ON THE COMPARATIVE EFFICIENCY OF TRAWLS MADE OF COTTON, POLYETHYLENE AND COMBINATION OF BOTH THE MATERIALS

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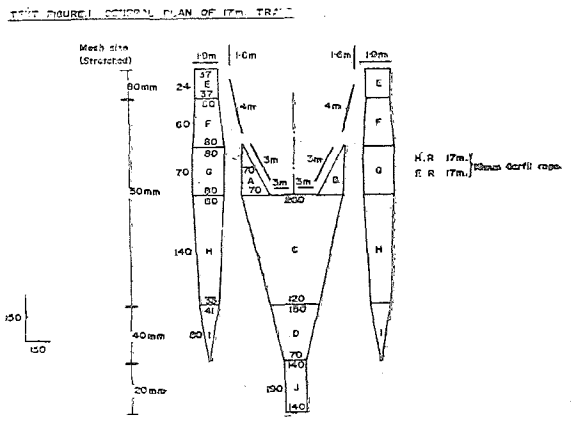
The merits and demerits of cotton, polyethylene and combination of the two materials ascertained on the basis of cost, wear and tear, maintenance, total catch and qualitative analysis of the catch are discussed by making comparative fishing experiments with the three trawl gears made of these materials. The study can be concluded with a suggestion for switching over to polyethylene twisted monofilaments for better, in case of bottom trawls without in any way adversely affecting the catch of shrimps and at the same time for enhanced fish catch. Eventhough the combination net is found to be equal in efficiency as the polyethylene net this idea cannot be conveniently adopted from the point of view of economy.

INTRODUCTION

The comparative fishing power of trawls made of vegetable fibre twines like cotton and synthetics like nylon (polyamide group of fibre) has been the subject of study of many workers (Firth 1950, Miyazaki 1962, Kuriyan 1965). The first two authors report the superiority of nylon over cotton as 4-5 times while according to Kuriyan (1965) cotton being heavy, sinks better and catches more of bottom fish. With the introduction of more buoyant materials like polyethylene and polypropylene, attempts have been made to study how far these materials can be utilised for the upper panels of the net with a view to ensure more lifting. The contribution of U. S. Bureau of Commercial Fisheries in 1961 in this direction deserves special mention and the net used is one with polypropylene on the upper side and manila on the lower side (Anon 1965). These investigations proved that polypropylene top sections allow better lift, reduces water resistance and ensures a higher vertical opening. Consequent on the production of different types of synthetic fishing gear materials in India, it was thought useful to assess the comparative fishing efficiencies of a combination net with a heavy vegetable fibre twine on the lower part and a buoyant synthetic material for the upper panels as well as with nets made exclusively with each of the materials.

METERIALS AND METHODS

The comparative fishing trials for the studies were conducted during the fishing season of 71-72 in the grounds off Cochin at depths ranging from 5-32m. The design (Fig. 1) of the three experimental nets were



identical and conformed to the popular design of 17 m. trawls operated along this area. One net was made of cotton (Net A) 20/6/3 and 20/9/3, the second with 1 mm dia. blue polyethylene (Net B) twisted monofilament and the third one a combination (Net C) of the two materials, with polyethylene on the upper part and left side panel and cotton on the lower and the other side panel. The cotton nettings were cutched and fixed by copper sulphate and ammonia to retard deterioration.

Seven aluminium floats of 12.7 cm dia. and 0.79 kg. buoyancy each were tied to the head rope of each net and the foot rope was weighted with 64 numbers of $\frac{1}{2}$ lb. sinkers. The otter boards used were of horizontally curved type (Mukundan *et al.* 1967) and of size 120 x 60 cm weighing 50 kg. each for all the three nets.

The nets were operated from a 9. 15m. wooden boat fitted with 50 BHP engine. On each day three hauls, one haul of one hour duration with each net were carried out, making one cycle of operation. A total of 29 cycles of fishing operations were completed during the period, the order of arrangement of nets in the cycle being placed statistically.

Pieces of webbing were collected periodically from the nets with a view to study abrasion, change in mesh size and breaking strength. The quantity of the catch and the specieswise composition of the same for each net were also recorded.

RESULTS

The netting of 17 m. trawl weighs 20.5, 15.0 and 17.5 kg. respectively for cotton, polyethylene and combination nets and the fully rigged nets 42.50, 37.00, 39.00 kg. The initial cost of the net works out as shown in table 1.

