MEASUREMENTS OF THE HORIZONTAL OPENING OF THE TRAWL NETS

by

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ABSTRACT

Noting that the horizontal opening of the trawl net is a key factor in the efficient operation of net, the paper describes methods by which this distance, i.e. between the otter-boards, may be estimated.

INTRODUCTION

It is generally known that the proper vertical and horizontal opening of the mouth of any trawl net is governed mainly by two forces"

i. Spreading force produced by otterboards, and

ii. Lifting force produced by floatation attached to the headline.

There is a definite relation between these two forces. It is known that an increase in spreading force causes a decrease in vertical opening of the net, and an increase in the floatation causes a smaller horizontal opening of the net. Accordingly in operating a trawl net there should be a balance between these two forces. In addition there are other factors like the type of net construction, the speed of towing, speed of current, rigging of groundrope and seabed condition, that also influence the opening of a trawl net. Skippers of fishing vessels should have some idea about the shape and behaviour of the fishing gear they use. They must know how the net opens if they want to gain the maximum advantage out of modern electronic and other aids which provide information on the presence of shoals and their behaviour on the fishing grounds.

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It has been too difficult to determine directly the spread of otterboards during trawling operation. The angle of warps is used by fishermen for determining the spread of otterboards on side trawlers. By this means they were able to know whether the spread of the otterboards is insufficient or too much. The angle between warps measured at the towing block determines the distance between otterboards. Really the angle was indirectly measured because the formula of similarity of triangles has to be applied. This angle might give an indication of the catches as well, because the decrease of the angle indicatesthat the spread between wings is smaller due to the big quantity of fish caught or any bottom obstacle trapped by the net. Other observations of warps at the towing block usually delivered more information for experienced skippers, but that is another problem which will not be discussed here.

It is not possible to make such an observation while trawling with stern trawlers. No towing block is used to join the two warps and it is not easy to estimate the distance between the two warps, without instruments. Some people have tried to estimate the distance between otterboards using the approximate angle of each warp but generally speaking the error has been very big and the usefulness of measurements has been doubtful. Others have tried to join the two warps together for a short while and to use the same formula as on side trawlers. This method is really complicated and cannot be applied very often under normal fishing conditions.

The author would like to explain his own method which was used on Ceylon stern trawlers and is much more practical than the one previously described. Of course the author realized that no one of the mentioned methods can provide very exact measurements. This can only be achieved by using proper instruments. But it is not possible for commercial fishing vessels to carry and use scientific instruments, and skippers of commercial trawlers will have to be provided at least with an approximate means of determining the horizontal opening of the net. It is estimated that the method used on side trawlers is far from being precise and has an error between 3 to 5%.

This paper provides the practical fishermen with a means of estimating the distance between otterboards on (a) side trawlers (b) stern trawlers and (c) shrimp trawlers - double rigged. The paper would further indicate how the horizontal opening of the headline is calculated after determining the distance between otterboards.

ESTIMATION OF THE OTTERBOARDS DISTANCE ON SIDE TRAWLERS

After shooting the gear the two towing warps are brought together by the towing block. The fore and after warps are usually horizontally situated and touch each other, but sometimes they may be

a little distance apart. It is necessary to estimate the distance between the two warps at a distance of 1 meter (or 1 yard) from the towing block. It should be the distance from centre of one warp to the centre of the other one or, otherwise from outside of one warp to the inside of the other. If the warps are not lying horizontally in the towing block or if there is some distance between them it is necessary to estimate that value to deduct it from the distance measured on one meter length of warps. The following figures will help to understand the details of measurements. (Figs. 1(a) and (b).)

The following formula helps to estimate the distance between otterboards:

$$1 : b = L : x \text{ hence } x = L \times b \text{ (see Fig. 2)}$$

where :
- 1 - one meter or yard piece of warp
- b - the true distance between warps on one meter distance
- L - total length of warp, from towing block to otterboard
- x - the distance between otterboards.

