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CONSTRUCTION OF A FOUR-SIDED OTTER TRAWL NET ADAPTED TO PHILIPPINE CONDITIONS

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FOUR TEXT FIGURES

The four-sided otter trawl net (fig. 1, C) which is a modification of the Pacific-type net was introduced in the Philippines during the latter part of 1947 (Warfel and Manacop, 1950). Since then this net has been widely adopted by local otter trawl operators, especially those of Negros, Iloilo, Samar, and Pangasinan. It has a decided advantage over two other types introduced almost at the same time, the *mestizo* and the *Florida* otter trawl nets (fig. 1, A and B) in that it has a wider mouth opening and about five times longer wings than the Florida Type and needs less netting in construction than the mestizo type. Thus it is claimed to be more effective in catching fish and to last longer in operation than any of the other two types of trawl nets.

The present paper describes in detail the construction of a four-sided otter trawl net having 57 feet headrope which may be divided into preparation of the nettings, shaping of the parts, joining the parts together and hanging the net (fig. 1).

PREPARATION OF THE NETTINGS

The four-sided trawl net (fig. 1, C) consists of two wings two-side bellies (SB_L and SB_R); upper and lower wedges or corners (UWd and LWd); intermediate bag (IB); cod-end (CE); and the funnel (FL). Other parts which are needed to strengthen it are the headrope and footrope, which are both made of abaca, and the rib lines of either cotton or abaca.

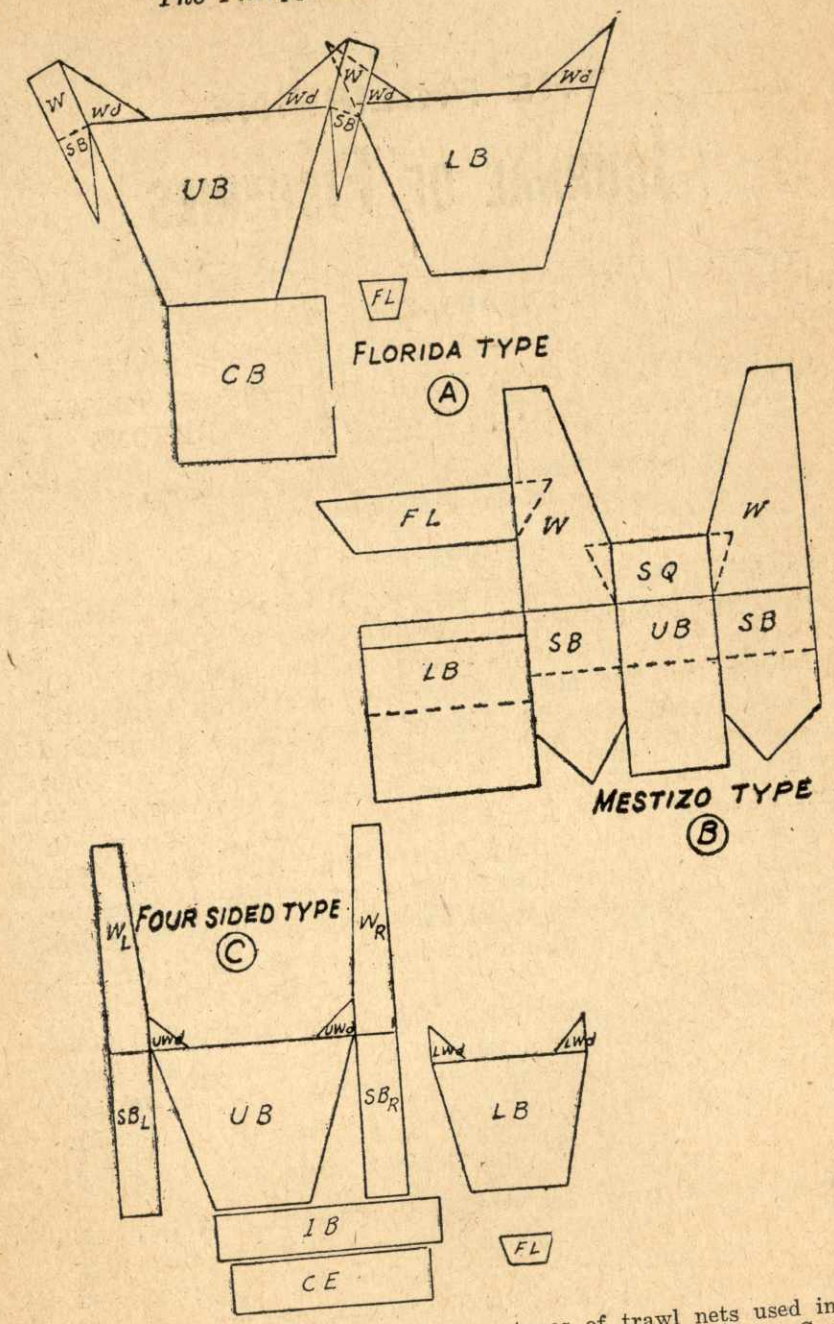


FIG. 1. Structural plans of three types of trawl nets used in the Philippines: A, Florida Type; B, Mestizo Type; C, Four Sided type. (UB, upper belly; LB, lower belly; W, wing