TABLE I

Material used for fabrication of trawls	Cost Net A Rs. Ps.	B Rs. Ps.	C Rs. Ps.
Cost of materials for netting assembly and rigging	451.00	270.00	360.00
Fabrication charges	350.00	450.00	400.00
Preservation charges	50.00	nil	25.00
Total	851.00	720.00	785.00

TABLE II

Particulars of species caught	Catch in kg		
	Net A	B	C
Bottom burrowers and swimmers	260.45	426.85	391.95
Off bottom and column swimmers	137.20	290.65	310.60

TABLE III

	Strength of webbing of 5 meshes × 20 cm. (kg)	
	Cotton	Polyethylene
Original	76.8	78.2
After 29 cycles of operation	42 66	69.8
Reduction in strength (%)	45 0	11.0

The catch consisted of bottom burrowers and swimmers like *Matapenaeus affinis, Pe aeus indicus, Metapenaeus debsoni, Parapenaeus stylifera, soles, sciaenids,* and *Platycephalus* and off bottom and column fishes like *Trichurus, Synagris Engraulis, Lactarius, Leognathus, Anchoviella* etc. The netwise catch data are illustrated in Table II.

The breaking strength of the webbings (kg.) initially and after 29 cycles of operation is indicated in Table III.

DISCUSSION

The initial cost of a completed cottton net is more by 18% when compared to polyethylene and an additional expenditure of Rs. 50/- is required for preservation with cutch and fixation by copper sulphate and ammonia.

A nylon net is reported as 1/3 the bulk of cotton net (Anon 1955) and lighter by 28% (Klust 1954) than cotton while polyethylene net used for the studies was lighter by 26.8% than. cotton. The monofilament webbing lost 11% of its strength during the period while the corresponding value for cotton netting is 45%. The mesh size did not show any appreciable variation, however distortion of meshes was noticed in the jib and wing portion of the polyethylene netting and this could have been avoided if stretched machine made webbing was used instead of hand braided netting used for the studies.

The results obtained, as regards the prawn and fish catch, horizontal spread and towing tension, were statistically analysed and are represented in Table IV.

For the purpose of comparing the catchability of the three nets, data collected were analysed using the analysis of Variance Technique. For framing the analysis of Variance table, the catch figures of prawn and fish were converted to their correspo-

TABLE IV

Analysis of Variance

Source	S. S.	D. F.	M. S.	F.
a) Fish catch				
Total	18.9300	86		
Between nets	0.6261	2	0.31305	4.61*
Between days	14.4972	28	0.51775	7.62*
Error	3.8067	56	0.06797	

Critical difference = 0.1356

	Net A	B	C
Average catch in kg. (logarithm)	0.8286	0.9974	1.0180
Average catch/hr. of fish (in kg.)	9.50	18.50	17.00

b) Prawn catch				
Total	15.4136	86		
Between nets	0.5259	2	0.26295	2.60
Between days	9.2291	28	0.32960	3.26
Error	5.6586	56	0.10104	

	Net A	B	C
Average catch/hr. of prawns in kg.	6.00	9.00	9.00

c. Horizontal opening				
Total	182.4773	56		
Between nets	0.6328	2	0.3164	0.44
Between days	156.0938	18	8.6718	12.13
Error	25.7507	36	0.7152	

Source	S. S	DF	MS	F
d) Tension				
Total	111706	65		
Between nets	9074	2	4537	7.25*
Between days	76382	21	3637	5.81**
Error	26250	42	625	

Critical difference for nets at 5% level = 15. 2261 kg.

	Net A	B	C
Average tension for the three nets in kg.	528.00	501.00	508.00

* Significant at 5% level.

** Significant at 1% level.

nding logarithmic values while data on tension and horizontal spread were taken as such. Though on the whole 29 fishing trips were conducted, horizontal spread of the nets was recorded only on 19 trips and tension in 22 trips. From the table it could be seen that the following are the important findings.

