

FISHING GEAR USED BY TRAWLERS OPERATING FROM CEYLON

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ABSTRACT

The paper describes in detail the three types of trawl net, Manila Granton trawl, Gandara type Ulstron net and the Hamuro Four Seam Trawl, used by Ceylon trawlers. Sketches and dimensions of the nets are given and data on experimental operation are presented.

INTRODUCTION

Upto 1964 all trawlers exploiting the Wadge Bank from Ceylon were reconditioned side trawlers which had been operating in the United Kingdom. (Mendis, 1967). Nets used by these trawlers in the Wadge Bank were identical to that used in the North Atlantic - namely the "Standard Granton Trawl Net" with a 79 foot head rope.

In 1964 the first of five new stern trawlers ordered by the Government of Ceylon arrived. When the order for these five trawlers was placed, the intention was to use identical gear on these trawlers as was being used in the older side trawlers. However, within a few months of the operation of these trawlers it became clear that this fishing gear was too heavy for them. The new trawlers with their low powered engines could not provide sufficient high towing speeds with the existing fishing gear. Since then various experiments have been carried out in order to find a suitable gear for these trawlers.

MANILA GRANTON TRAWL NET (79 FT)

The net was made of Manila twine of uneven thickness ranging from 3.2 to 4.5 mm. Design and specifications of this net as used in 1967 is given in Fig. 1. However, it appears that several versions of this net were used by Ceylon trawlers. One version (Hamuro, 1966) had the same number of meshes at the square, but the codend mesh size was 5 1/4". The nets used by the side trawlers around 1956 had a head line length of 80 ft. (Medcof, 1963). There are no records available of the specifications of the nets used at other times. The side trawlers with their above 650 h.p. engines could easily attain speeds of 4 knots, when towing the "Standard" Manila Granton trawl net. The stern trawlers could tow the same net at towing speed of under 3 knots.

GANDARA TYPE ULSTRON NET (85 FT)

In 1965 Mr. W. Dickson of the FAO designed a Granton trawl net now referred to as the Gandara Type Ulstron Net (Dickson, 1966). Design and the specifications of the net is given in Fig. 2.

The net is made out of Ulstron twine which has a comparatively higher breaking strength. But due to its fibre yarn construction the obstacles entangled in the net do not disengage easily. The net has been designed to work with 90 ft. spreading wires. Mr. Dickson stated that the headline height is approximately 50% greater than that of the Manila Granton Trawl Net. This net in spite of its longer headline length is lighter than the Manila net and a towing speed of 3.54 knots at 290 r.p.m. was observed (maximum engine output is at 374 r.p.m.).

This net was first tried out in the Wadge Bank on M/T GANDARA when Mr. Dickson came to Ceylon in April 1966. Records of catches and details of measurements made during the experiment are not available and the only fact that bears evidence to the success of the net is the total catch which was counted at 1635 baskets or an estimated 66 tons for eleven days of fishing whereas the other vessels fishing on the same grounds using the Manila net returned catches of around 50 tons for 14 or 15 days of fishing.

HAMURO FOUR SEAM TRAWL NET (37.1 M)

A four seam trawl net for the stern trawlers was designed by Dr. C. Hamuro, FAO Fishing Gear Technologist, who came to Ceylon in 1966. Fig. 3 gives the design and the rigging details of the net.

Specification of Netting Twine, Head Rope and Ground Rope

1. Twine Polypropylene (Knea light)
380d/48,57,90,120
2. Head rope 12 mm diameter wirerope
3. Ground rope 14 mm diameter wirerope

	<u>Center</u> 6.5 m	<u>Bottom</u> 4.77 m	<u>Middle</u> 9.06 m	<u>Top</u> 6.38 m
Iron ball 200 mm	2 pcs.	1 pc.	1 pc.	1 pc.
Rubber sinker		-	-	-
120 x 180	23	14	30	-
112 x 180	-	-	-	22
105 x 165	-	-	-	-
Rubber tube M-60	11 pcs.	-	-	-
60-90	-	12	28	20
Iron sinker	11 pcs.	-	-	-
Wire clip	6 pcs.	7	7	7

Specification of Other Materials for Four Seam Trawl Net

1. Pendant wire for wing end	Ø12 mm wire rope 32.4 m
Pendant wire for wing end	Ø14 mm wire rope 33.0 m
2. Head rope	Ø16 mm wire rope 203 m (101.5 m x 2)
3. Joining rope	Ø16 mm wire rope 12 m x 2
4. Pendant wire for O.B.	Ø12 mm wire rope 20.8 m
5. Trangle plate	2 pcs.
6. Pendant swivel (22 mm)	2 pcs.
7. 8 letter type ring (25 mm)	2 pcs.
8. End ring (22 mm)	2 pcs.
9. End ring (25 mm)	2 pcs.
10. Shackles (25 mm, 16 mm, 22 mm)	25 pcs.

Polypropylene twine has been used for the construction of the net. This twine is composed of strands made out by twisting a number of monofilaments together. It has a very high breaking strength and a low specific gravity, (0.95).

