

A REPORT ON THE DESIGN, CONSTRUCTION, AND OPERATION OF THE GERMAN (HERMANN ENGEL TYPE) TRAWL NET IN MANILA BAY

By

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ABSTRACT

A series of trial operations using the German high-opening trawl net (Hermann Engel type) and other types of nets were carried out in Manila Bay on board the F/B Carlos Renato II and F/B Maria Cynthia II owned by Mr. Lauro G. Javier of Navotas, Rizal. The trials were undertaken under the supervision of the author and Per Eilefsen, Gear Technologist/Masterfisherman of the UNDP-FAO program. The trials were conducted to demonstrate and determine the workability of the new trawl net on board the boat of Mr. Javier and to compare its efficiency with the locally-assembled and designed Norsenet trawls.

The trials were also undertaken to determine the efficiency of the modified German high-opening trawl net in Manila Bay. The new nets were dissected and plans were drawn to serve as bases for mending and repair in case of damage and to facilitate copying when found more efficient than the locally-made nets.

The technical assistance activity of the UN expert and the author included fishing trials, trawl net and otter board designing, and advisory and technical services.

The use of the new net enabled the boat to maintain a dragging speed of $3\frac{1}{2}$ to 4 knots. This was not possible previously when the old kuralon nets were being used.

INTRODUCTION

To increase the production of his boats and at the same time help the government attain self-sufficiency in fish, Mr. Lauro G. Javier, a fishing boat owner from Navotas, Rizal, requested Per Eilefsen, UNDP Gear Technologist/Masterfisherman and the author to make fishing trials using the German trawl net (Hermann Engel

type) and the Norwegian star trawl net in Manila Bay from November 20, 1970 to February 15, 1971.

The Bureau of Fisheries and Aquatic Resources and the United Nation Development Program (UNDP) granted the request for technical assistance. Mr. Javier, in turn, allowed the use of his boats, the F/B Carlos Renato II and the F/B Maria Cynthia II.

The German high-opening trawl net was operated successfully and Mr. Javier decided to duplicate the net and acceded to the author's suggestions to modify the meshes — from 160 mm to 300 mm mesh. The successful operation of the UNDP demonstration trawl net, as well as the modified one convinced the operator to construct more nylon trawl nets for his other boats. Through the use of the new net, the boat was able to maintain a dragging speed of three-and-a-half to four knots, which was not possible previously with old kuralon nets.

MATERIALS AND METHODS

F/B Carlos Renato II has a gross tonnage of 44.9 tons and a net tonnage of 24.33 tons. It is propelled by 2 x 225 horsepower Gray Marine engines and had a free running speed of eight knots. The gypsy heads are coupled to one of the main engines. The insulated fishhold is located in front of the super structure. The bow to the astern of the boat has a roof to protect the fishermen from sun and rain.

F/B Maria Cynthia II has a gross tonnage of 40.01 tons and a net tonnage of 27.35 tons. The boat is powered by 2 x 250 horsepower Cummins marine engines. The construction of this boat is almost identical with F/B Carlos Renato II.

A. *Fishing Gear and Accessories* — The fishing gear and accessories tried during the experiment were the German (Hermann Engel type) trawl net (294 x 160 mm mesh and 418 x 160 mm mesh), the Norwegian Star trawl net (560 x 170 mm mesh), which were owned by the FAO-UNDP/SF, and the locally-made Norsenet type of trawl. The two UNDP demonstration nets were made of pure nylon twines whereas the latter was made of kuralon twine. The structural plan of the trawl nets (the modified and the dissected net) is shown in Figures 1, 2, 3, 4, and 5. The particulars of these nets are shown next page.

Local and UNDP nylon trawl nets

	Meshes Around the Opening of the Groundrope			
	418 x 160 mm	294 x 160 mm	560 x 60 mm	600 x 60.96 mm
Headrope Length	61.16 m	41.76 m	23.4 m	23.9 m
Foot rope Length	73.42 m	50.96 m	30.18 m	30.48 m
Weight of net in air	183 kilos	89 kilos	-	-
Number of floats:				
12 cm. dia.	-	-	-	25 pcs.
15 cm. dia.	-	-	-	23 pcs.
18 cm. dia.	-	-	-	18 pcs.
20 cm. dia.	48 pcs.	29 pcs.	35 pcs.	-
Number of sinkers:				
Lead rings	-	-	170 pcs.	-
3 link chain/pc.	23 pcs.	60 pcs.	20 pcs.	60 pcs.
6 link chain/pc.	20 pcs.	-	36 pcs.	-
Assorted stones	84 pcs.	70 pcs.	70 pcs.	60 pcs.
Sweep line length	10 fathoms	10 fathoms	10 fathoms	10 fathoms
Pendants	23 fathoms	20 fathoms	50 meters	20 fathoms
Otter board size	112 cm x 227 cm	42" x 97"	112 cm x 227 cm	42" x 97"
Otter board weight	153 kilos	80 kilos	153 kilos	80 kilos

Newly-made nylon trawl nets

	Meshes Around the Opening of the Groundrope		
	294 x 160 mm	196 x 250 cm	132 x 300 mm
Headrope (cable)	43.7 m. 3/8" dia.	41.86 m 3/8" dia.	36 m 3/8" dia.
Footrope (cable)	50.5 m. 1/2" dia.	53.18 m 1/2" dia.	43 m 1/2" dia.
Pendant (Manila)	20 fms. 1 1/2" dia.	20 fms. 1" dia.	43 m 1/2" dia.
Sweep line (Manila)	10 fms. 1 1/2" dia.	10 fms. 1 1/2" dia.	10 fms. 1" dia.
Floats (T-I-20)	29 pcs.	27 pcs.	21 pcs.
Chain weights	60 kgs.	60 kgs.	44 kgs.
Otter board size	112 cm x 227 cm.	112 cm x 227 cm	109 cm x 214 cm
Otter board weights	153 kgs.	153 kgs.	90 kgs.