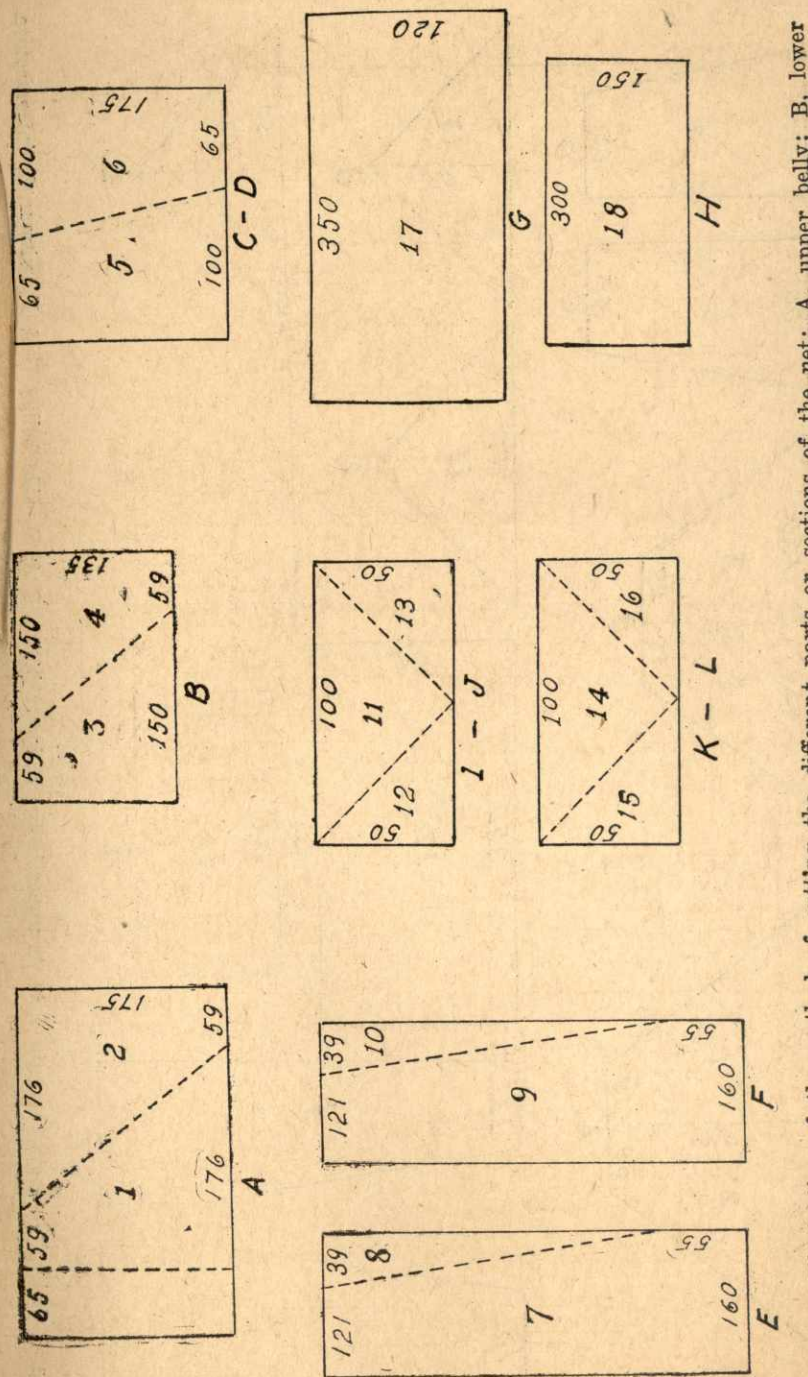
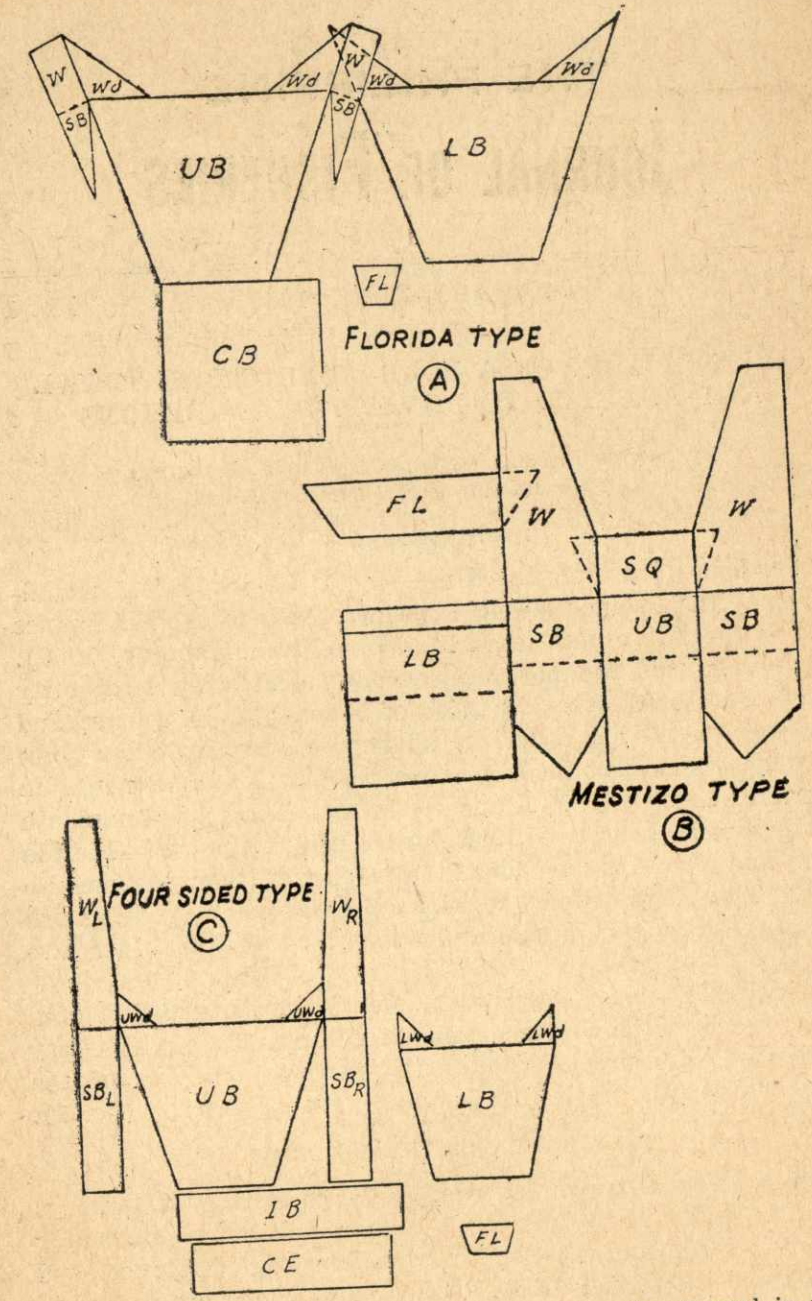


