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## PRELIMINARY REPORT ON EXPERIMENTAL FISHING WITH AN IMPROVED TYPE OF TRAWL-NET

## RAPPORT PRÉLIMINAIRE SUR DES EXPÉRIENCES DE PÊCHE AVEC UN CHALUT DE TYPE AMÉLIORÉ

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### *Abstract*

A new type of trawl-net incorporating the best features of the Italian and Atlantic type trawls has been developed. This net proved more efficient than the Italian net in actual comparative fishing.

### *Résumé*

Un nouveau type de chalut a été construit, combinant les avantages du chalut italien et du chalut atlantique. Ce chalut s'est révélé avoir un meilleur rendement pratique que le chalut italien.

\* \* \*

The otter trawl was introduced in the Mediterranean later than in the Atlantic. Its present form differs greatly from the otter trawls used outside this sea. There are two reasons for this:

1. The Italian trawl-net was developed from the Italian "paranzella" net, which is an old-fashioned fishing gear.
2. The specific fishing conditions of the Mediterranean where soft muddy bottoms, and demersal fishes of very small size, and relatively poor catches predominate. Furthermore, Israeli trawlers have never found schools of fish distributed both on the bottom and several fathoms above on their depth-recorders as have been reported often in other seas, nor have they recorded schools of fish directly on the bottom.

For the purpose of this paper the otter trawl gear is divided into two major parts. The net itself, and the remainder, including the warp doors and the ground-cables or tow-lines.

1. *Otter-trawl gear, other than the net.* The Italian gear is the most extreme expression of Vigneron-Dahl's idea. In a Mediterranean trawler, powered by a 120 H. P. engine, there is at least 200 meters of a soft, flexible "Hercules" (rope wrapped wire) line, between the net and the otter-boards. On trawlers in other seas, the ground cables are generally much shorter, and consist mostly of pure steel wire. There are also differences in proportions of trawl-boards, and in the length of warp. The present paper deals mostly with the net itself.

2. *The trawl-net.* Throughout the world almost all types of bottom otter trawl-nets are constructed on the same pattern. Their whole body consists of nearly identical top and bottom parts with an additional square on the top which hangs over the mouth of the net. There are differences between the shape of the upper and the lower wings, the latter being much longer. Fig. 1-4 illustrate the point: All the trawls represented are constructed on the same pattern, apparent differences in the drawings resulting from the different scales used by the various authors.

On the contrary, in the Mediterranean, the trawl-net used is very different from that used in other seas (Fig. 5). The bottom part has much less webbing and much heavier twine, and is attached to the top part to permit a high degree of slackness in the bottom part. The cod-end consists of one tube-like piece common for top and bottom. The net parts are never shape-cut. All nets must be hand-made. The wing consists of one part. The body is completely connected to the wings, as compared with non-Mediterranean otter trawl-nets where the body is never completely connected to the wings and some sections of the body form the mouth. The mouth in the Italian net is formed by two upper and lower wedges. The wedges are loosely sewn into the body and the whole net attached to ropes by means of long threads (hangings) called "armatura". The Italian trawl-net is much longer than other trawl-nets. A trawl-net used by a vessel with 120 H. P. engine is nearly as long as those used by powerful oceanic trawlers having engines of 1000 and more H. P. The relation between the number of meshes in the net's mouth compared to the cod-end is also different. In the non-Mediterranean type it is about 5 : 1, while in the Italian net it is 2 : 1, including both wedges.

As far as we know, all experiments with complete Atlantic otter trawl gear, or only the Atlantic trawl-net instead of the Italian, in Mediterranean waters have been a failure. The experiments also failed when the large mesh webbing in the body was replaced by a small size mesh.

There are hundreds of variations of the Italian trawl-nets and practically every skipper has his own way of constructing and adjusting his trawl, but in general the net shown on fig. 5 may be taken as typical for 120 H. P. trawlers.

### *The Italian trawl-net in action*

It is commonly believed that the success of the Italian trawl-net is due to the fact that the lower part of its long body adapts itself very closely to the bottom, and is flexible enough to follow its configurations. The lower part of the mouth is very broad, and the foot-rope does not allow the fish to escape under the net. All of this is probably due to the fact that the upper parts of the net are shorter and more tautly adjusted to the rope than the lower