B. *Fishing Grounds* — Manila Bay, which has an area of about 520 square miles, is considered the oldest and most heavily fished area among all other fishing grounds in the Philippines. Manila Bay is ideally located, sheltered from two prevailing winds, southwest and northeast winds, so fishing can be carried out throughout the year except during typhoons. The bottom topography is generally flat and muddy with an average depth of 15 fathoms. The southwest monsoon brings along a great amount of rain that washes off the fertile plains surrounding the bay. The nutrients from the uplands and plains are being brought down to the bay by way of big rivers, estuaries and other media to fertilize the bay waters.

C. *Fishing Gear Design and Construction* — The net design was a two-seam German high-opening trawl net. The first net made was copied from the 294 x 160 mm mesh German high-opening trawl net. The second gear was the same type but in a modified form with a mouth circumference of 39.6 m, smaller than the first design by 7.4 m (Figures 1 to 3).

1. *Nylon Materials* — The nylon materials used for these gears were cheaper by 40% than commercial nylon twine sold in the markets. These materials came from second hand nylon ropes with big diameters. The damaged yarns were converted into a rope of smaller diameter for use as pendant, lines, etc. and the good ones retwisted to smaller twines as thick as 210/72, 210/60, 210/48 and 210/33.

2. *Cable Wire Rope* — The cables were 3/8" and 1/2" in diameter with hemp center served with manila ropes and twines for longer use.

3. *Manila Hemp (Musa textiles)* The three-ply manila twine was used to cover the 3/8" diameter cable applying the clove hitch method for the headrope. The 1/2" cable was inserted in between the strands or ply of the old manila rope 3/4" to 1" diameter (Figure 4).

4. *Construction of the trawl net:*

a. *Preparation of nylon netting* — All nylon nettings were hand-braided with a width of 100 meshes up to 100 m long with the exception of the bag portion which was of fine mesh and was quite cumbersome for the weaver to make. The knots em-

ployed in weaving the netting were a combination of reef and trawlers' knot. The methods of weaving this kind of knot are as follows:

1. Pass the knitting needle in between the bights coming from above;
2. Form a loop as in making a trawlers knot and pass the needle from below taking the two (2) legs or bights of the half mesh;
3. Swing the needle upward in the direction of the netting and the needle coming from below passing in between the legs;
4. Pull the needle to tighten the knot (see Figs. 5 and 8). It was found that this knot, when properly tightened is so much better than the local machine-made nettings because this does not easily slide or slip nor deform when slight snag is encountered at the bottom.

The methods of tightening the knots was crudely done but proved to be effective. When a desired length was finished, say 15 m long, the netting was soaked in water. Then an iron rod is passed through the meshes at both ends of the nettings. Nettings are then stretched horizontally and held taut at both ends in a wooden framework strong enough to support the weight of three or four persons. As a test, a man walks over the knots, criss-crossing the netting from one side to the other. The jerking motion of his body tightens the knots until they are hard. This jerking motion slowly removes the water from the knots. The nettings are then hung in the shade to dry.

b. *Tapering the Net Parts* — Discussion will center on the tapering of the modified German trawl net, 132 x 300 mm mesh, because a slight difference in the cutting sequence was recorded as compared to the original trawl net of 294 x 160 mm mesh.

1. *Split upper wing ends* — the inner portion was tapered "one point and two bars" while the outer portion was cut "all bars."
2. *Split lower wing ends* — the inner side was tapered "three points and two bars" while the outer side was cut "all bars."
3. *Upper wings* — the inner part was cut "one point and two bars" and outer side with "all bars" cut.
4. *Lower wings* — the inner side of the net was cut "one point and four bars" while the outer side was cut "all bars."

5. *Square, lower and upper bellies* — all sides were tapered "one point and two bars" with the exception of the last section of the belly which was tapered "one point and one bar" 56 times, and "one point and three bars" 16 times on both sides.
6. *Bag* — This section had a cutting taper of "all points" on both sides.
7. *Assembling of the trawl parts* — Ordinarily, the average trawl net has only 12-18 parts but this modified trawl net consisted of 27 sectional parts because of the varied mesh sizes used.

The sectional parts of the net were joined one after the other by weaving a half mesh row of double twines. This was done to distinguish each part from the other easily and to facilitate replacement of the damaged parts. When the weaving of the half mesh row on all sections was completed, the upper and lower parts of the trawl net were obtained.

The upper half of the trawl was joined with the lower half through the lacing method. Lacing is a method of joining two pieces of webbing by winding and fastening a twine at intervals with a jam or stop hitch. Joining the two halves was effected by taking up 10 meshes (five meshes on each side) and the lacing twine was wound around the bunched meshes two or three times and secured by a jam or stop hitch.

8. *Hanging the upper section to the headrope* — The upper wings and square were attached to the 3/8" cable wire rope served with manila twine. In hanging the trawl net to the headrope, stretch the headrope to full length and hold at any convenient place. The wing part was hung at 104-108% (L/W x 100) while the square was given 50% hanging. The wing portion was directly attached to the headrope with a rolling hitch and then locked. The square was hung to the headrope by a series of clove hitches and locked as one wove a half mesh row of double twine on it.
9. *Hanging the lower section to the footrope* — The footrope was prepared by opening the ply of the manila rope (old one) and wire cable inserted in between the ply as it passed around the wire cable (Fig. 4). It has been proven that the life span of the cable can be prolonged by wrapping it with friction tape (electrical tape) and serving with manila rope.

The lower half of the trawl was now attached to the footrope in the same manner as the headrope.