FIG. 2. Illustration of the method of cutting the different parts or sections of the net: A, upper belly; B, lower belly; C & D, side belly; E & F, wing; G. Intermediate bag; H, cod-end or bag; I, J, K, and L. wedges or corners.



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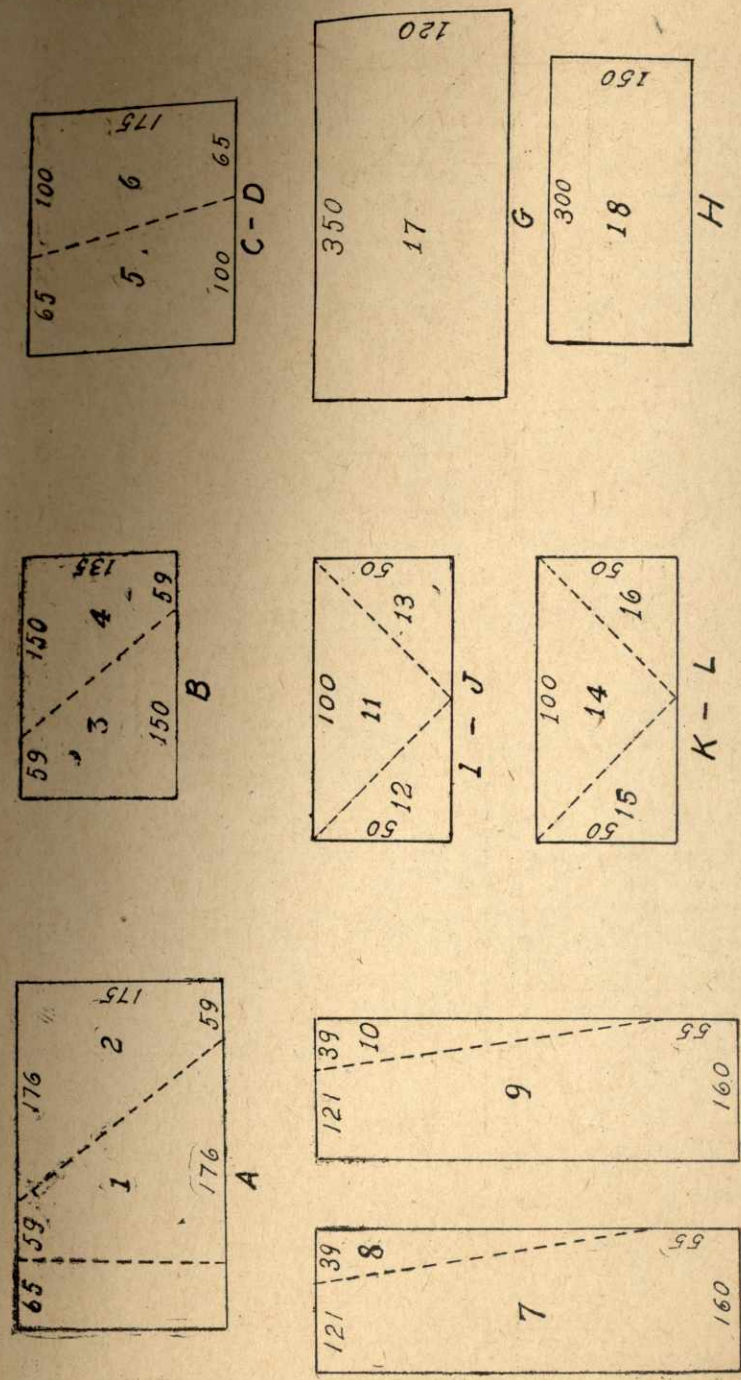