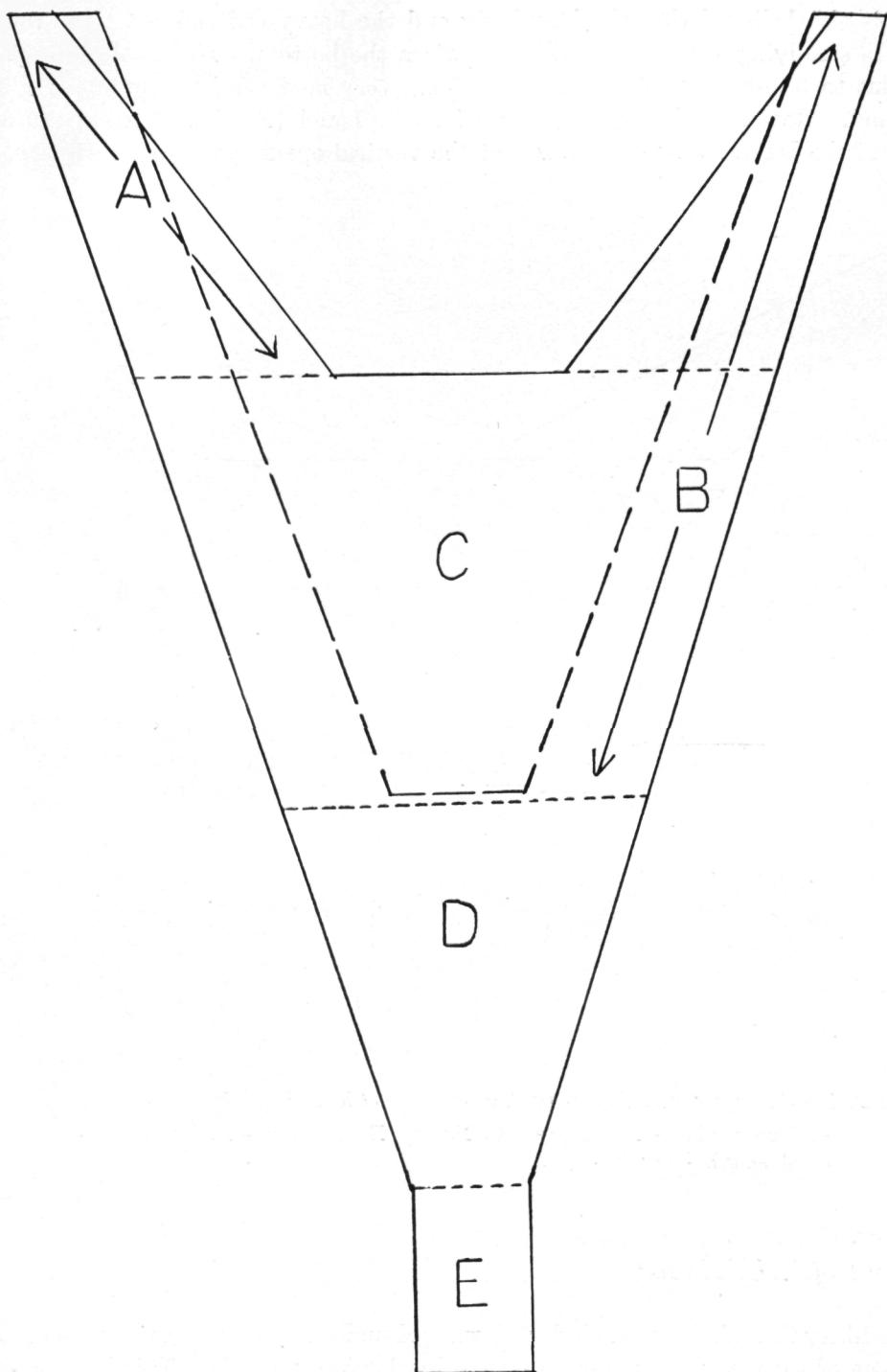


FIGURE 1. *Atlantic trawl net. American and European big trawlers (800 H.P. and more), (Lissner, 1946).*  
A. Upper wing - B. Lower wing - C. Square - D. Belly - E. Cod-end. Total length 38 m.

parts. It is also believed that the long body and the heavy cod-end resist the towing force and assist in steadyng the position of the trawl on the bottom. The whole intention of this device seems to be to engulf every creature living very near the bottom, or partly buried in mud or sand. Recent under-water observations in Israel (Fried and Assaf, 1956) on the operations of the Italian trawl-net show that the vertical opening of the mouth is 90-120 cm.

