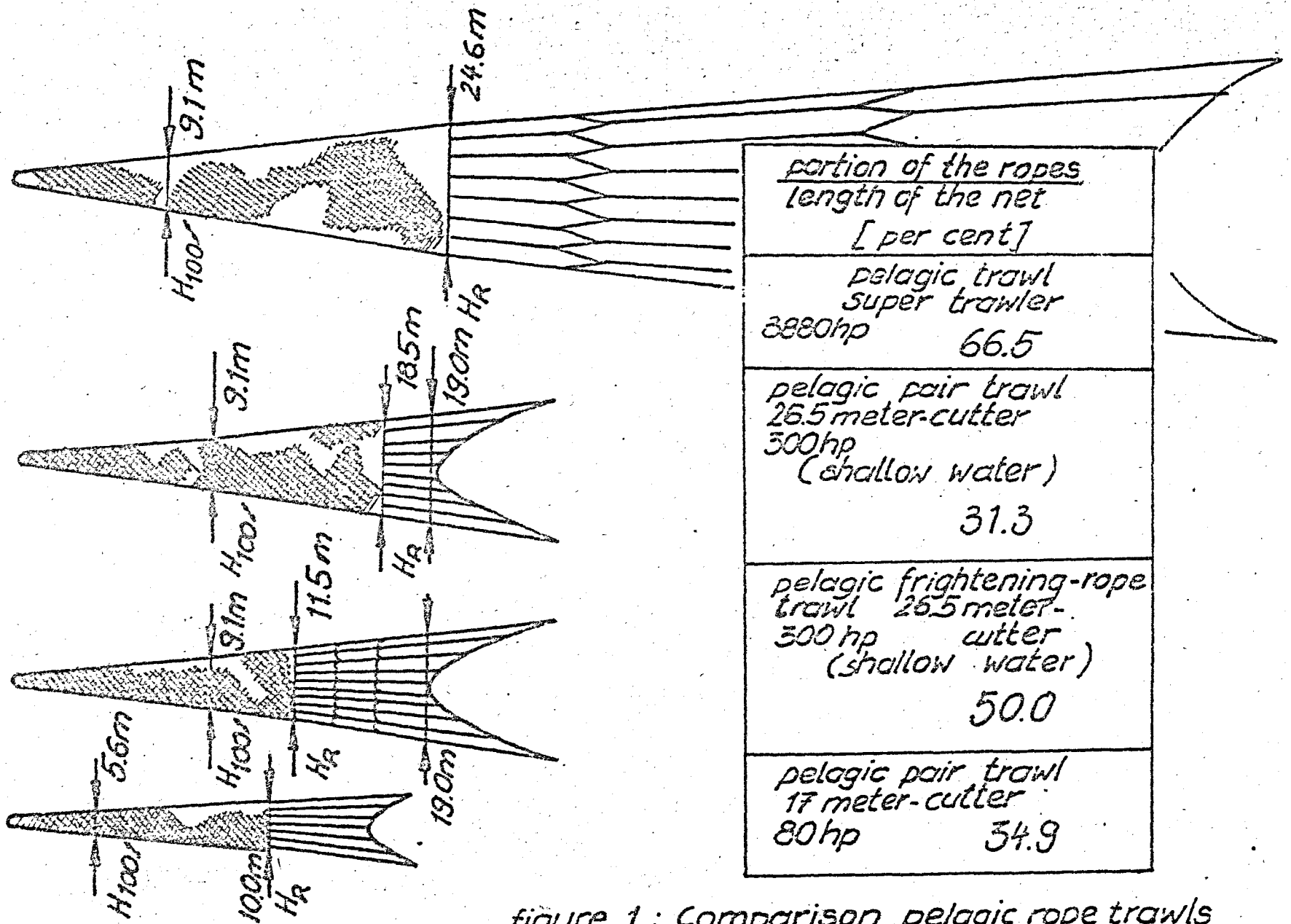
Fischereiforschung 3/1981



portion of the ropes / length of the net [per cent]	
pelagic trawl super trawler 3880hp	66.5
pelagic pair trawl 26.5 meter-cutter 300hp (shallow water)	31.3
pelagic frightening-rope trawl 26.5 meter-cutter 300 hp (shallow water)	50.0
pelagic pair trawl 17 meter-cutter 80 hp	34.9