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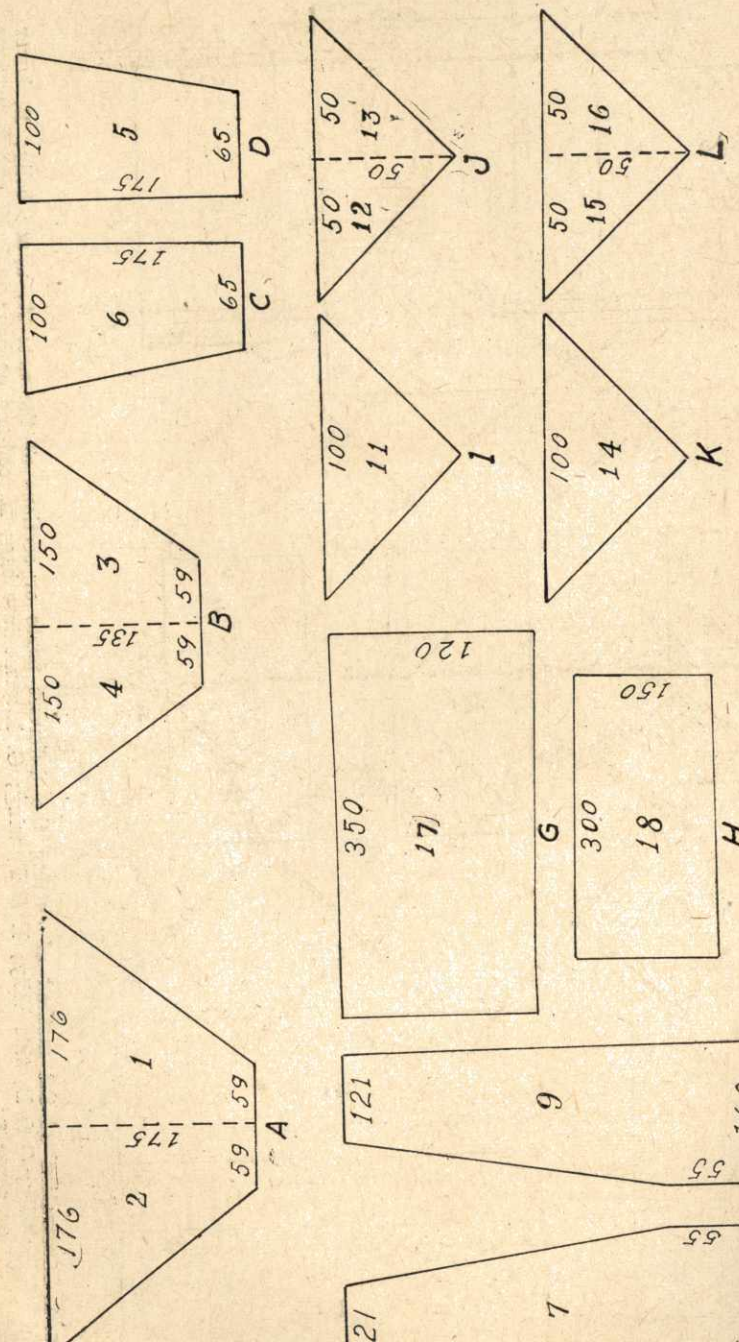

FIG. 3. Individual sections of the net: A, upper belly; B, lower belly; C & D, side belly; C & F, wings; S, intermediate bag; H, Cod-end or bag; and I, J, K and L, welges or corners.