In the above calculations no allowance has been made for any error which could arise as a result of hanging of warps, drift force, speed of towing etc. The formula only gives an approximation of the distance which is very often useful for practical purposes.

Further calculations which serve to estimate the horizontal opening of the headline will be expressed in the second part of the paper because they are same for side and stern trawlers.

ESTIMATION OF THE DISTANCE BETWEEN OTTERBOARDS ON STERN TRAWLERS

The towing warps on stern trawlers pass through two towing blocks situated high up on each side of the gallows (gantry). It is easy to measure the fixed distance between the centre parts of blocks through which are passing the towing warps, DE. (Fig. 3). All the other measurements will be related to this distance. It would then be necessary to determine the distance between the towing warps at a fixed distance from the towing block AB. Of course the more the distance from pulleys more exact the measurements will be. Whether it is 1 meter or more does not make any difference. It is advisable to measure the distance between towing warps at 5 or more meters. The points A & B should be fixed for all measurements.

The distance between the two fixed points AB on both warps are measured indirectly, by means of a sextant. The figure No. 3 indicated a plan for taking the measurements and thereby calculating the distance between the warps.

The position of the point C depends on the type of construction of the gallows. It is easy to establish it on Unigan system, and on small stern trawlers without slip. On big factory ships it is not so difficult to choose the proper place for that purpose, because most of them have special bridges on the roof under the slip which can be used. Then it is assumed that the proper place for point C is found and from that point it is easy to see the two fixed points A & B on towing warps.

a. Equipment and calculations:- Two shackles or similar heavier links are hung from special springs or belt hooks which could be easily slipped up on to the warp wires and made to slide along the wires to the required points A & B. These shackles are attached to two thin wires or monofilament of equal length (approx. Ø up to 0.5 mm). These two wires of predetermined lengths would represent AC & BC in Fig. 3.

The distance BE & AD should be measured at the beginning of the operations. It is not necessary to repeatedly measure the distance BE & AD. Once it has been done it will probably suffice for an entire fishing trip, since the twine or monofilament that slipped down the warp with the spring hook will not alter in length.

The following data can be gathered without difficulty:

- distance between towing pulleys DE
- lengths of distances AC & BC
- the position of spring hooks on towing warps AD & BE
- the angle measured by means of sextant.

Using the above data the distance between AB can be calculated easily from the following formula : $AB = AC \sin \frac{\alpha}{2}$

b. The distance between otterboards:- Once the value of AB has been determined it is possible to calculate the distance between otterboards. In the Fig. 4 EF & GD represent the total length of warp which has been paid out.

For the calculation, the principle of similar triangles is used (as in side trawlers examples). Triangles AHD & GTD are equiangular and therefore the corresponding sides are proportional.

$$\frac{AH}{AD} = \frac{GT}{GD} \qquad GT = \frac{GD}{AD} \times AH = \frac{GD}{AD} \times \frac{(AB - DE)}{2}$$

Hence : $GF = GT + TK = KF = 2\,GT + DE$

$$= 2\,\frac{GD}{AD} \times \frac{(AB - DE)}{2} + DE$$

$$GF = DE + \frac{GD}{AD} \times (AB - DE)$$

In general it would suffice if trawler skippers are able to find out the approximate distance between otterboards. This will be a certain extent, help them to judge if the horizontal opening of the trawl net is satisfactory.

c. The distance between otterboards on shrimp trawlers double rigged

The similar methods can be used on side or stern shrimp trawlers if only one net is used. But today the common practise is the double rigging for shrimping, that is two nets and four doors are used for fishing, one from each side of the boat, and additionally one small trial net operating from the stern of the vessel is used for estimating the abundance of shrimp on the fishing ground. The estimation of the distance between otterboards (two pairs) is very important because it should be known whether the spreading force of otterboards is sufficient or not, that is whether the correct size of doors was applied and whether the resistance of the sets can be decreased or not.