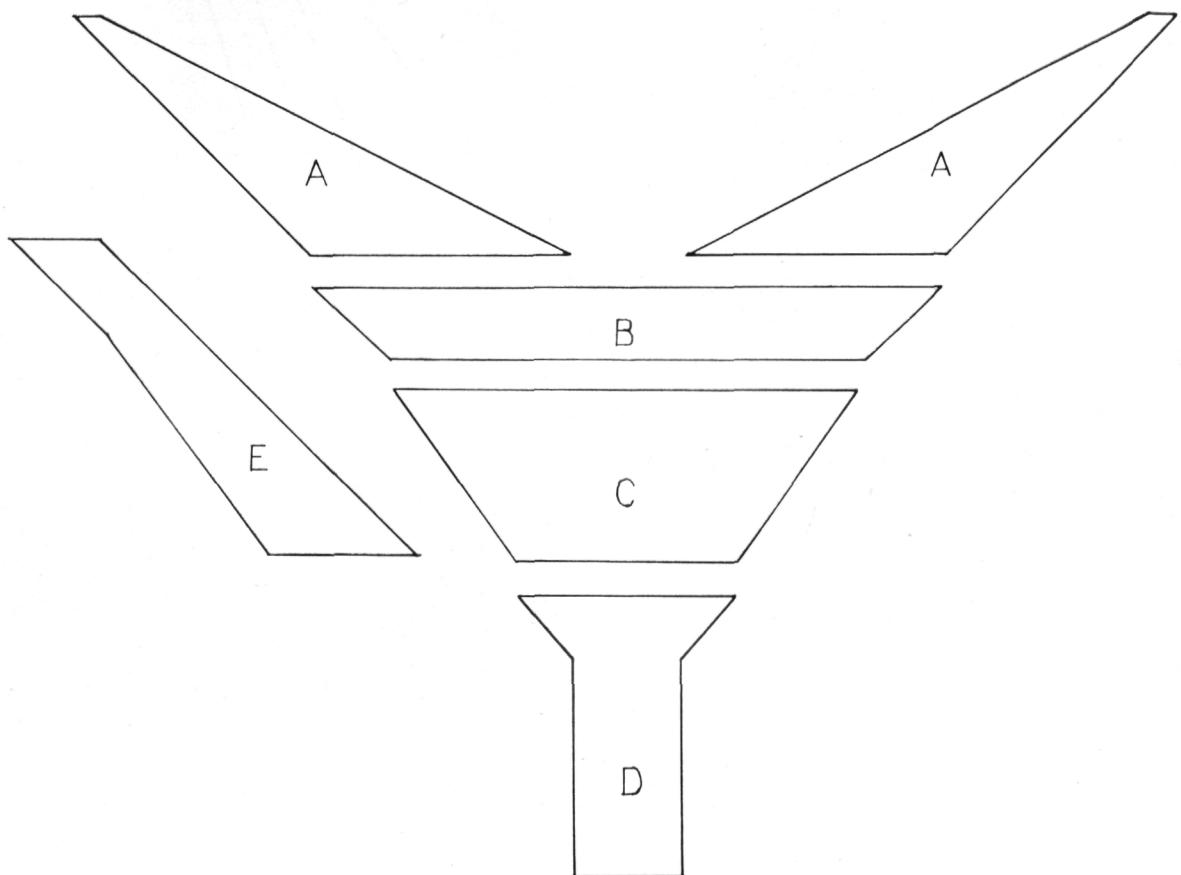


FIGURE 2. *Russian trawl net. Big steam trawlers (over 800 H.P.), Murmansk. (Baranov, 1948).*

A. Upper wing - B. Square - C. Belly - D. Cod-end - E. Lower wing  
Total length - about 43 m.

#### *Development of a hybrid-net*

It is unlikely that all ground fish dart down and under the net when the trawl gear engulfs them. Some of them must attempt to escape by darting upwards. This is also most likely to be the case with the pelagic and mid-water fishes such as horse mackerels (*Carrangidae*), blue-fish (*Pomatomidae*), barracudas (*Sphyraenidae*), etc. It is also probable that even the fish which ordinarily dart down and under the net may, under certain circumstances,

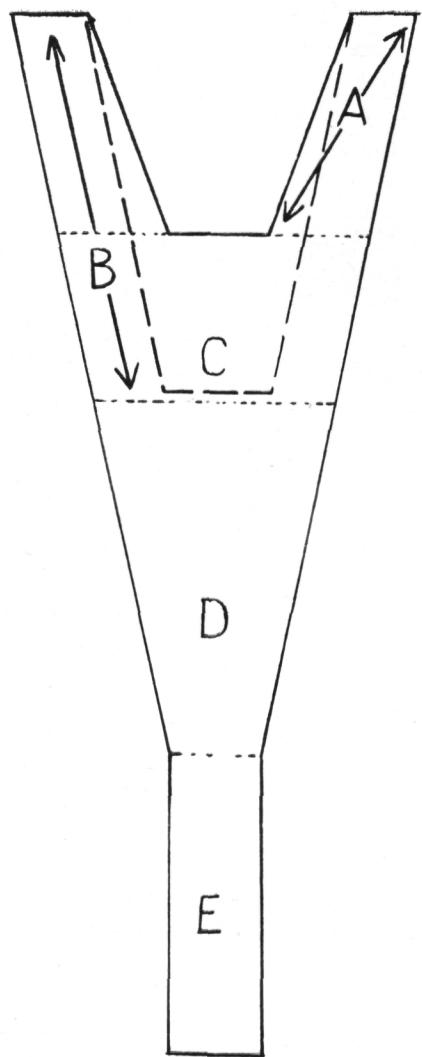


FIGURE 3. *Russian trawl net. Small trawlers. (150 H.P.). Baltic Sea and Northern coasts of U.S.S.R. (Voynikanis-Mirsky, 1953).*