figure 1 : Comparison pelagic rope trawls super trawler – 17m cutter

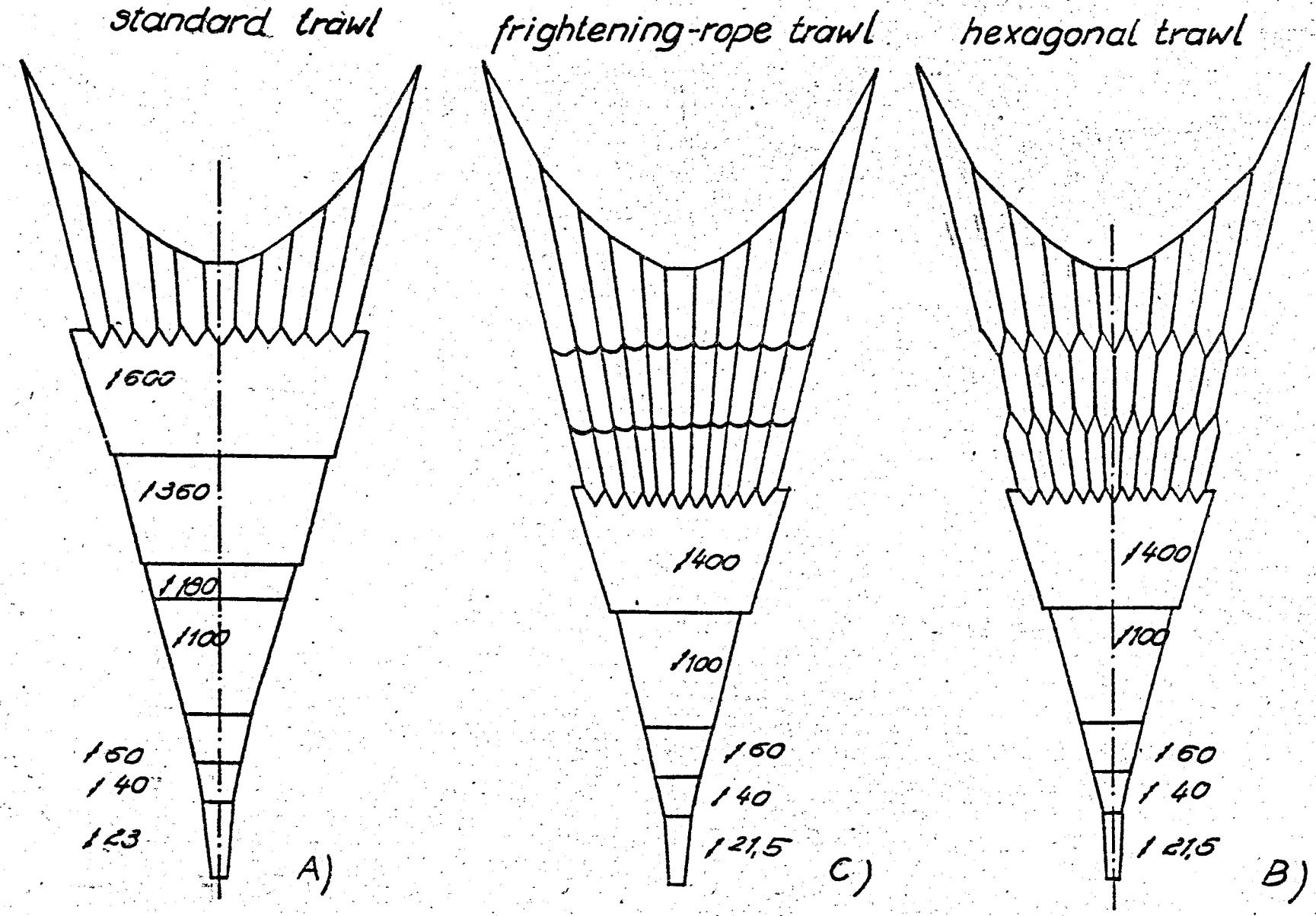

standard trawl
1600
1360
1180
1100
160
140
123
A)
frightening-rope trawl