The rigging of shrimp sets is presented in Fig. No. 5.

Each otterboard is held in position by a branch towing wire of 40 to 50 meters length joined to the main towing wire which runs through the towing block up to the drum of the winch. That is one drum serves for one set of trawl. The towing blocks are situated at the end of booms attached to both sides of boat.

It is evident that there is no possibility to measure any angle or distance for each set of trawl and therefore it is necessary to find a different solution in that case. There are some conditions which limit the observation, it is that observations can be done in shallow waters (up to 20 meters). Usually the shrimping are in shallow waters, but even otherwise it is necessary to examine in that special condition, which provides us with very important information.

For measurement the following additional equipment is used.

- Two plastic or aluminium floats (painted yellow or red), which are attached to the ends of otterboards with a twine or monofilament having a length equal to twice the depth of fishing ground.

- A sextant for measuring the angle between floats.

It is necessary to establish a fixed point of observation on the deck by means of the sextant and to calculate the distance between floats and the point of observation. This can be done on square millimeter paper and it is possible to correct the change in the distance due to changes in depth of ground and the inclination of the twine joining floats with the otterboards.

Having the above data the following formula can be applied:

$$AB = 2AC \sin \frac{\alpha}{2} \quad \text{(used before)}$$

ESTIMATION OF THE HORIZONTAL OPENING OF THE HEADLINE

Once the distance between otterboards has been determined it is possible to calculate the approximate distance between the headline ends of the trawl net or that between the Dan Lenos. The relation between headline length and the distance between its ends can then be calculated.

Figure 7 indicates the method of estimating the horizontal opening of the headline of trawl.

EP & GM = length of bridles
PN & MO = length of legs
NR = length of side line of the trawl
NO = distance between the wings of trawl
S = length of headline.

In the calculations it is assumed that ONR & FGR are triangles. Applying the formula of similar triangles in the case of ONR & FGR

$$ON : RN = FG : FR$$

$$ON = \frac{FG \times RN}{RF} = \frac{FG \times RN}{RN + NP} + PF \text{ otherwise}$$

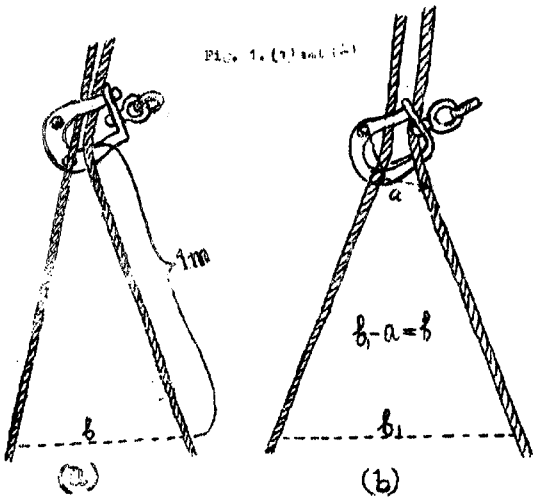
Horizontal opening

$$ON = \frac{(\text{distance between doors}) \times (\text{length of sideline})}{\text{length of sideline} + \text{length of leg} + \text{length of bridles}}$$

$$\text{net opening \%} = \frac{L \text{ which is equal to } ON}{\text{length of headline}} \times 100$$

Generally speaking it has been found through long experience in trawling that different types of fishing and nets need different proportions of horizontal opening of the mouth of trawl. For bottom and above bottom fishing mostly 2 seam trawl nets have been used. Fishes like herring and mackeral need nets with high vertical opening while typical bottom fishes require a net with a wider horizontal opening. As mentioned in the introduction there is a definite relation between these two factors. That is a higher vertical opening causes a decrease in horizontal opening and vice versa. Usually it is estimated that for bottom fishing the horizontal opening of the headline is oscillating between 50 to a maximum of 70% and for above bottom fishing 35% to a maximum of 50% of the length of the headline.