A. Upper wing - B. Lower wing - C. Square - D. Belly -  
E. Cod-end

Total length - 24.5 m.

be rising off the bottom and may be taken by a trawl-net with a larger vertical opening. Because the Italian trawl has a small vertical opening, it cannot catch fish found more than one meter from the bottom. An attempt, therefore, was made to increase the mouth height while preserving the characteristic features of the Italian net, particularly its ability to follow the bottom contours. Experiments were made to increase the floatability of the Italian net by means of Philip's trawl-planes or a kite. It appeared that these devices assisted in keeping the mouth open vertically only to a very limited extent and that an exaggeration in use of floating devices led to the lifting of the whole net off the bottom. The limitation in the vertical opening of the mouth of the net is inherent in the Italian net. In this net, the shortest (imaginary) line from the cod-end to the beginning of the wing (the wooden spreader) runs along the top-central parts of the body, the "armatura" of the upper wedge and the head-line. If the net is being towed, the strain is on the upper part of the net and tends to prevent the

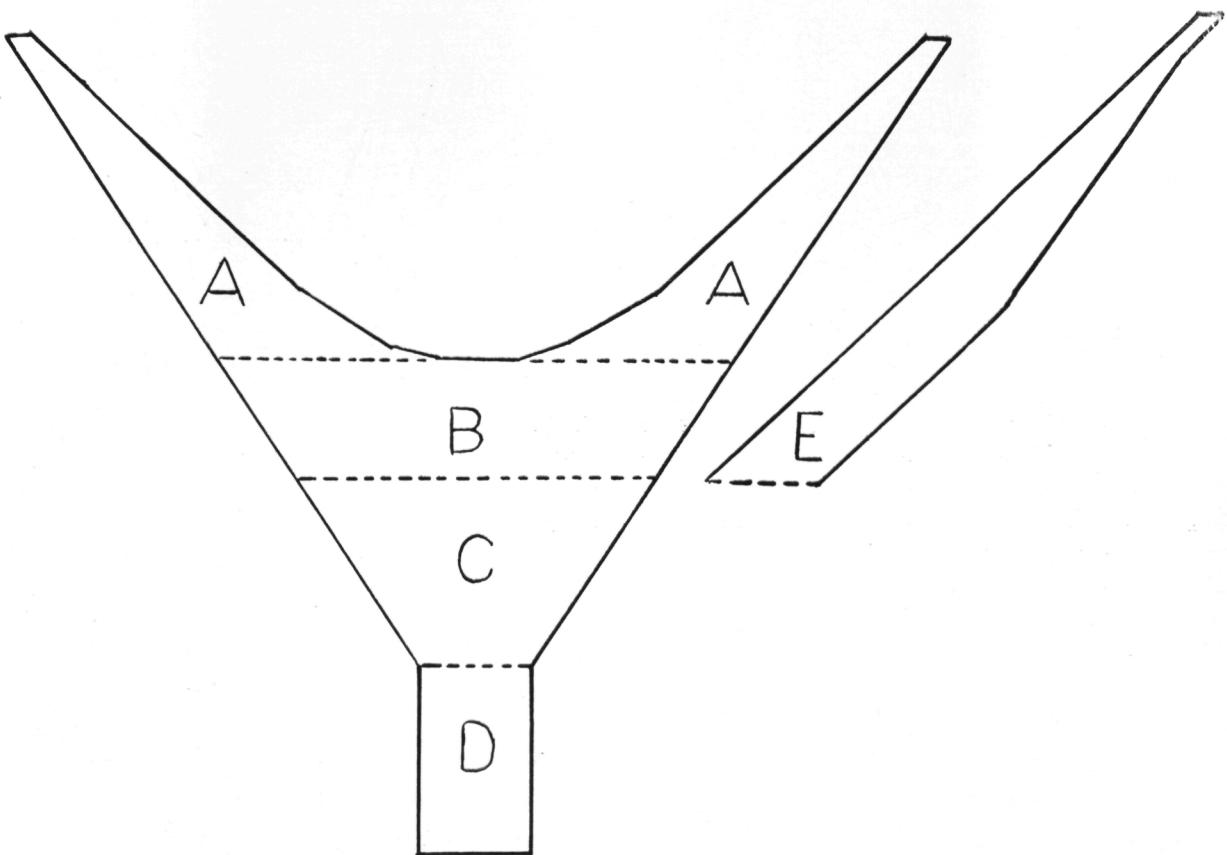


FIGURE 4. *Japanese trawl net. Big trawlers. East China Sea. (Bourgois, 1951).*

A. Upper wing - B. Square - C. Belly - D. Cod-end - E. Lower wing Total length - 38-40 m.