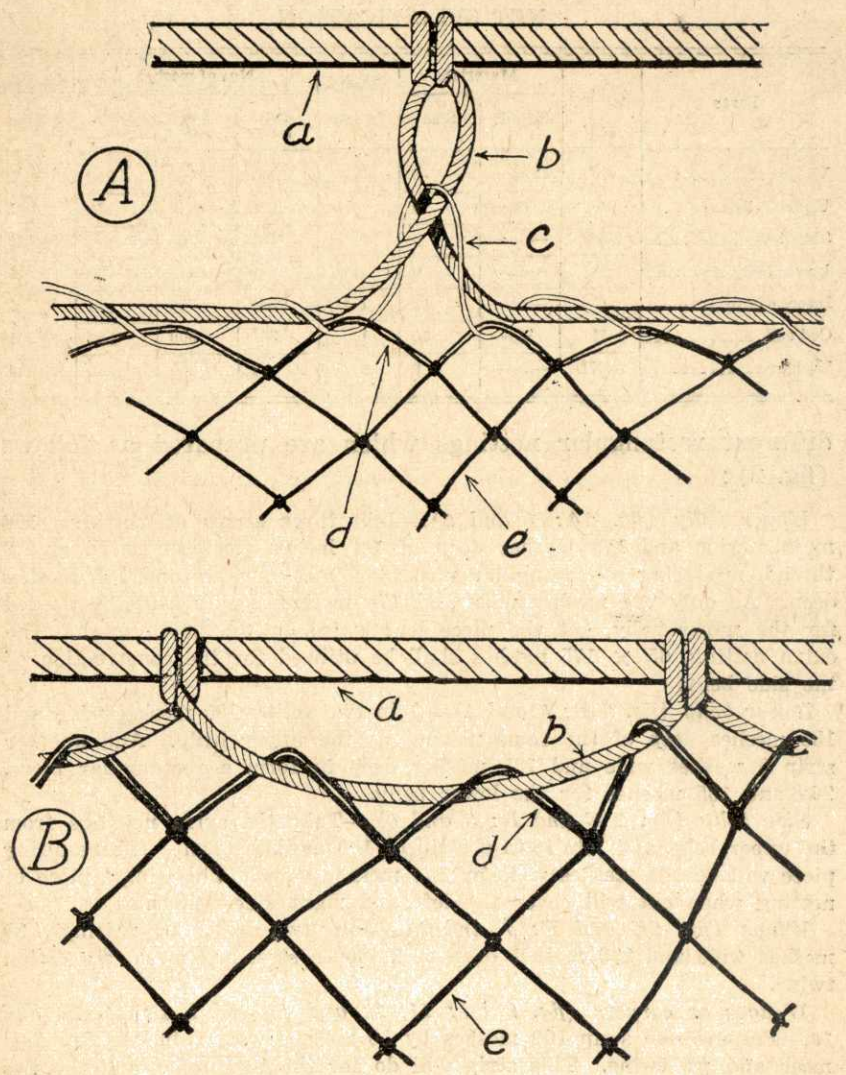

FIG. 4. Two ways of hanging on otter trawl net: *a*, footrope or headrope; *b*, hanging line or staple; *c*, lacing; *d*, selvage; *e*, net proper.

Nettings are sold in the market in bales, each 100 to 200 meshes wide and 100 meters long. It is, therefore, sometimes necessary to join one or two pieces, cut crosswise, then shaped according to the parts of the net by the bar-knot method.

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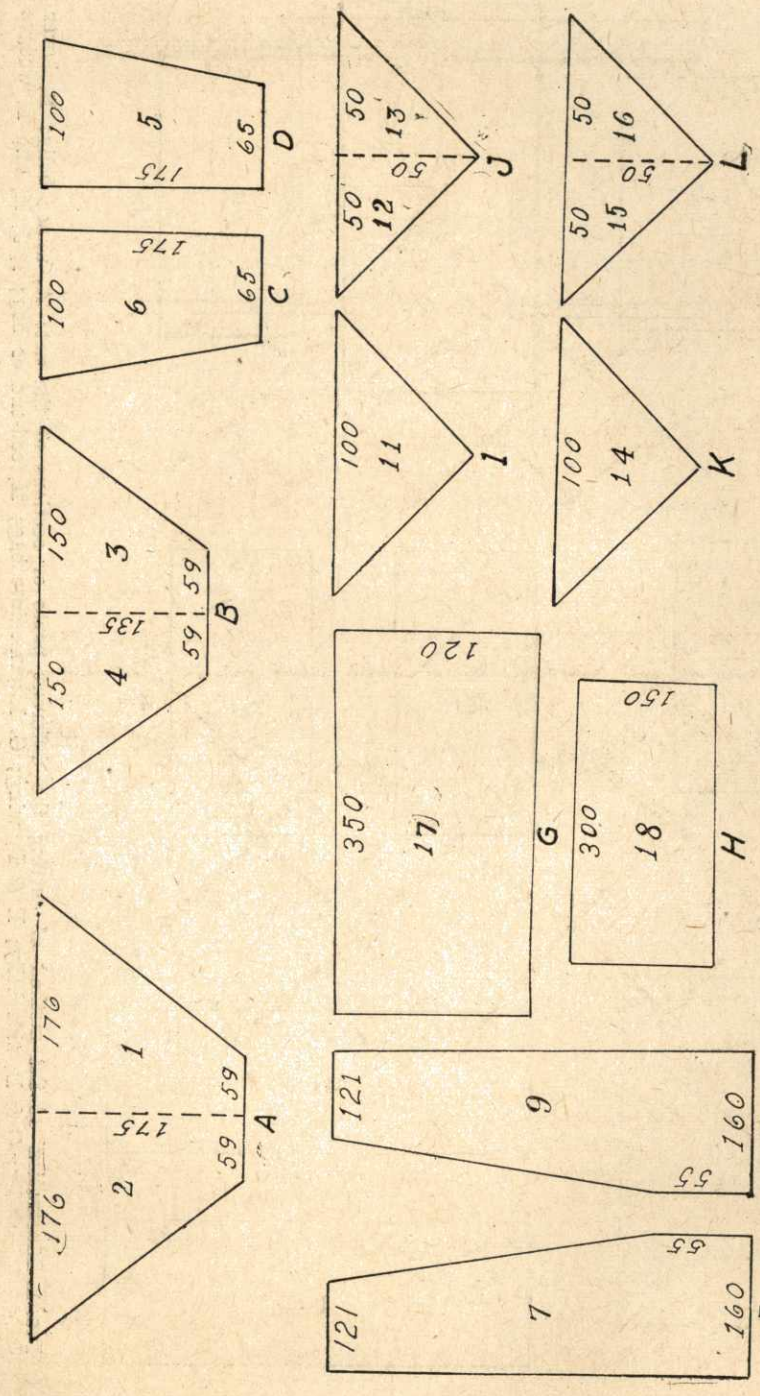

