

THE SELECTION OF THE TRAWLING GEAR ON THE BASE OF
THE TECHNICAL EFFICIENCY OF THE NET

by

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ABSTRACT

The paper briefly defines and discusses the major factors involved in the selection of trawling gear and notes that modern fishing gear technology provides a means for the selection and operation of the best type of gear. It concludes that prolonged and expensive sea trials can be avoided.

INTRODUCTION

There is a considerable difference of opinion as to the type and method of construction of nets for trawling. The problem can be tackled from different angles but finally all aim at providing an efficient net for the particular type of fishing. Numerous factors influence the operation of a net and their factors have to be taken into consideration when designing gear. One may lay emphasis on particular factors while another may lay emphasis on other factors and so on when designing a net. Hence the variation in the type of construction.

Given below are some factors which influence the opinion in formulating the gear.

- 1 - The presence of fish on fishing grounds.
- 2 - The proper material and construction of the net.
- 3 - The proper adjustment of the gear to the power at disposal.
- 4 - The proper rigging, according to the type of fish to be captured.

- 5 - The skill of the skipper and the crew of the boat.
- 6 - The proper usage of modern aids in fishing, which provide information about the presence of the fish and their behaviour.

Each of the above mentioned factors can even individually be the sole criterion in the designing of the fishing gear to be used. Generally all the factors are taken into consideration in designing gear and therefore it is difficult to determine the main cause of proper or improper results in fishing without a detailed analysis. Some of these mentioned factors can be analysed by means of special methods. Others involve a human factor which is difficult to measure and can only be estimated after a long period of experience.

This paper intends to discuss some of the factors which influence the fishing efficiency of a net. Method of determining the effectiveness of the fishing gear used in the exploitation of fish stocks is also discussed.

II. THE METHOD USED FOR ESTIMATION OF THE FISHING GEAR EFFICIENCY

Several methods have been employed in the estimation of the efficiency of trawling gear. The easiest though not the best is to use the fishing gear of a new type for a long period, and compare the fishing results with the effort of the fishing gear used previously. This method does not solve the problem, because after some time another design of net can prove that it is much better than either of the first two and the situation might be repeated without end.

The better method is to make comparative fishing tests with the new and old type of fishing gear using two or more boats, on the same ground at the same time. This method is very expensive and involves the use of more than one boat and hence is not often resorted to. Generally one boat is used to examine different fishing equipment and the opinion is expressed after trials with this one boat. Of course the criteria of estimation of the quality of nets depend on the quantity of fish captured by the nets.

The other method is to make the technical measurements of the main factors under which the net could operate. These would involve the speed of towing, vertical and horizontal opening of the mouth of the trawl and the resistance of the fishing equipment etc. These measurements can be done even on predetermined experimental grounds where the application of the instruments are safe.

In the above, it has been assumed that the net has been perfectly constructed. Often it happens that the construction of the net has not been properly solved and therefore it seems to be necessary to examine first the net has been really correctly constructed.

III. METHOD USED FOR NET CONSTRUCTION EXAMINATION

This problem is solved in different ways in various countries. Some developed countries have established special institutions whose sole responsibility is the examination and report on the construction of trawling gear. Here models of nets are examined with the help of air tunnels or water basins. In other countries the natural observations are carried out by means of television, automatic photo cameras, echosounders, or other electronic devices and even by divers who take measurements and report their observations. All the methods help more or less in the estimation of the construction and indicate faults or errors made. All of them are very useful but on the other hand they are very expensive, as they involve the use of research boats, special apparatus and people proficient in the subject.

The other methods of estimating the proper construction are the theoretical analysis of the design and the use of results obtained by examining models of the net. Later examination of the net in actual fishing operations will indicate whether the theoretical factors are confirmed in practice. If it is not so the rigging or operation of the trawling set need to be corrected.

The author has published his own geometrical construction method which is helpful in solving the problem of the estimation of the proper construction of trawls. (Prace Morskiege Institutu Morskiege, Volume 14, series B : Trawl set and its choice for the vessel. 1967). This method can be applied to any trawl net construction on the basis of the design of the net without examination in the sea.

The trawl accepted by such analysis and then by technical examination in the sea, decides whether the net matches the power of engine of the boat. It can then be introduced into practice for commercial fishing.