vertical opening of the mouth. The floats and the water pressure force the mouth open vertically but the opening is definitely limited by the antagonistic closing forces of towing. This is very clearly seen in Fig. 6, where an Italian trawl-net has been photographed on shore after placing it in a towing position. Notice that when the body and wings form the letter "Y", and the net is taut, the head rope can be barely raised to a man's waist. Fixed in the same way, but with its lower side up, the foot-rope can be easily lifted because there is no tension on it. This flexibility of the foot-rope is desirable and we wished to retain it, but at the same time we wanted to remove the towing tension from the head-line so that the vertical opening of the mouth could be increased. We attempted, therefore, to move the towing tension from the upper part of the net to the sides of the body. The sides of a common Italian trawl-net were strengthened by the addition of ropes. The central top part of the body was cut out and then the same piece sewn back with some slack allowed. The wings were divided into two parts. The upper one was connected to the side-rope with slack. The upper wedge as well as "armatura" connection were taken out of the net, and all upper connections were now direct net to rope. The lower part of the net was not touched at all.

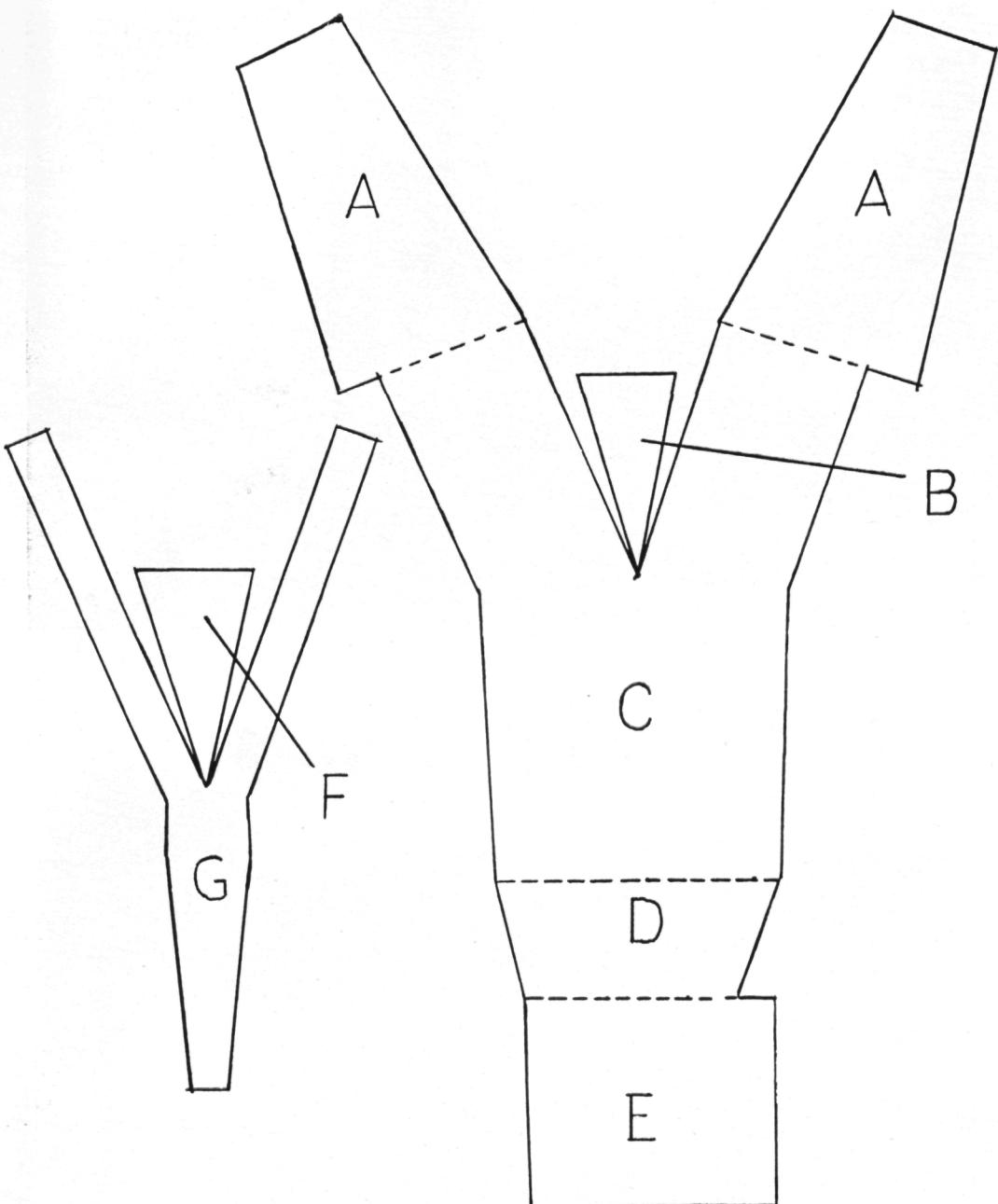


FIGURE 5. Italian trawl net. Israel. Trawler "Tzofia", 115 H.P.