1400
1100
160
140
121,5
C)
hexagonal trawl
1400
1100
160
140
121,5
B)

figure 2 A, B, C

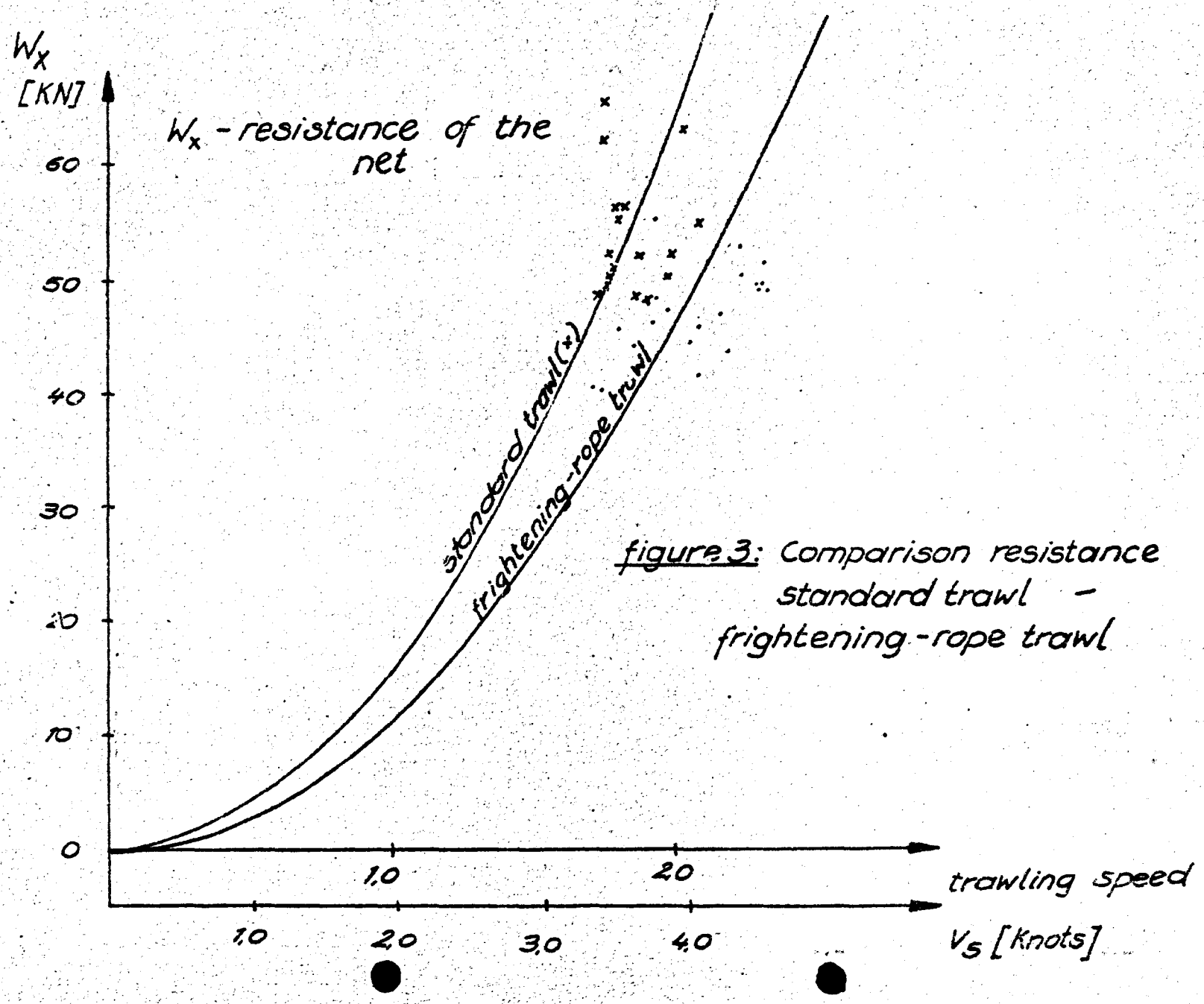
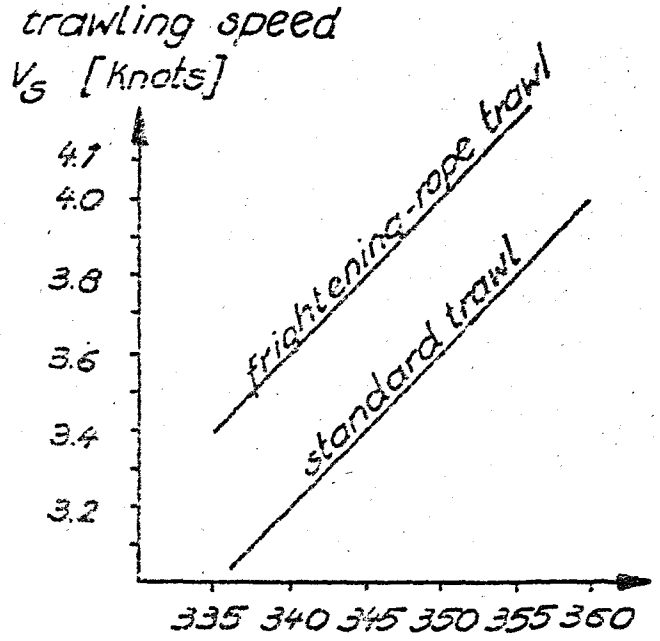