IV. TECHNICAL EFFICIENCY OF THE TRAWL

There are several methods for the correct construction of nets. They all aim and provide for the efficient working of the net. Sometimes it is necessary to construct a net of low resistance enabling the net to be towed at a fast speed. At other times it would be necessary to obtain a high vertical opening and at still other times a wider horizontal opening etc. Therefore it is very important to have a standard method or kind of solution which can help in the estimation of the fishing gear, and selection of trawl nets suitable for a particular type of fishing operation.

Assuming that the given net is properly constructed (after analysis) and that its technical factors examined in the sea indicate a proper behaviour of the net during fishing operation - it should be said that given design of the net is satisfactory for efficient fishing and can be compared with any other design using the same method.

In that case it appears to the author to be useful to introduce the special expression of technical efficiency of trawling gear which combines the ability of fishing of the net explained with the help of characteristic technical factors. Being assured of proper construction of nets, this mentioned 'technical efficiency' can be expressed in terms of the correct horizontal and vertical opening of the net and proper speed of towing. The technical efficiency of the trawl net can be expressed in cubic meters of water which is filtered through the net in unit time during towing. For example in typical bottom exploitation where the vertical opening of the net does not play an important role, the technical efficiency of fishing gear can even be expressed in square meters of ground which was covered in unit time. For above bottom fishing or pelagic trawling it must be expressed in cubic meters only. It seems to be practical to accept one second as the unit of time. Hence the value of the technical efficiency of nets is calculated as: the horizontal distance between wings (in meters) X vertical opening of the mouth (in meters) X speed of towing (in m/sec) = m^3/sec .

The presence and behaviour of the fish on the fishing ground will decide which type of net is to be used. This factor can be examined by means of echosounders, which are accurate enough and record the presence and abundance of fish.

The technical efficiency of the trawling gear can be changed or improved by adjusting the rigging. For example the vertical opening can be increased by the application of more floats or by change of the angle of attack of otterboards and vice versa.

The value of the technical efficiency itself can be treated like an indicator for the type of exploitation, because it is useless to operate with very high opening nets if the fish are lying on the bottom or to use the low vertical mouth opening of the trawl for above bottom or pelagic fishing. It means that different types of fishing need different constructions of net, which can be expressed in terms of the "technical efficiency".

In Figure 1 the author intends to express the meaning of effectiveness of different nets under different conditions of fishing grounds.

The speed of towing of the fishing gear affects the technical efficiency of a net to a great extent. Some types of fish can only be caught by towing the net at a high speed while for other types of fish the speed of towing is not the principal factor. The highest speed is required for pelagic fishing, and above bottom fishing. A lower speed is used for typical bottom fishing.

The effectiveness of different trawl nets can be judged and adjustments made to it once the technical efficiency has been determined. Three examples are presented below to illustrate this:

1. If the technical efficiency of a 85 ft net is found to be $33\text{m}^3/\text{sec}$. it can easily be prepared for typical bottom trawling with a vertical opening of about 1.5m the spread between wings to be 15m and the net to be towed at a speed of about 1.5m/sec. (3 Kn).
2. If the technical efficiency of the net of the same length of headline is found to be $60\text{m}^3/\text{sec}$ the net could be towed at a speed of about 3.5 kn. The net could have a vertical opening upto 4 meters at the 8.5 m spread between wings.
3. Pelagic trawling nets should have a technical efficiency of not less than $220\text{m}^3/\text{sec}$. Such a net would have a mouth opening of 200m^2 in which case it would have to be towed at 2 kn which speed is insufficient for pelagic trawling, especially for speedy species or better net with opening of 130m^2 should be towed at 3 kn.