10. *Hanging the split wing ends* — The split wing end was directly attached to the 3/8" or 1/2" diameter polypropylene rope. This line was attached to the seam part by loosely lacing it along the bars and seized as it reached the junction of the seam and the bar. It was also loosely laced along the seam and permanently seized at the end of the bag part.
11. *Splitting strap* — Since the boats did not have any boom to lift the bag, the splitting strap was not provided for.
12. *Quarter rope (Ayuda)* — This line is locally known as "ayuda" which is placed at the corner of the wings and bossom of the footrope and up to the sweep line. The extension of this line was passed to the niger head thus hauling of the net part was made easier and faster.

Modifying the Otter Board — The flat otter board was modified by increasing the width of the iron shoe to five inches so that it may skim or glide on the mud easier.

THE FISHING TRIALS

Fishing demonstration trials with various nets were carried out on board F/B Carlos Renato II and F/B Maria Cynthia. Both boats employed the fly-shooting method of operation. Every shooting and hauling operation of the trawl net was carefully noted (Tables I to VIII).

Because of insufficient time, the author was able to observe only a whole day fishing trial with the newly constructed net, 294 x 160 mm mesh. The remaining trials were left to the masterfisherman when the net was performing perfectly well. When the modified net was ready for trial, the masterfisherman was instructed on how to adjust the floats and sinkers of the net. The author was also asked to supervise the construction of the trawl nets for the other boats of the company.

The manner of shooting and hauling operation was similar to other bottom trawls in Manila Bay with the bag payed out first followed by the belly, wings, pendants, boards and ultimately the tow-

ing ropes. It took four to eight minutes only to set the net and 25 to 35 minutes to haul it. The paying out of the net was done in a fly-shooting manner wherein the metal triangular frame where the pendants and sweepline were connected was held taut at the stanchions of the boat. Subsequently, both doors were lowered in the water with the sweepline forming the slack. As soon as the doors were riding horizontally on the water surface, the triangles were set free. Simultaneously, the towing ropes were released and the boat went full speed ahead. The propeller would be disengaged only when about 25 fathoms of towing rope were left to be payed out and the boat glided to pull out the remaining rope. The boat would then be given the normal dragging rpm. The towing rope used was made of nylon materials which normally lasts more than three years.

In the hauling process, the reverse order of shooting of the net was followed. When the bag was reached, the end part was opened and its corners secured in the wooden platform leaving the catch suspended in water. With the use of a large dip net, the catch was brailed out of the bag. The catch was then sorted by the fishermen according to kinds and sizes.

RESULTS AND DISCUSSIONS

A. *F/B Carlos Renato II* had a cruising speed of about eight knots. A gypsy or niger head was provided to haul the gear. The data on the locally-made net, as well as on the imported ones, are presented in Tables I and II. The towing warp length, pendants, and sweeplines were kept constant for both nets. The board was also common for both nets. The dragging speed of the boat is 2.5 to three knots for the locally-assembled net while three to 3.5 knots for the German trawl, 294 x 160 mm mesh.

It can be noted that although the German trawl had a much longer headrope than the other net (41.76 m and 78.4 feet or 23.9 m respectively), it was much easier to drag it at the bottom because its meshes were much larger as compared to the locally-made net. Besides, the new net was made of pure nylon twines whose specific gravity was much lower than kuralon materials. It was also noted that

the German trawl net was much cleaner as compared to the other nets.

The adjustment of the board was maintained in the first and succeeding hauls for the locally-made net where the forward angle of the fore bracket with the plane of the board was 15° only. Further adjustments of the rear chain bridle did not give any noticeable increase in the catch.

Observations on the locally-made net revealed that there was much gilling of fish near the bag portion (last section of the belly) which was not noticed in the German trawl net. In spite of the larger mesh of the German trawl net on the wing and mouth portions, the anchovy catch was greater than the catch in the locally-made net. This observation is contrary to the belief of the crew members that the German trawl would only catch bigger-sized fish. The surface float used in the locally-made net was observed to be crumpled so much so that it lost its original bouyancy.

The setting and hauling operations for both nets ranged from four to eight minutes and 25 to 35 minutes respectively. In the absence of a mechanical winch the fly-shooting method was adapted. The catch was brought on board by brailing with a large dip net because the boat was not provided with a boom. Besides, the fishing boat operator believed that lifting the bag with a boom will affect fish quality.

B. *F/B Maria Cynthia II* had a free running speed of 10 to 11 knots. The setting and hauling procedures were the same as its sister boat. Data are shown in Tables II and IV.

Observations made on the Star trawl revealed that we have not yet achieved the correct adjustment to make it function efficiently. Furthermore, only three dragging operations have so far been made to make our findings conclusive.

Although the 418 x 160 mm mesh-German trawl had shown better catch performance than old nets, observers were not satisfied with the outcome because its bottom belly was always filled with mud particles. However, the intermediate bag was always very clean. This maybe because the maximum vertical and horizontal opening of the net was not yet attained. It was also noted that the extension piece (leg) on the headrope was cut. This maybe attributed to the kinks of the said part which was not noticed during the shooting

operation or to the uneven length of the pendants. It was found out later that the lower pendant has stretched so much giving more tensions along the headrope.

C. *Catch Composition* — During these fishing trials, trawl catches consisted of a great variety of species. To segregate these species would be very hard for us, so the sorting of fish was done in the usual manner as in the other trawlers of Manila Bay. Tables V to VII show the total catch composition of a group of fishes and its percentage based on the volume of catch. As per evaluation of the data gathered, it appears that the locally-made net and the German trawl net have their own advantages and disadvantages on the basis of catch composition.

1. *Rastrelliger* — The local net seemed to be more efficient in getting these species with a percentage of 58.96% as compared to 30.34% of the 294 x 160 mm mesh and 8.49% of the 418 x 160 mm mesh German trawls.

2. *Anchovy* — The 418 x 160 mm mesh German trawl got the most with a percentage of 30.03% followed by the 294 x 160 mm mesh which is 17.21% and none for the locally-made net.