A. Wing - B. Upper wedge (*Scaglietto*) - C. Upper part of the body (*Gola*)  
 D. Presack (*Canone*) - E. Cod-end (*Sacco*). F. Lower wedge - G. Lower part of the body (*Tosello*).  
 Total length - 35-37 m.

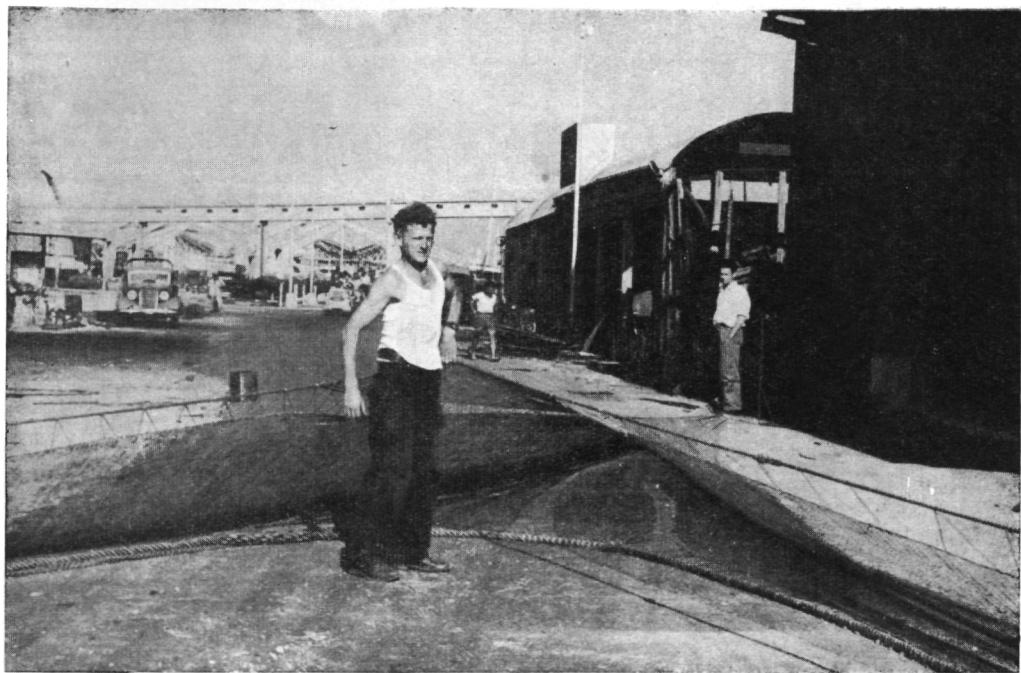


FIGURE 6. *Italian trawl-net spread on shore in a towing position.*



FIGURE 7. *The hybrid-net ("Tzofia"-type) spread on shore in a towing position. Notice the slackness of the head and foot ropes, while only the side ropes are taut.*

This hybridizing of the Italian trawl-net with the Atlantic type permits easy raising of the head-line and increases the vertical mouth opening. The hybrid-net was also photographed on shore after placing it in towing position (Fig. 7). Notice that the net here is also held taut, forming a figure "Y", but that the head-rope now can be raised much over the height of a man.

Full description of this hybrid-net ("Tzofia"-type) is given by M. Ben-Yami (1956).

### *Results of experimental fishing with the hybrid-net*

The net was tried in 1955-1956 on board the Israeli trawler "Tzofia", a British M. F. V.-type, with a 115 H. P. engine. About 90 tows were made in regular commercial fishing and the net worked well, especially on the hard, stony bottom in the vicinity of Mount Carmel.

A comparative experiment was made in which the "Tzofia" was paired with an Italian built, 110 H. P. trawler, the "Pal-Yam". The towing speed of the "Pal-Yam" is lower than that of "Tzofia" and therefore her catches are lower. The parallel fishing experiments were carried out under regular commercial fishing operations. A total of 58 parallel tows were used in the study. Of these, 30 tows were made when both boats worked with their regular Italian nets, and 28 when "Pal-Yam" used her regular net and "Tzofia" used the new hybrid-net. The catches of the two boats, in simultaneous tows, using the Italian gear, is summarized in Fig. 8: out of 30 parallel tows, 19 of them showed a greater catch for the "Tzofia" than the "Pal-Yam". In Fig. 9 the catches of simultaneous tows for the two boats have been recorded, in this case the "Pal-Yam" fishing with the Italian net and "Tzofia" with the hybrid-net: out of 28 tows, 24 showed a greater catch for the "Tzofia". These results indicate that the hybrid net is more efficient than the Italian net. More details are given in the report by the crew of "Tzofia" (1956).