The Four Seam Trawl net according to Dr. Hamuro has several advantages over the Granton Trawl net which is a two seam trawl net. This net in addition to the lower and upper parts has two side panels, which help the net achieve a higher vertical opening and provide easy passage of water through the net.

The net was first tried out by Dr. Hamuro in September, 1966, (Hamuro 1966). A concave type of otterboard (2.2 m x 1.35 m = 2.97 m²) was used. The horizontal opening was theoretically estimated to be 15 m, when 50 m bridles were used. Headline height was measured with a net height meter. The average net height obtained at various towing speeds is as follows:

Towing speed (knots)	Net height (meters)
2.5	3.92
2.8	3.62
3.2	3.28

The warp tension was measured with a tension meter and the resistance was estimated to be 2,600 kg. For 18 1/2 hours of fishing 218 baskets including 18 baskets of prawns were caught.

Comparison of the Three Nets

It was felt that the above-mentioned three nets should be subjected to comparative fishing tests before a final selection of a suitable gear is made. This was undertaken by Mr. S.L. Okonski, FAO Fishing Gear Technologist

who came to Ceylon in 1967. The experiments were conducted in November 1967, on M/T MEEGAMUWA (Okonski, 1967). For comparative fishing two identical vessels should fish the same grounds simultaneously. It was not possible to obtain the service of another identical trawler and the three nets were tried out separately by the same vessel.

No tension meter was available to measure the resistance of the fishing gear. It has been calculated theoretically using Dickson's formula:

$$D_n = S \frac{d}{a} \frac{1}{125} \left(1 + \frac{6.6 \times 2Y_g \times H}{S} \right)$$

Where D_n = total net drag in tons

S = total surface area of netting in square feet

d/a = ratio of twine diameter to bar length

$2Y_g$ = ground rope spread at the wing ends in feet

H = head line height at center in feet

$S_d/a = 2 S_d/a$

A special method devised by Mr. Okonski has been employed to measure the spread at the wing ends. The average net's height was deduced theoretically as no net height meter was available. Results of measurements and calculations for the three nets have been analyzed in detail in Mr. Okonski's Report. Table I is a summary of the results.

Another experimental trip was arranged in February 1968, (Okonski, 1968). Results obtained were very similar to those obtained during the first trip.

It would be useful to compare the results of Mr. Okonski's experiments with the results obtained by Dr. Hamuro during his experiments. Table II is a comparative study of the results obtained by Dr. Hamuro and Mr. Okonski.

A direct comparison of these results is not possible due to the fact that these experiments were conducted on different vessels at different times under different conditions. But the results do not differ very much and the disparity is minimal in the case of the towing speed and the resistance. The deviation in the catches is due to the fact that Dr. Hamuro's experiments were conducted at a time when the fish returns of the vessels were comparatively better.

ANALYSIS OF RESULTS

The methods employed to obtain certain measurements were not accurate enough for a rigorous analysis. Resistance of the Four Seam Trawl net has been measured by Dr. Hamuro using a tension meter. But only the tension of one warp was measured and even so only one measurement was taken. Even in Mr. Okonski's experiments the resistance was not measured directly but deduced theoretically using Dickson's formula. For the net's height Dr. Hamuro's results could be considered as more correct as he used a net height meter. Mr. Okonski's results are more correct in the case of the measurements of the spread at wings.

Table I

Comparative Study of Three Trawl Nets

	Manila trawl net	Ulstron net	Four seam trawl net
1. Size of net	small	medium	big
a) Head line length	24.1 m	25.92 m	37.10 m
b) Surface area of webbing in action	407.8 m ²	495.6 m ²	506.4 m ²
2. Quantity of webbing used for the construction	big	small	big
a) Area of resistance of webbing	66.0 m ²	39.9 m ²	60.0 m ²
b) Thickness of twine	thick	thin	medium
c) Capacity of surface of webbing from 1 m of area of resistance	6.2 m ²	12.3 m ²	8.45 m ²
3. Shape of the net in action (average values)			
a) Spread of ground rope	not measured	17.9 m	15.0 m
b) Per cent opening of head line	38.5	62.5	38.4
c) Horizontal mesh opening	0.51	0.58	0.53
d) Constructional vertical opening	not calculated	2.35 m	3.04 m
e) Area of mouth at square	"	25.3 m ²	24.5 m ²
f) Average speed of towing			
- with rectangular otter-boards	1.31 m/sec.	not used	1.54 m/sec.
- with oval otter-boards	1.58 m/sec. at 310 r.p.m.	1.83 m/sec. at 290 r.p.m.	1.84 m/sec. at 310 r.p.m.
4. Efficiency of trawling			
a) Area dragged per hour	51400 m ²	99900 m ²	96500 m ²
b) Catch per towing hour ⁴ in baskets (751 bs/basket)	1.54	4.4	2.84
good fish. total	3.63	4.9	4.38
5. Resistance of the fishing set (average)			
Resistance of net	2.92 tons	2.10 tons	2.90 tons
Towing speed (knots)	2.9	3.54	3.16
(Average)	at 310 r.p.m.	at 290 r.p.m.	at 310 r.p.m.