3. *Hairtail* — The 294 x 160 mm mesh German trawl had a percentage of 15.17% while the 418 x 160 mm was 14.09% and the locally-made net had the least with 6.2%.

4. *Trash fish* — Among the nets used, 418 x 160 mm mesh had the biggest percentage of 28.58% of trash fishes followed by the 294 x 160 mm mesh which got 22.09%, and for the locally-made nets which also got 10.93%.

The Star trawl was purposely not mentioned in these comparisons because the fishing time was so short and we did not gear it into working condition.

D. *German Trawl Net 924 x 160 mm Mesh* — In Table II, it can be seen that the average catch of this net is 90.94 kg per trawling hour (trash fishes not included), and it is more efficient than the locally-made net (600 x 2.4 mesh net).

The otter board used by this net measured 112 cm x 227 cm with a weight of about 153 kilos. The iron shoe was modified into five inches wide which gave us a very good performance of the board. It was shown that the net performed perfectly well at a bracket angle

of 33° to 60° (angle of the forward bracket with the plane of the board)

The German trawls were not tried for night operation. Non-operation at night cut down fuel consumption by almost 40%. The increase in the volume of catch tired the fishermen, as they have scarcely finished sorting the last haul when another one comes up. Non-operation at night also enabled the fishermen to rest at night hence they were more efficient during daytime operations.

G. *German Trawl Net 418 x 160 mm Mesh* — In addition to the discussions in paragraph 3 of Sec. B of Results and Discussions, it was observed that the 418 x 160 mm mesh trawl which had shown its superiority over locally-made nets that were used previously was rather unproportional to the speed of F/B Maria Cynthia II.

Modified German High-Opening Trawl Net 132 x 300 mm Mesh — The author spent several days supervising the construction of the new nets for the boats. The masterfisherman managed the operation quite well — asking instructions only when problems were encountered.

The dragging speed of F/B Carlos Renato II was 3.5 to 4 knots. The board that was used measured 109 cm x 214 cm and weighed 90 kilos. The fore bracket had a good working angle of 30° with this net. In some instances, the modified net had much better catch than the 294 x 160 mm mesh net. This maybe due to the greater area of coverage with the same length of dragging time in the modified net. Furthermore, there may be lesser turbulence or backlash at the mouth of the net due to the large meshes that allowed the water to pass out fast and freely. However, in spite of the large meshes (300 mm) at wings and mouth portion, this net was more efficient in catching anchovies as compared to Mr. Javier's old kuralon nets.

Another Modified trawl net 196 x 250 mm mesh — The performance and behavior of this net was almost identical with the first modified trawl net.

The catching efficiency of the German high-opening nylon trawl nets was superior to their old kuralon trawl as can be seen in Tables I to VIII. With the success of the demonstration, Mr. Javier immediately equipped his six boats with nets constructed from the locally-twisted nylon twines.

CONCLUSIONS

As a result of 2½ months of technical assistance to Mr. Javier, it can be concluded that:

1. The fishing trial showed that the average catch of the 294 x 160 mm German trawl was 90.94 kg per trawling hour while the locally-made net was only 32.48 kg per trawling hour.

2. The combined efforts of the UNDP expert and the author proved to be very fruitful since the catch of the boats greatly improved through the use of the modern trawl net.

3. By reducing the turbulence or backwash at the mouth opening, the catching efficiency of the net was increased.

4. Big meshes (300 mm stretch) at the mouth opening enabled the boat to catch not only big fishes but also anchovies which were not caught in sufficient quantities by other trawlers of Manila Bay during the same months of the fishing trial.

5. Hand-woven nettings with a combination of trawlers and reef knot when properly tightened, proved better than the local machine-made nylon webbings because their knots do not easily slide nor slip.

6. It is more advantageous to use 20 to 25 fathoms of pendant or bridle than the wooden spreader or *danleno* at the legs of the net. The position of the spreader is unstable so sometimes it may collapse during fishing operations.

7. By filtering the sea water faster, the dragging speed of the boat increased.

8. Through proper guidance and supervision, the local net cutter can interpret the trawl net design correctly.

RECOMMENDATIONS

Based on our observations on board F/B Carlos Renato II and F/B Maria Cynthia II, the following recommendations are hereby made:

1. Surface floats should not be used as bottom floats because these floats cannot withstand the water pressure at certain depths.

2. The masterfisherman should, from time to time, check the lengths of pendants or bridles especially when they are new or when the net encounters snags at the bottom.

3. The small mesh net should be kept for future use particularly during the season for shrimps.

4. The otter boards of the remaining four boats should be provided with a wide iron shoe at least to prevent the board from going deeper into the mud. It should also be provided with holes for attachment for additional weights in case the boats will go to deeper fishing grounds.

5. The boats must be provided with trawl winch (hydraulic if possible) if they wish to operate in deeper waters.

6. The fishermen, if possible, should not use lacing method in repairing the net on board the boat especially when it comes to big meshes. Ordinary mending procedures must be observed although trimming of the damaged part is not affected. Likewise, untreated kuralon twine must be used on board the boat for temporary mending purposes and correct permanent mending and repair to be done ashore with the use of the right kind of twine.

7. The net cutter must always check and refer the measurements of the net parts with the original design while mending and repairing the net. Utmost care should be observed while mending the sections with big meshes (300 mm).