Hence the approximate data of the distance of otterboards and the horizontal opening of the trawl can be very useful factors to be estimated by skippers. It is really the key point of the adjustment of the trawling gear by skippers during commercial fishing.



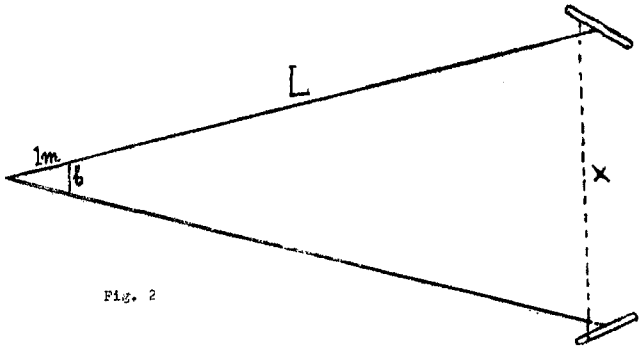


Fig. 2

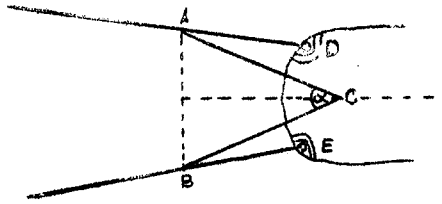


Fig. 3

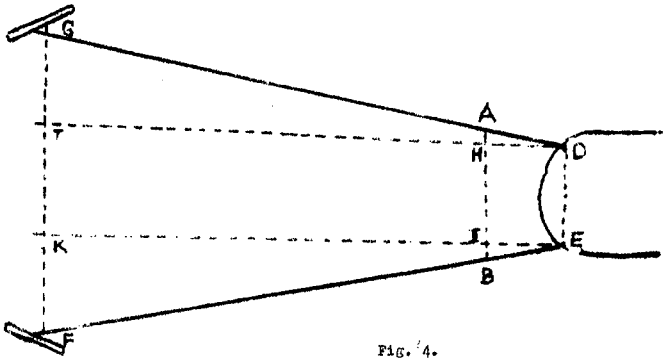


Fig. 4.

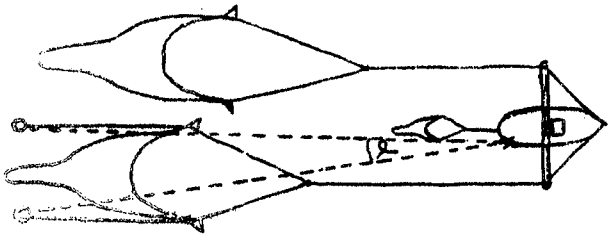


Fig. 5.

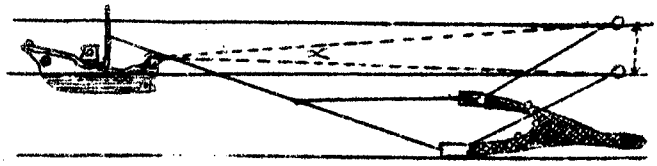


Fig. 6.

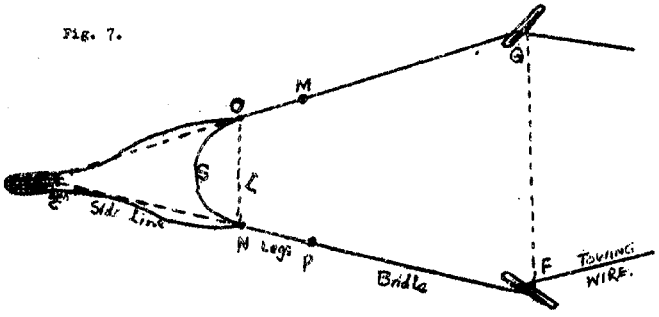


Fig. 7.