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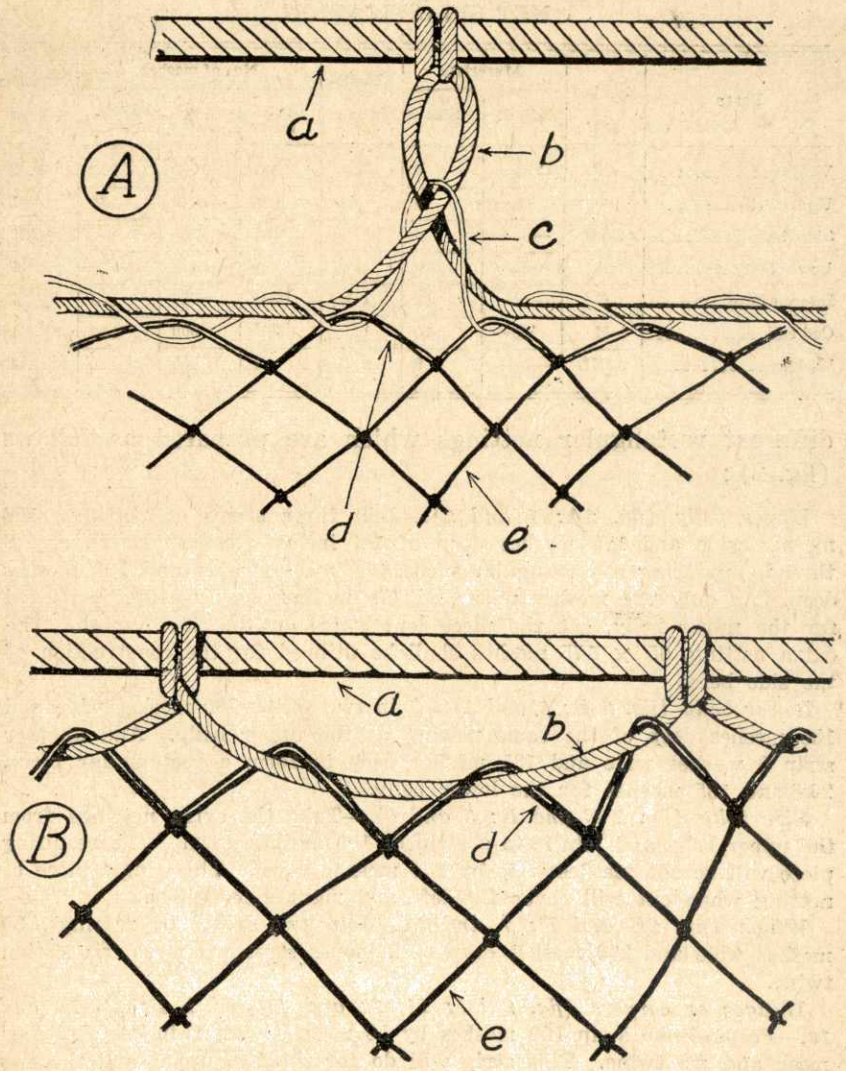

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NET SPECIFICATION

Parts	Symbol	Materials		Mesh in inches	No. of meshes			Number of pieces
		Kind	Size		1st row	2nd row	Vert. row	
Wings	EF	Cotton	9	2	121	160	250	2
Upper belly	A	—do—	9	1-3/4	352	118	175	1
Side belly	C&D	—do—	9	1-3/4	100	65	175	2
Lower belly	B	—do—	9	1-3/4	300	118	135	1
Intermediate	G	—do—	12	1-3/4	350	350	120	1
Cod end	H	—do—	15	1	300	300	150	1
Wedges	IJKL	—do—	9	2	1	50	50	4

different rectangular nettings which are prepared as follows (fig. 2):

Upper belly (*fig. 2A: 1 and 2*).—Join three strips of nettings, 100 meshes wide and 175 meshes deep of 1¾ inches stretched mesh and 9 thread, producing a rectangular piece, 300 meshes wide and 175 meshes deep. As only 234 meshes wide and 175 meshes deep netting is needed for the upper belly, cut the piece lengthwise on the 235th mesh. The extra netting, 65 × 175 meshes shall be utilized for the construction of the side belly.