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TABLE I. Data for the Locally-made Norsenet

1970	Depth : of water : (fathoms)	Length : of rope : (fathoms)	Place : (fathoms)	Set : Haul	Tide : Hrs.	Duration of : dragging : Min.	Catch : in : trays	Remarks
12-9	13	170	Central : Manila : Bay	0655	1000	3	5	24
								Catch was rather good with the ff;
								: species caught:
								: Rastrelliger - 19 trays
								: Mixed fishes - 5 trays
								: Weights used - 60 pcs. of assorted
								: stones
								: 60 pcs. of 3 link
								: chain
								: Floats used - 60 pcs. of Japanese
								: floats
								: Pendant - 120 feet
								: Sweepline - 60 feet
12-9	13	170	Central : Manila : Bay	1020	1400	3	40	19
								: Time consumed in setting the net was
								: 5 minutes and 20 minutes in retrieval.
								: Too much gilling of the fish was observed
								: near the protection nylon cloth. Catch
								: was composed of:
								: Rastrelliger - 10 trays
								: Spanish mackerel & pomfret - 2 trays
								: Moonfish & crevalle - 1 tray
								: Mixed small fishes - 1 tray
								: Trash fishes - 1 tub

TABLE I. Data for the Locally-made Norsenet
(Continuation)

13	170	Central : Manila : Bay	1425	1830	4	5	27 3/4
							The height of the focal center of the
							: board is 10" only while the angle of the
							: bracket to the plane of the board is 15°.
							: This haul is composed of:
							: Rastrelliger - 18 trays
							: Mixed small fishes - 4 trays
							: Trash fishes - 3/4 tray
13	170	Central : Manila : Bay	1900	2330	4	30	6
							: Tickler chain was added to the ground
							: rope. The catch was not good consisting
							: of:
							: Shrimps - 1 tray
							: Mixed small fishes - 5 trays

Total catch - 497 kg (71 trays excluding trash fishes)

Total fishing time - 15.3 hours

Average catch - 32.48 kg/hr (trash fishes not included)

Note: One wooden tray contains 7 kg of fish

TABLE II. Data for the 294 x 160 mm mesh German Trawl

1970	: Depth : :(fathoms)	: Length of : : rope	: Place	: Time		: Duration of		: Catch :		Remarks
				: Set	: Haul	: Hrs.	: Min.	: in	: trays	
12-10	: 13	: 170	: Central: Manila Bay	: 0525	: 0725	: 2	: 0	: 34		Same pendant and sweepline used in the German trawl. 60 pcs. of assorted stone weights and 70 pcs. of 3 link chain were also used. Catch was good, composed of the following: Rastrelliger - 16 trays Anchovy - 3 trays Hairtails - 5 trays Trash fishes - 2 trays
12-10	: 14-11	: 170	: Central:	: 0810	: 1110	: 3	: 0	: 49		The rear chain bridle was adjusted by removing 2 links. The focal center height is now 14". Catch was good, composed of assorted fishes: Rastrelliger - 11 trays Anchovy - 7 trays Hoya - 2 trays Hairtails - 7 trays Spanish mackerel - 2 trays Moonfish - 2 trays Crevalle - 1 tray Pomfrets - 2 trays Trash fishes - 3 tubs

TABLE II. (continued)

12-10	: 13-14	: 170	: Central:	: 1205	: 1505	: 3	: 0	: 56		Net was set for 4 minutes only. Hauling time was 25 minutes. The catch was good made of the following: Rastrelliger - 11 trays Anchovy - 17 trays Hairtails - 12 trays Moonfishes - 2 trays Crevalle - 1 tray Herring - 1 tray Hoya - 1 tray Mixed fishes - 1 tray Trash fishes - 2 tubs
12-10	: 11-13	: 170	: Central: Manila Bay	: 1550	: 1800	: 2	: 10	: 31.75		The chain bridle was adjusted once by removing 2 more links. The focal center height was 18-3/4". It was observed that at this angle of the bracket the towing rope was vibrating too much. They continued operation and increased the length of the rear chain bridle. The catch was good. Rastrelliger - 14 trays Anchovy - 2 trays Crevalle - 6 trays Barracuda - 4 trays Hairtails - 2 trays Trash fishes - 3/4 trays

Total catch - 924 kg (132 trays) excluding trash fishes

Total fishing time - 10.16 hours

Average catch - 90.94 kg/hr (trash fishes not included)

Note: One tray contains 7 kg of fish

TABLE III. Data for the Star Trawl (560 x 60 mm. mesh)

Depth in (fathoms)	Length of rope (fathoms)	Place	Time Set	Haul Hrs.	Duration of dragging Min.	Catch in tray	R e m a r k s
12-15	13-14	Central: Manila Bay	0815	1000	1 : 45	2 :	Aside from the 170 pcs. lead rings, 60 pcs. of assorted stones and 20 pcs., 3 link chains were added to the foot- rope. Pendant was 50 meters while the sweeping line was 10 fathoms long. The net did not touch the bottom and the catch was very poor, composed of the following: Herring - 1 tray Anchovy - 1 tray The dragging speed was 3 to 3.5 knots.
12-15	14	Central: Manila Bay	1040	1210	1 : 30	14 :	36 pcs. additional chains of 6 links/ pc. At this adjustment net barely touched the bottom. Catch was a little better. Anchovy - 2 trays Herring - 2 trays Trash fishes - 2 trays
12-15	14	Central: Manila Bay					8 floats of the headline were removed. This time the catch was much better than the first two hauls. Crevalle - 8 trays Hairtails - 2 trays Anchovy - 3 trays Herrings - 1½ trays Trash fishes - 1 tub

Total catch - 143½ kg (20½ trays excluding trash fishes)
Total fishing time - 4.25 hours
Average catch - 33.76 kg/hr.

Note : One wooden tray contains 7 kg of fish

TABLE IV. Data for the German Trawl (418 x 160 mm.)