### *Underwater observations of hybrid-nets*

An improved type of hybrid-net, called "type B", was constructed in summer 1956. This net and the "Tzofia"-type hybrid-net were observed and photographed underwater by skin-divers.

The fishing height of both of these nets was about 2.5 m. and the spread of the wings, although not measured, appeared a little smaller than that of the Italian net, observed in identical conditions Fried and Assaf, (1956). The general impressions on the behaviour of the hybrid nets while in action are given in the diver's report (Y. Assaf, (1956).

The various parts of the type B hybrid-net are cut out from factory-knitted, rectangular webbing, an improvement compared to the "Tzofia"-type and the Italian nets, which are hand made. The construction of the type B net was described by the author in the Fisherman's Bulletin No. 9 (1956). This net was used successfully in regular fishing conditions by the R. F. V. "Hazvi" (Hamburger, 1956).

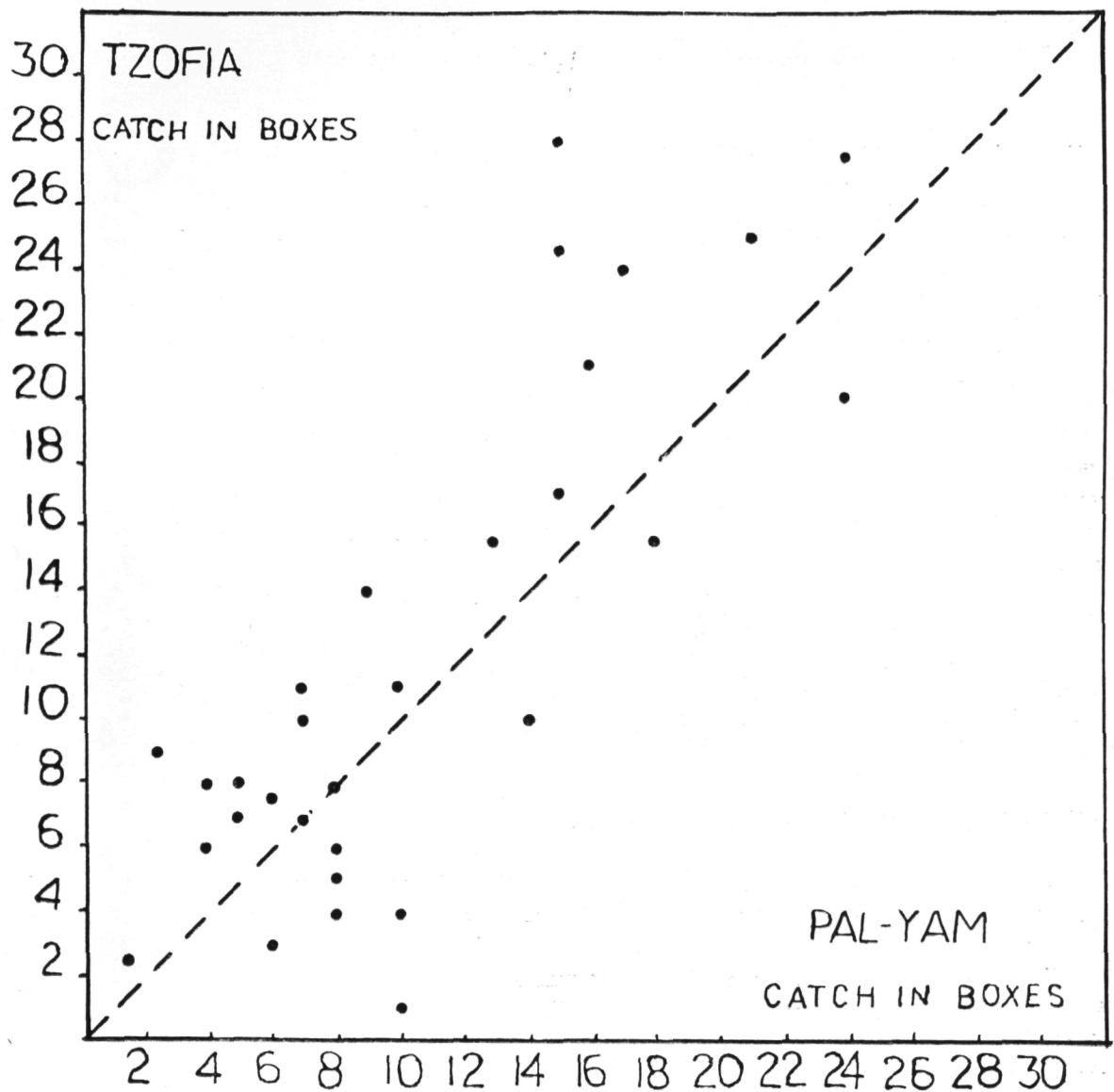


FIGURE 8. Results of 30 simultaneous tows, while both boats used the Italian trawl net.