Lower belly (*fig. 2 B: 3 and 4*).—Join two strips 100 meshes wide and 135 meshes deep of the same netting as the upper belly. Add another strip 9 meshes wide and 135 meshes deep to form a rectangular piece, 209 and 135 meshes for the lower belly.

Side belly (*fig. 2 C and D: 5 and 6*).—Take the extra nettings from the upper belly and join it to a strip of 100 meshes down. The resulting piece will be 165 meshes wide by 175 meshes down. This single piece of netting when cut will cover the left and right side bellies.

Wings (*fig. 2E and F: 7 and 9*).—Join two strips of nettings, 80 meshes wide and 250 meshes deep of 2 inches stretched mesh, #9 cotton twine.

Wedges or corners (*fig. 2 I-J: 11, 12 and 13 and K-L: 14, 15 and 16.*—Prepare one strip 100 meshes by 50 meshes with 2 inches stretched mesh and #9 twine. This strip will do for the two upper and the two lower wedges.

Intermediate bag (*fig. 2G: 17*).—Join three 100 meshes wide and one 50 meshes wide all 120 meshes deep nettings forming one rectangular piece 350 meshes wide and 120 meshes deep of 1¼" stretched mesh of #15 twine. The two sides are later joined to form a prepared intermediate bag.

Cod-end (*fig. 2H: 18*).—Join three strips of 100 meshes wide and 150 meshes deep of 1" mesh stretched #12 cotton seine twine. The two longitudinal sides are joined to form a ready-made cod-end or bag.

The intermediate bag and the cod-end do not need further cutting as they are formed in their original rectangular forms.

SHAPING OF THE PARTS

Parts of the net are cut from the prepared rectangular piece of nettings as follows (fig. 3):

Upper belly (*fig. 3A: 1 and 2*).—Take the netting intended for the upper belly and count 59 horizontal meshes from the left. At the 60th mesh, cut the upper two bars slanting towards the right. From there, apply the 4 bars and 1 knot cut as illustrated in fig. 2A. The resulting two pieces are again joined together along their vertical straight side with the wider side of one and shorter horizontal sides of the other so that a trapezoidal net is formed for the upper belly.

Lower belly (*fig. 3B: 4 and 3*).—The same procedure is followed for the lower belly as for the upper, since both are of the same shape, although with different dimensions. The resulting form after the cutting and joining are made is 300 meshes at the head and 118 meshes at the base.

Side bellies (*fig. 3C and D: 6 and 5*).—Fig. 2C–D shows the method of cutting the side bellies. Take the prepared netting for this part. After the 65th mesh from the left, cut the netting using the 2 knots and 1 bar count and slanting towards the right. One piece of the net thus cut is for the left side belly and the other for the right side belly.

Wings (*fig. 3E and F.*)—Two nettings (fig 2E and F) should be cut separately for left and right wings. Take one piece and count 54 meshes upward starting from the lower right-hand corner. From that mesh start the 2 knots and 1 bar-cut (fig. 2 B, E, and F), slanting towards the left until the net is thoroughly cut. Do the same with the other piece and use one for the left wing and the other for the right wing.

Wedges or corners (*fig. 3I, J. and L*).—Utilize net I–J and K–L in fig. 2 for the wedge corners. Cut out I–J from the upper left-hand then upper right-hand corner towards the center of the lower edge by cutting all bars. The two small pieces thus cut are later joined together to form one wedge and the remaining big piece is for the other wedge (fig. 3: I–J).

For the other two wedges, take the other piece (fig. 2: K and L) of netting and cut as above. Again join the small pieces together and the two similar shapes thus made will be for the remaining two more wedges (fig. 3: K–L).

HOW TO JOIN THE PIECES TOGETHER

As shown in fig. 3 there are twelve individual sections comprising the whole four-sided trawl net (A to L) which have been cut from prepared rectangular pieces as described in the preceding paragraphs. These sections are formed as follows: the upper belly (A) is formed by joining two pieces (1) and (2) in the illustration as previously cut; the lower belly (B) by joining (3) and (4); the wedges (I–J) and (K–L) by joining (12) and (13), and (15) and (16), respectively. The other parts or sections, namely, the wings (E) and (F); and

the side belly (C) and (D); the wedges (I) and (K); and the intermediate bag (G) and cod-end (H) are in their original forms.