Table II*
Results of Experiments with Different Trawls

	Dr. Hamuro's Results				Mr. Okonski's Results			
	Manilla Net	Ulstron Net	4 Seam Trawl Net	Manilla Net	Ulstron Net	4 Seam Trawl Net	Manilla Net	Ulstron Net
1. Spread at the wings in meters	8.0	-	15	9.0	13.9	9.35		
2. Net's height in meters	3.5 to 4.0 at 300-320 r.p.m.	-	3.5	2.35	2.35	3.04		
3. Resistance of the net in Kg.	-	-	2600	2920	2100	2900		
4. Catch in baskets per towing hour	3.75	-	7.35 (leaving aside 133 baskets of Paraw/1.5 hrs.)	3.63	4.9	4.38		
5. Towing speed in Knots	3.2 at 320 r.p.m.	-	2.9 at 320 r.p.m.	2.9 at 310 r.p.m.	3.54 at 290 r.p.m.	3.16 at 310 - 315 r.p.m.		

Comparative fishing nets clearly indicate that the Manila Granton trawl is the least efficient of the three nets, technically and otherwise. The Four Seam Trawl net gave better results but could be further improved. The Ulstron net yielded the best results, but the twine used for its construction was found to be too delicate. Manila net offered the highest resistance and the towing speed obtained was only 2.9 knots at 310 r.p.m. Fish found in the Wadge Bank are considered to be fast swimmers and a towing speed of about 3.5 knots has been recommended for their exploitation. The towing speed could be increased only by lowering the resistance of the fishing gear. This could be achieved by altering the size of the net, mesh size or twine size or all three factors.

No one of these solutions could be applied to the Manila net. Decreasing of the net size will obviously lower the efficiency and would not be a proper solution. The mesh size could be slightly increased from 5" to 5½" but the change in resistance caused would be insufficient. Manila twine has a very low breaking strength and cannot be made thinner. The only solution is to replace manila twine by a thinner but strong synthetic twine.

The Four Seam trawl net on the contrary could be improved by altering all three factors. The wings could be shortened without affecting the opening of the mouth; mesh size can be increased. Even the twine used can be replaced by thinner twine as polypropylene twine has a very high breaking strength. The towing speed obtained with this net was 3.16 knots at 310 r.p.m. The net could be redesigned with slight modifications to easily achieve the target towing speed of 3.5 knots.

For the Ulstron net the twine should be replaced by polypropylene or polyethylene twine of same thickness and no further improvement is necessary.

CONCLUSION

In the Wadge Bank, the snappers, groupers and allied demersal fish commonly but erroneously referred to as "mullet" are the commonest fish found throughout the year, (Mendis 1965 and Fernando 1968). They belong to the resident stock and do not follow any migratory pattern and do not live in shoals, but are found scattered all over the area feeding on bottom fauna. For their exploitation a net with a high horizontal opening could be recommended and the Ulstron net whose spread at wings is more than 50% higher than that of the 'Standard' granton net seems to be the most suitable.

Other than the "mullet", Carangid fishes, locally known as "Paraw" which are migratory constitutes a large portion of the catch during the south west monsoon (from May to September). They are fast swimmers and are found slightly above the bottom. A trawl net with vertical opening would be required for efficient exploitation and in this respect the Four Seam trawl net whose vertical opening is more than 3.5 m is ideal.

REFERENCES

- Dickson, W. (1966). Report of Travel to India and Ceylon. FAO Fish. Travel Rep. and Aide Memorie No. 4.
- Fernando, E.F.W. (1968). Species Composition of fish Captured by Trawlers in the Wadge Bank. IPFC Procs., 13(3):521-530.
- Hamuro, C. (1966). A Special Report on the 200-ton Trawler "Pesalai" (with Emphasis on the Character and Behaviour of its Fishing Gear). Ceylon Fish. Corp., Publ.
- (1966). Experimental Trawling with the 4-Seam Trawl net (Hamuro type) on the Stern Trawler "Pesalai" at the Wadge Bank. Ceylon Fish. Corp., Publ.
- Medcof, J.C. (1963). Partial Survey and Critique of Ceylon Marine Fisheries, 1953-55. Bull. Fish. Res. Sta. Ceylon, 16(2): 29-118.
- Mendis, A.S. (1965a). The Trawler Fishery. Bull. Fish. Res. Sta. Ceylon, 17(2).
- (1965b). Resources of the Wadge and Pedro Banks. Bull. Fish. Res. Sta. Ceylon, 18.
- (1967). Trawler Fisheries of Ceylon. Proceedings of the 2nd Annual Session of the Ceylon Ass. for Adv. of Science, 2: 27-144.
- Okonski, S.L. (1967). Report of Experimental Trip on m/t. "Meegamuwa". Ceylon Fish. Corp. Publ.
- (1968). Report on the 2nd Experimental Trip on m/t. "Meegamuwa" between 22nd-29th February 1968. Ceylon Fish. Corp. Publ.