Depth in (fathoms)	Length of rope (fathoms)	Place	Time Set	Haul Hrs.	Duration of dragging Min.	Catch in tray	R e m a r k s
12-16	15-17	Central: Manila Bay	1600	1800	2 : 0	49½ :	Chains used were 64 pcs. and 20 pcs. of 3 lines and 6 link chains respectively. There were 84 stones of assorted sizes, 42 floats of 8" dia. were also used. The sweeping line measured 10 fathoms while the pendant was 25 fathoms. The net became very hard at the bottom but set plenty of shells and crabs. Also caught were: Anchovy - 1½ trays Shrimps - 1 tray Mentipetrids - 4 trays Hairtails - 1½ trays Mixed fishes - 3 trays Bastrelliger - 5 trays Crabs and sea mantis - ½ tub Trash fishes - 6 tubs
12-16	17	Central: Manila Bay	1515	0815	3 : 0	71½ :	30 pcs. of 3 link chains were removed, and the pendants were checked. Pendants were not of same length. The time of set setting was 4 minutes & hauling was 25 minutes. The net was still hard at the bottom. Catch was good, composed of: Anchovy - 15 trays Crevalle - 2 trays Barracuda - 4 trays Hoya - 2½ trays Bastrelliger - 8 trays Hairtails - 2 trays Mixed fishes - 5 trays Squid & shrimps - 1 tray Pomfrets - 2 trays Trash fishes - 6 tubs

TABLE IV. (Continuation)

1970	Depth in (fathoms)	Length of rope (fathoms)	Place	Time Set	Haul	Duration of dragging in Min.	Catch in tray	Remarks
12-17	16	170	Central: Manila Bay	0610	0910	3 : 0	73½	One more link was removed at the chain bridle making the focal center 22½" high. The backstope at the port side board was adjusted. The angle of the bracket to the board is now 36°. Haul was composed of the ff: Anchovy - 26 trays Pomfret - 12 trays Barracuda - 2 trays Hairtails - 12 trays Mixed fishes - 1 tray Big-eyed scad - 2 trays Rastrelliger - 2 trays Hoya - 2½ trays Squids - ½ tray Trash fishes - 2½ tubs Catch composition of the haul was: Rastrelliger - 8 trays Anchovy - 40 trays Barracuda - 2 trays Threadfins - 2 trays Hardtail - 1 tray Hairtails - 14 trays Trash fishes - 3 tubs
12-17	16-15	170	Central: Manila Bay	1015	1315	3 : 0	72	Lengths of lower & upper backstope of the board were equal. The left extension piece was cut on the first hour of dragging. There was no catch. It was very windy. Catch was good, composed of the ff: Anchovy - 13½ trays Hairtails - 3 trays Crevalle - 3 trays Pomfret - 2 trays Mixed fishes - 2 trays
12-18	13	170	Central: Manila Bay	1525	0825	3 : 0	41	Backstope returned to original length (lower was shorter than the upper backstope). Weather was calm and the catch was good. Anchovy - 7½ trays Crevalle - 3 trays Hairtails - 5½ trays Moonfishes - 1 tray Nemipterids - 1 tray Crabs - 1 tray Shrimps & squids - 1 tray Pomfrets - 1 tray Rastrelliger - 2 trays Trash fishes - 3 tubs

TABLE IV. (Continuation)

1970	Depth in (fathoms)	Length of rope (fathoms)	Place	Time Set	Haul	Duration of dragging in Min.	Catch in tray	Remarks
12-18	13	170	Central: Manila Bay	0925	1325	3 : 40	58	Backstope returned to original length (lower was shorter than the upper backstope). Weather was calm and the catch was good. Anchovy - 7½ trays Crevalle - 3 trays Hairtails - 5½ trays Moonfishes - 1 tray Nemipterids - 1 tray Crabs - 1 tray Shrimps & squids - 1 tray Pomfrets - 1 tray Rastrelliger - 2 trays Trash fishes - 3 tubs
12-18	13	170	Central: Manila Bay	1425	1805	3 : 40	56	One more link at the rear chain bridle and 6 pcs. of 3 link chains were removed at the footrope and 8 kg weight with the 3 kg chain weights were used instead. Angle of the bracket with the plane of the board is now 55°. The extension piece at the right wing was cut, perhaps on the latter part of the dragging operation. Catch was good. Crevalle - 9 trays Hairtails - 25 trays Anchovy - 3½ trays Mixed fishes - 2 trays Rastrelliger - 5 trays Trash fishes - 2 tubs

Total catch - 2,866½ kg. (409½ trays excluding trash fish)

Total fishing time - 37.58 hours

Average catch - 76.27 kg./hour

Note: One wooden tray contains 7 kg. of fish

TABLE V. Percentage and Catch Composition of Locally-made Nets Haul Number

Species	1 kg.	2 kg.	3 kg.	4 kg.	Total Catch kg.	Percentage
Rastrelliger	133	70	126	-	329	58.960
Anchovy	-	-	-	-	-	-
Hairtail	-	-	35	-	35	6.272
Shrimps	-	-	-	7	7	1.255
Hoya	-	14	-	-	14	2.51
Halo	35	14	28	35	112	20.072
Trash Fish	-	35	26	-	61	10.931
Total					558	100.000
Total Fishing Time = 14.3 hours						

TABLE VI. Percentage and Catch Composition of German Trawl (294 x 160 mm. mesh) Haul Number

Species	1 kg.	2 kg.	3 kg.	4 kg.	Total Catch kg.	Percentage
Rastrelliger	112	77	77	98	364	30.346
Anchovy	21	52.5	119	14	206.5	17.215
Hairtail	35	49	18.4	14	182	15.173
Hoya	-	28	28	28	84	7.003
Halo	-	21	35	42	94	8.17
Trash Fish	70	107	70	20	265	22.093
Total					1,199.5	100.000
Total Fishing Time = 10.16 hours						

TABLE VII. Percentage and Catch Composition of Star Trawl (560 x 60 mm. mesh) Haul Number