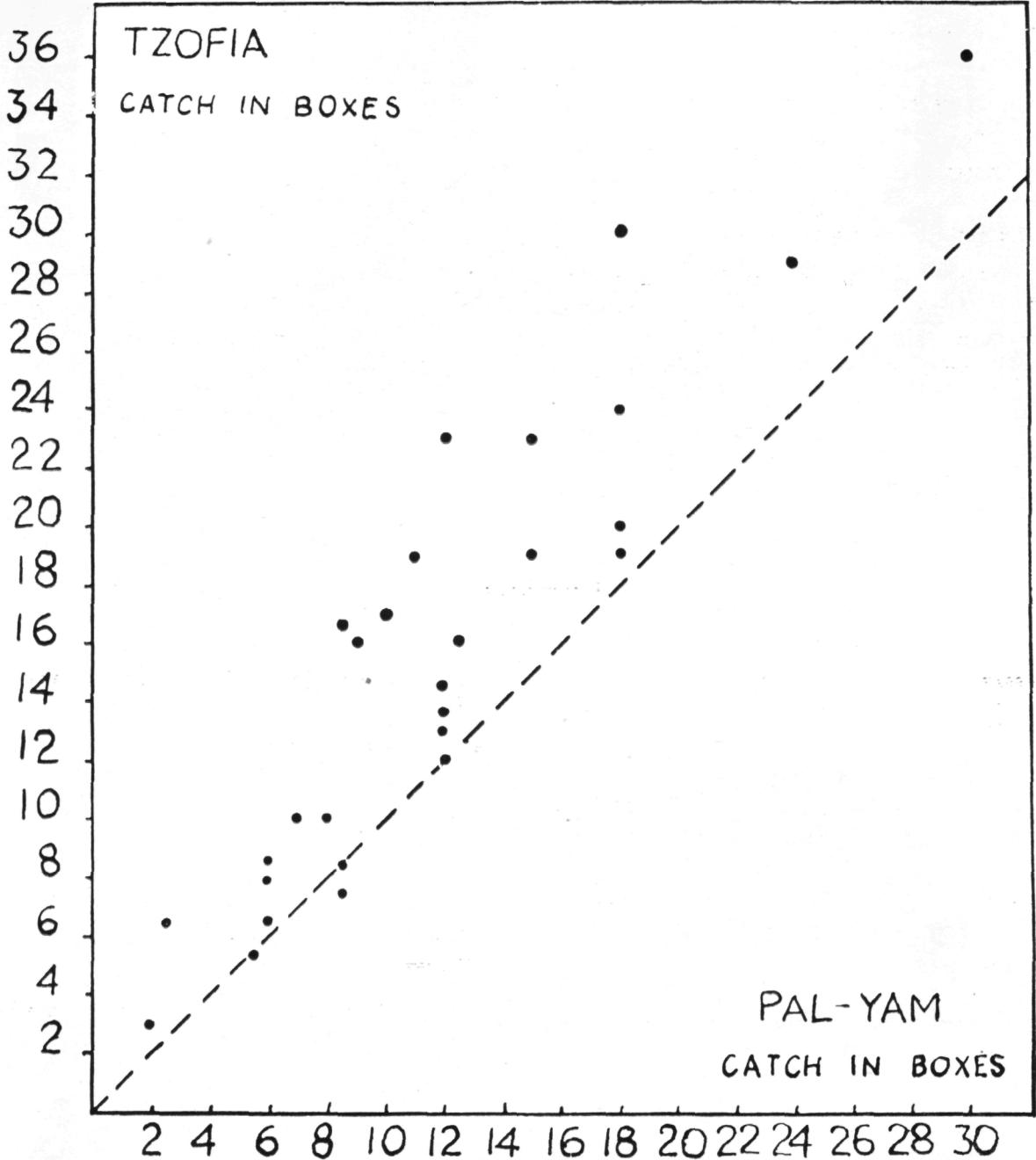


FIGURE 9. Results of 28 simultaneous tows, while "Pal-Yam" used the Italian net, and "Tzofia" the hybrid-net.

### **Conclusions**

- (1) There is no need for the Italian trawl-net to be the only good one in use by the Mediterranean trawl fishery.
- (2) Further development of the hybrid-net can lead to introducing a simplified, cheaper and more efficient trawl-net, constructed from standard, factory-made pieces of webbing.
- (3) Commercial fishing with the already tried "Tzofia"-type and type B hybrid-nets promises good results.

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