CONCLUSION AND SUMMARY

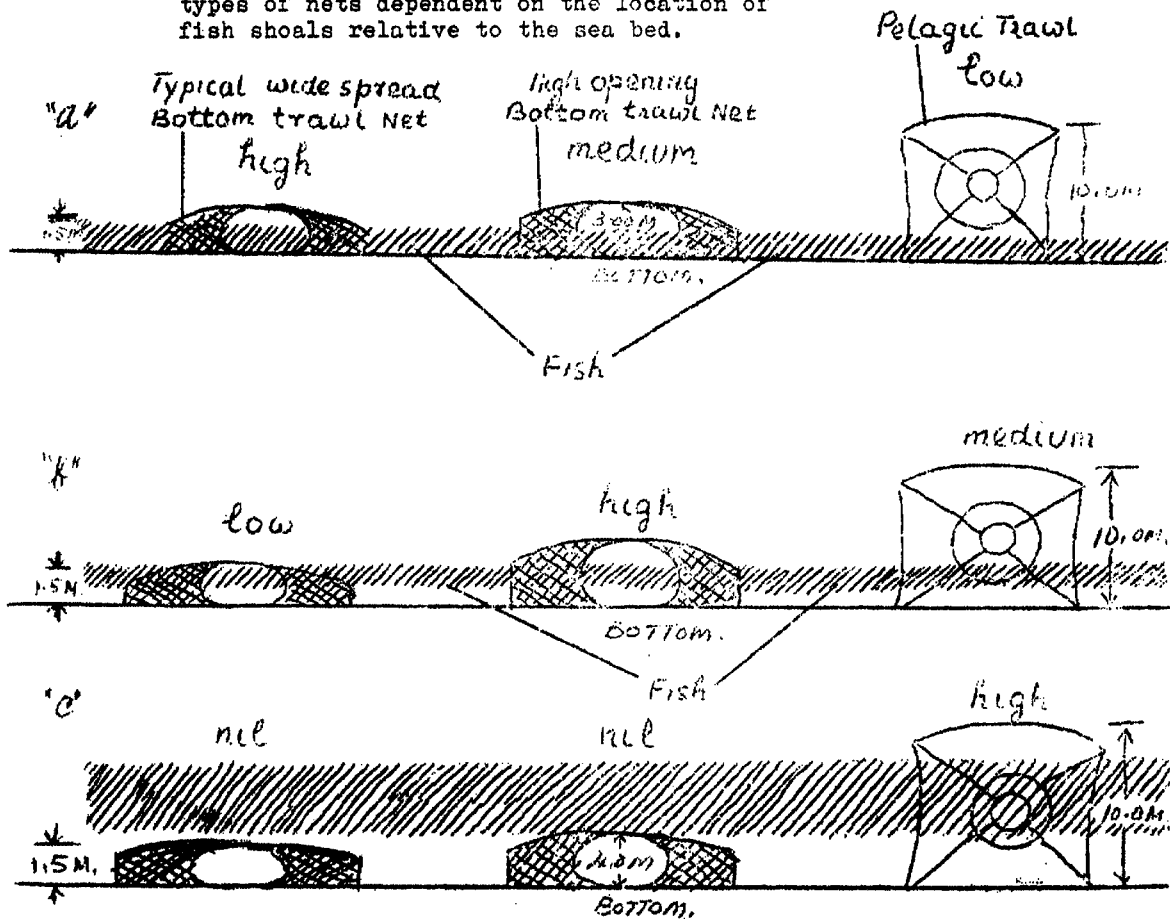
The study of the technical efficiency of trawling gear provide the best means of determining the most suitable type of net for a particular type of fishing. This factor seems to be helpful in the classification and selection of nets according to the type of fishing because it can be expressed exactly and can be measured easily and therefore is comparable at comparative fishing.

In the light of the above discussions all the factors which influence fishing effort and which were outlined at the beginning of this paper can be briefly summarized as follows:

1. Presence of fish on fishing ground.
This is the principal factor and a fishery will depend on the results of a resources survey.
2. The proper material and construction of the net.
This factor can be estimated during constructional analysis and, only nets which are accepted or corrected by that analysis can be used in practice.
3. Proper adjustment of the gear to the power of the fishing boat available.
This factor is also to be solved by technical examination in the sea after the geometrical analysis.

4. Proper rigging for the types of fish present in the fishing grounds.
This problem is also to be solved by adjustment of rigging suggested by analysis.
5. Skilled skippers and crew of the boat.
This is a human factor. Experience, professional study, courses and practical demonstrations are means of increasing their skill.
6. Proper usage of modern aids in fishing.
This factor is mastered by skilled crew, and with frequent practise and demonstration the crew might get accustomed to use modern devices in the fishing services.

Fig.1- Fishing Effectiveness of the different types of nets dependent on the location of fish shoals relative to the sea bed.



- Note: i. "a" fish shoals lying at the sea bed.
 "b" fish shoals lying slightly above the sea bed.
 "c" fish shoals away from the sea bed.
- ii. Relative percentage of fish captured by the net for the different conditions is indicated as "high", "medium", "low" and "nil".