Species	1 kg.	2 kg.	3 kg.	Total Catch kg.	Percentage
Anchovy	7	14	21	42	16.44
Hairtail	-	-	14	14	5.47
Herring	7	21	10.5	38.5	15.07
Crevalle	-	-	56	56	21.92
Trash Fish	-	70	35	105	41.1
Total				250.5	100.000
Total Fishing Time =					

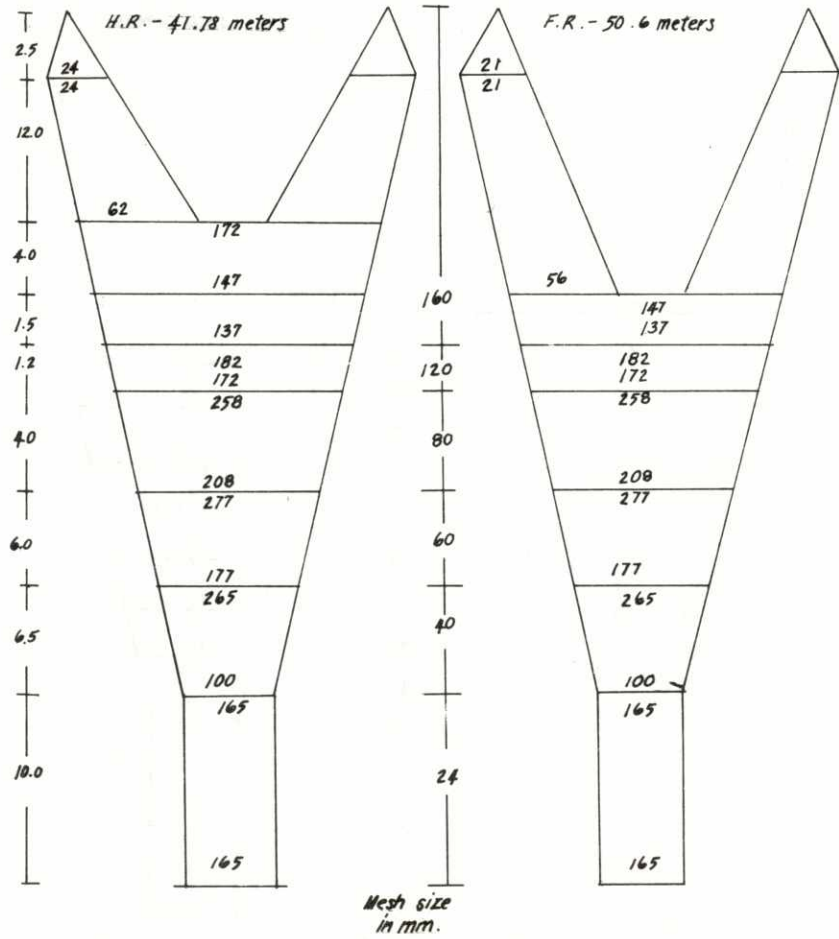
Note: Hoya - first class fish (large-sized fish)
Halo - second class fish (medium-sized fish)

TABLE VIII. Percentage and Catch Composition of German Trawl (418 x 160)
Haul Number

Species	1	2	3	4	5	6	7	8	9	10	Total	Percentage
	kg.	kg.	kg.	kg.	kg.	kg.	kg.	kg.	kg.	kg.	kg.	kg.
Rastrelliger	35	56	45½	35	38½	14	56	-	17½	35	332½	8.49
Anchovy	10½	105	210	217	105	182	280	94½	52½	24½	1,176½	30.03
Hairtail	10½	14	91	24½	7	64	98	21.6	38½	175	552	14.09
Shrimps	7	3½	-	-	-	-	-	3½	3½	-	19½	0.50
Squids	-	3½	-	-	-	3½	-	-	3½	-	14	0.35
Hoya	-	59½	63	21	49	52½	49	14	7	38½	353½	9.02
Halo	49	49	14	21	14	14	7	49	35	77	329	8.40
Mullet	-	-	7	-	-	-	-	7	-	-	10½	0.27
Grabs	3½	-	-	-	-	-	-	-	7	-	10½	0.27
Trash Fish	210	210	140	70	17½	87½	105	105	105	70	1,120	28.58
Total												
Total Fishing Time	37.58 hours											
											3,918	100.00

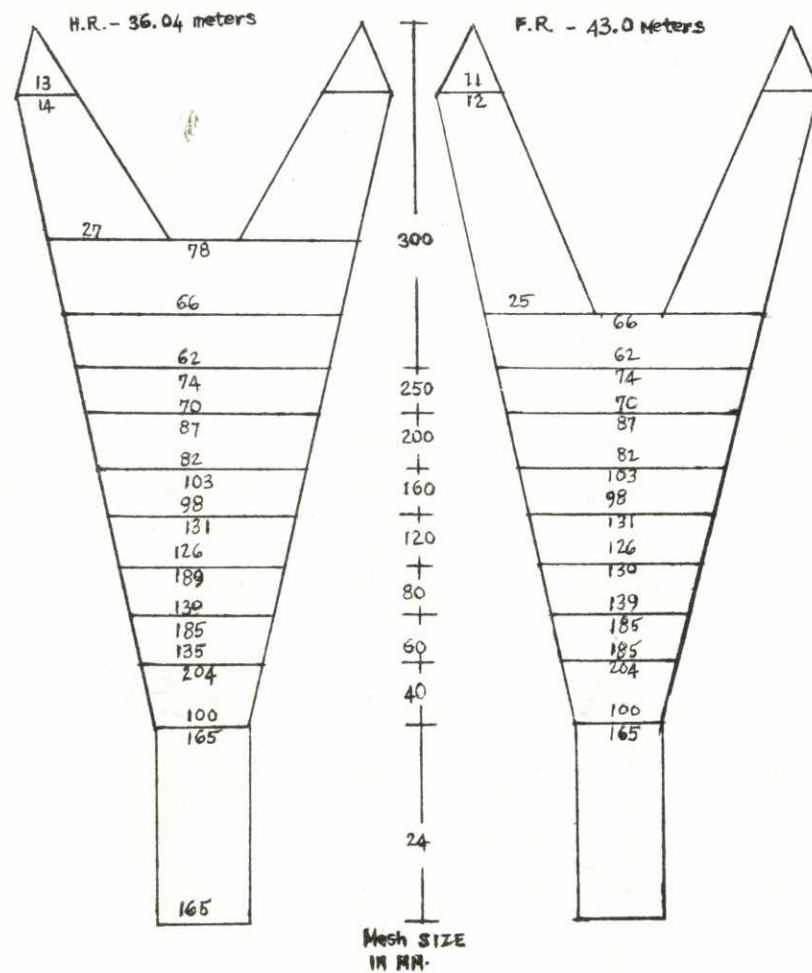
German High Opening Trawl 294 x 160 mm. original as directed by P. Eilefsen, A. de Jesus