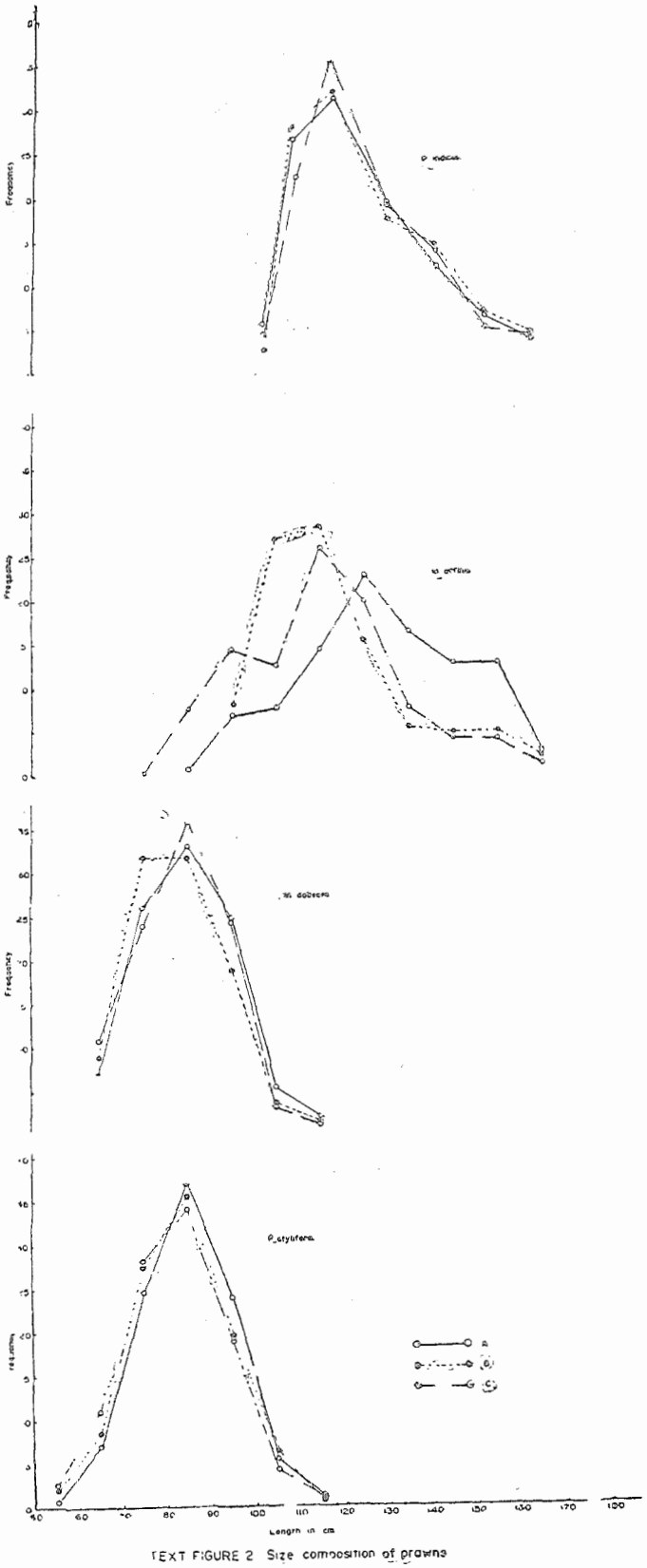
a) Fish catch :

Between nets variation was significant at 5% level indicating that the three nets were not equal in their catching rate of fish. The critical difference at 5% level for the nets is 0.1356 kg. in terms of logarithmic values and the average catch of fish in terms of logarithmic values were 0.8286 kg., 0.9974 kg. and 1.0180 kg. for cotton, polyethylene and combination nets respectively. It could be inferred that polyethylene and combination nets are equal in their catching rate of fish. The catch of fish in cotton net was significantly lower compared to combination and polyethylene nets.

The percentage increase in the total catch of fish in nets B and C was 95 and 79 respectively compared to net A. Categorising it into two groups, bottom swimmers and column swimmers, the percentage increase is divisible as 64 and 112; 50 and 120 for polyethylene and combination nets respectively. The greater proportion of fish catch is contributed by the column fishes and partly by the bottom swimmers.

b) Prawn catch and horizontal spread :

Between nets variation was not significant as regards prawn catch and horizontal spread.



TEXT FIGURE 2 Size composition of prawns

c) Towing tension :

Between nets variation was significant and it could be evident from the table that the cotton net was offering significantly higher tension compared to other two nets.

An analysis of the size and species composition of the catches of the three nets indicate no appreciable difference in their trend. Since prawn is the commercially important fishery an attempt was made to study the size distribution of the various species landed by the three nets. With a view to find out whether there is any difference in the commercially important species of prawns, the size composition are represneted in Fig. 2. It can be seen that the peak is for 120-130mm, 100-130mm, 80 - 90 mm and 80 - 90mm length groups for *Penaeus indicus*, *Metapenaeus affinis*, *Metapenaeus dobsoni* & *Parapenaeus stylifera* respectively. Mohamed (1967) states that the commercial size of four species are 136-145mm, 121-130 mm, 86-95 mm, and 81 - 90 mm respectively which almost conform to the above values.

The general assessment of the catch data indicate the better shape and mouth opening of polyethylene nets, greater sinking of cotton netting and increased vertical lift of the polyethylene upper panels. The better shape of the net is assumed to be due to lesser flexibility of polyethylene twines over cotton. The better sinking of cotton and higher vertical lift of polyethylene netting can be attributed to the specific gravity of the respective materials.

The investigations carried out on the comparative fishing trials with three nets, of cotton, polyethylene and combination of the two, can be concluded with a suggestion for switching over to polyethylene monofilament twisted twine for the fabrication of bottom trawls without in any way adversely affecting the catch of shrimps and at the same time for enhanced fish catch. Further it is reported that for better performance of polyethylene trawls it is advisable to use lesser number of floats than cotton which in turn reduce the tow drag. (N.N. 1959). Even though the combination net is found to be equal in efficiency with polyethylene net, this idea cannot be conveniently adopted from the point of view of economy.

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