Joining the different parts to form the whole net is the next step. Pieces A to L of Figure 3 are joined together to make up the main body of the trawl. The pieces are joined as shown in the structural plan (fig. 1) from the wings down to the last part, the cod-end or the bag. In joining the sections, knitting with a net needle is applied. Mesh to mesh joining is used in the following: upper belly to side belly; upper belly to upper wedges; lower belly to side belly; lower belly to lower wedges; and mesh-to-mesh with *bating* for wings to side belly; all parts of the lower belly to the intermediate bag; and intermediate bag to the cod-end or bag proper. In joining the wings to the side belly, the *bating* is done once for every five meshes of the side belly; for the belly to the intermediate bag, once for every 7 meshes of the intermediate bag. In simple terms the proportions are as follows: 5 meshes of the side belly to be joined with 4 meshes of the wings; 23 meshes of the formed belly with 22 meshes of the intermediate bag; and 7 meshes of the intermediate bag with 6 meshes of the cod-end.

"*Bating*" in this article is defined as the method of decreasing the number of meshes in a net or section of the net. It is important to "bate" regularly when making the otter trawl net to insure even stress in the net when it is in operation. This factor has a great bearing in the catching efficiency of the whole gear.

Selvaging.—Selvaging strips in otter trawl nets are usually made in order to strengthen the edges of the net, especially those in contact with the headrope, footrope and hanging lines. The selvage may be of several meshes deep only but they are made of slightly bigger twines than those of the net proper. They are commonly knitted to the net before the net is hung.

HANGING THE NET

Proper hanging of the net does not only contribute to the attainment of high efficiency in the operation of the gear but also imparts an even distribution of the strain to all its components during the operation. After the different parts or sections have been connected the main body of the trawl is ready for hanging to the footrope and headrope.

The ropes for headrope, footrope and rib lines are first stretched to avoid shrinking while in the process of hanging and to

minimize expansion when used. They may be stretched by pulling on the ground or on the surface of the water by tying the rope on a moving vessel.

The headrope and footrope are cut from abaca rope of 1¼ inches diameter, 83 feet and 90 feet long, respectively.

There are two ways of hanging the net to the headrope or footrope which will both work well. One is by attaching staples or separate hanging line to the headrope or footrope at equal intervals by clove hitches and attaching the net to the staples or hanging line by lacing with a #9 or #12 cotton seine (doubled) at regular stress, and the other by simply passing the hanging line through the meshes of the net to be hung, tying the same line to the headrope or footrope by clove hitches as hanging goes along (fig. 4A and B).

The second method is done by folding the headrope and marked at the center. Then tie it between two posts of similar supports, one on the center thus marked and the other at the tips. At equal intervals of 4 inches for the main belly of the net and 5 inches for the wings, mark the headrope with chalk or charcoal. After the rope is marked evenly, have the hanging line, cotton twine ₱72, prepared in a knitting needle ready while attaching the center of the net to the center of the headrope. Pass the knitting needle through the center of the net and make a clove hitch in the rope. Then with another needle twine, continue the hanging on both sides of the net with particular attention to having the same number of meshes entering in each side. At the wings, make the interval of the clove hitching of the hanging line slightly longer. Proceed hanging up to the tip of the wings.

The procedure for hanging the net to the footrope is the same as that for the headrope except that the footrope is made longer so that the alignment of the meshes is stretched a little in such a manner as to provide the necessary even stress on the net.

The footrope must be longer by at least 10 per cent. In this case the footrope must be 65 feet long and the headrope about 57 feet.

NET SIZE AND VESSEL POWER

In otter trawling the right proportion of the size of net to the power of the vessel is paramount importance in the success of the fishing operation. Not only is efficiency of the gear enhanced, but also economy in expenses is achieved due to the minimized and unnecessary engine breakdowns.

The 57-footer net described in this paper is ideal for a 40- or 50-footer boat with a 225 H.P. high-speed engine or an 80–100 H.P. medium speed diesel engine of any brand. A regular speed of two knots, or slightly more, can be attained, which is just ideal for Philippine conditions to cover a good amount of fishing ground and catch a substantial amount of demersal fishes and shrimps.

In this respect, it is recommended that nets be made to such a size which can be dragged at a speed of 2 knots at least, with engine power slightly over half of its full load to avoid unnecessary breakdown of the engine.

REFERENCES

MONTILLA, J. R., and C. R. DIMEN.
1952. Fisheries statistics of the Philippines. Bureau of Fisheries, Manila, Philippines.

RASALAN, SANTOS B.
1950. New methods of fish capture in the Philippines. Bull. Fish. Soc. Phil. (Manila), 1: 57–66.

SCOFFIELD, W. L.
1938. Trawling gear in California. Calif. Fish and Game Fish. Bull. No. 72. 60 pp. 24 figs.

WARFEL, H. E., and P. R. MANACOP
1950. Otter trawl explorations in Philippine waters. Fish and Wildlife Service, U.S. Dept. of the Interior, Washington, D.C.

WHITELEATHER, R. T., and H. H. BROWN.
1945. Experimental fishery survey in Trinidad, Tobago, and British Guiana. Anglo-American Commission, Washington, D. C.

ILLUSTRATIONS

TEXT FIGURES