figure 3: Comparison resistance standard trawl - frightening-rope trawl


trawling speed
V_S [knots]
4.1
4.0
3.8
3.6
3.4
3.2
frightening-rope trawl
standard trawl
335 340 345 350 355 360
rate of revolutions of the main engine per minute

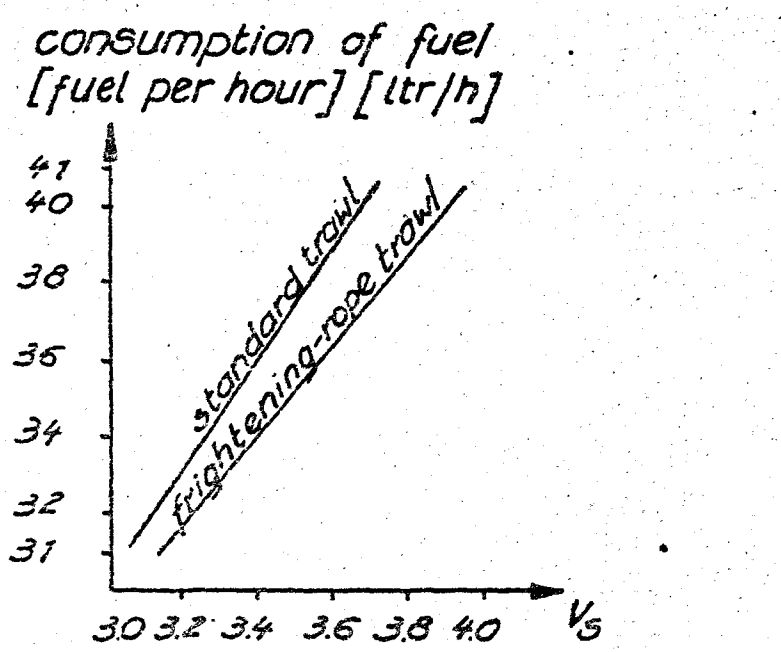

consumption of fuel
[fuel per hour] [ltr/h]
41
40
38
35
34
32
31
standard trawl
frightening-rope trawl
3.0 3.2 3.4 3.6 3.8 4.0
V_S
trawling speed V_S [knots]