fig. 1



Modified High Opening Trawl 132 x 300 mm. (German type) designed by A. de Jesus

Fig. 2



Modified German Trawl 196 meshes x 250 mm. designed by A. de Jesus

Fig. 3

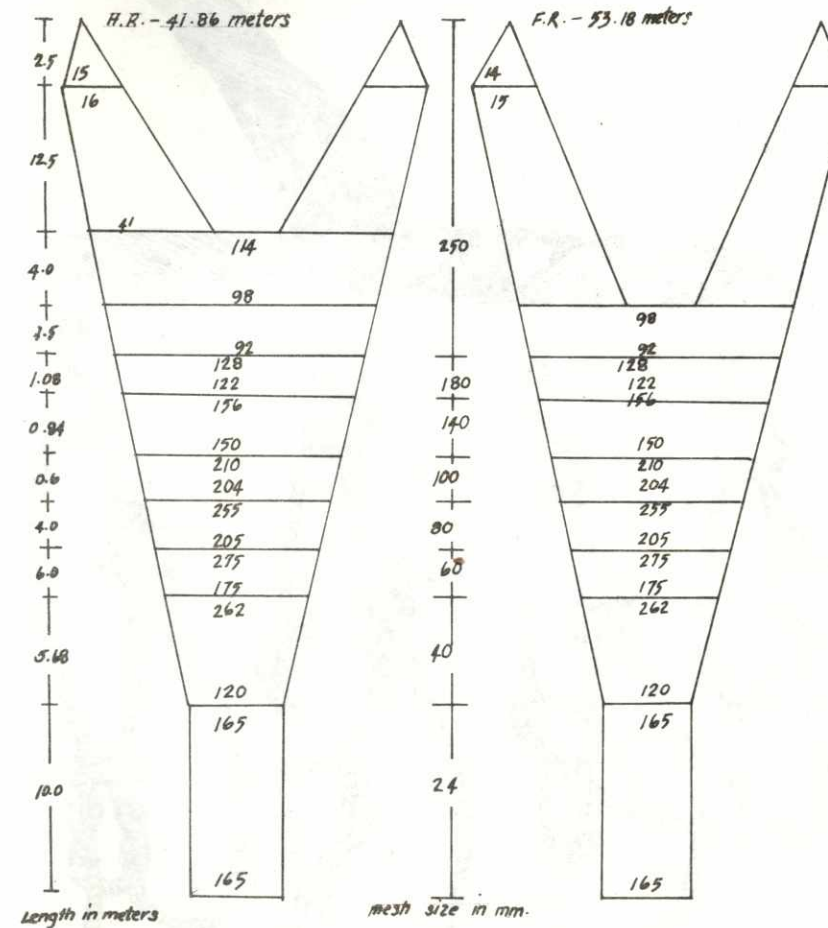


FIG. 4

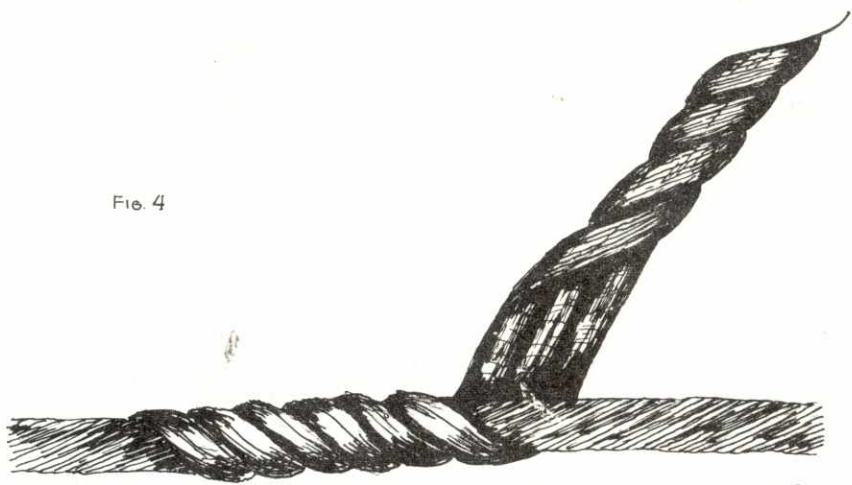


FIG. 5



FIG. 6

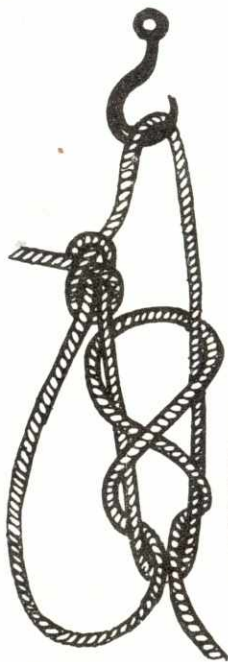


FIG. 7



FIG. 8