figure 4

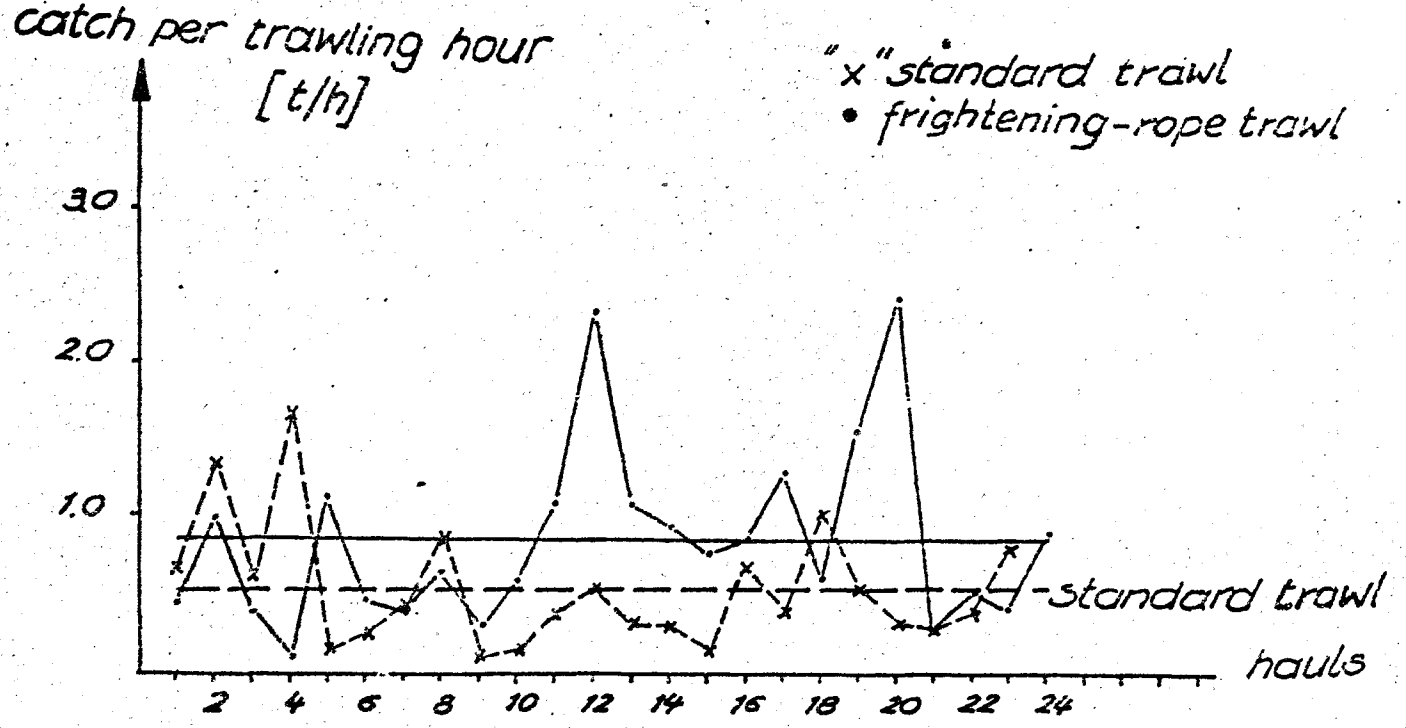


figure 5 : comparison catch per trawling hour
frightening-rope trawl - standard trawl