COMPARATIVE EFFICIENCY OF TRAWLS MADE OF NYLON, POLYETHYLENE MONOFILAMENT AND TAPE TWINES

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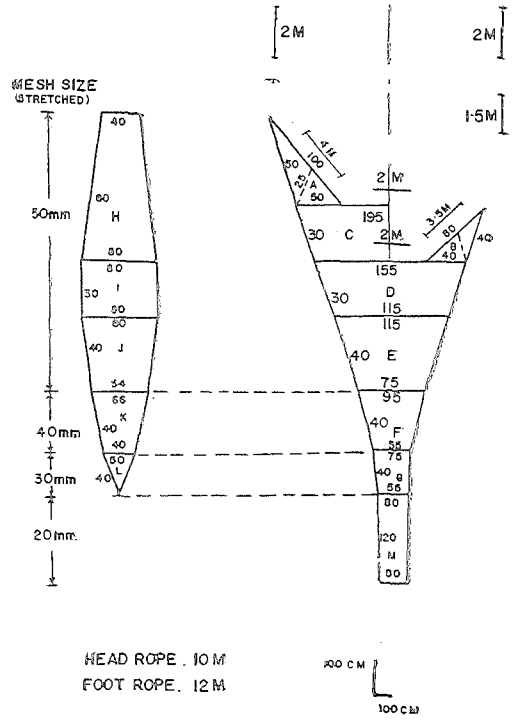
Results of comparative fishing operations conducted with three nets of identical design made of nylon, twisted polyethylene monofilament and high density polyethylene (HDPE) tape twines are presented in this communication. Since the tape net recorded the highest prawn and fish catch, monofilament and nylon following in order, it can be recommended to the fishing industry as one of the cheapest and effective fishing materials evolved for trawl fabrication.

INTRODUCTION

Trawl gear investigations have been aimed at the improvement of the gear from the stand point of achieving least resistance with maximum water filtering capacity. Man made fibres, especially of polyethylene group, offer immense potentialities as a suitable trawl gear material. Selection of trawl gear material has been studied by Mugaas (1959), Klust (1955) and von Brandt and Klust (1971). Kartha, George and Radhalakshmi (1974) have conducted experiments with trawl nets made of cotton, polyethylene monofilament and combination of the two and found polyethylene net superior to the other two from the point of view of catch efficiency as well as cost of the gear. The suitability of synthetic weaving tape as trawl gear material in comparison with polyethlene monofilament and hard twisted nylon is the subject matter for the present investigation.

MATERIALS AND METHODS

Three nets (A, B and C) were fabricated with twines of nylon, polyethylene and HDPE tape. All the three nets were of identical design i.e. of bulged belly type and having a head rope length of 10 m. (Fig. 1). The head rope of each net was attached with 5 aluminium alloy floats of 12.7 cm. diameter and 0.795 kg. extra buoyancy each and the foot rope carried 40 numbers of lead sinkers weighing 220 g. each. The otter boards used were of the horizontally curved type (Mukundan, Satyanarayana and Krishna



Iyer, 1967) and of size 101 x 50.5 cm. weighing 40 kg. each. The physical properties of the netting twines used for fabrication are given in Table I.

Fishing experiments were conducted off Cochin from a 9.15 m. wooden fishing vessel fitted with 50 BHP engine during the fishing season 1972-73 at a depth range of 10–15m. Each day 3 hauls were taken, one haul of one hour duration with each net making one cycle of operation. A total of 29 cycles of fishing operations were conducted during the period, the order of arrangement of nets in the cycle being placed statistically. The specieswise composition and the quantity of the catch for each net were also recorded. Pieces of webbing were cut out from different parts of each net to assess the deterioration due to the combined effect of stress, strain and abrasion by noting the mesh strength. The testing of mesh strength was done based on the method recommended by Indian Standards Institution (1971).

Results And Discussion

The netting of nylon, polyethylene and tape weighs 7.40, 5.10 and 10.10 kg. and the fully rigged nets 19.90, 17.60 and 22.60 kg. respectively. The catch was composed of penaeid species of prawns like *Penaeus indicus*, *Metapenaeus dobsoni*, *Parapenaeopsis stylifera*, *Penaeus monodon* and *Metapenaeus affinis* and varieties of fish like *Cynoglossus* sp. *Sciaenids*, *Leognathus* sp. *Anchoviella* sp. *Opisthopterus tardoore* and *Platycephalus* sp.

The catch per hour of operation of each net is presented in Table II and the statistical analysis of prawn catch, fish catch and horizontal opening of the nets are given in Table III. Table IV presents the percentage strength retained by the different parts of the three nets after 29 cycles of operation.

Carrothers (1957) and von Brandt (1956) recommended that substitution of net materials should be based on comparative wet knot strength. In the present studies there is difference in the basic materials, as also types of yarn, i.e. nylon is used for net A as muitifilament, polyethylene for nets B and C as monofilament and tape twines respectively. The effect of wetting and knotting conjointly improves the mesh strength property of polyethylene monofilament and tape twines over nylon as is evident from Table I. Substitution of material for this experiment is based on wet mesh strength irrespective of the thickness of twines.

TABLE I

PHYSICAL PROPERTIES OF NETTING TWINES

Net		A	B	C
Material		Nylon twines	Polyethylene monofilament twines	HDPE tape twines
Diameter m.		1.11	1.11	1.35
Weight g.	Dry	0.515	0.555	0.668
	Wet	0.770	0.662	0.709
	In water	0.068	-0.040	-0.182
Twist per m.	Outer	276	216	174
	Inner	185	46	117
Breaking strength kg.	Dry	20.6	16.0	17.8
	Wet	19.5	18.0	20.1
	Wet knot	11.8	13.7	14.8
Breaking stretch %	Dry	75.2	93.3	54.0
	Wet	85.3	54.6	45.6
Modulus of elasticity g./den.	Dry	2.4	5.0	6.0
	Wet	1.9	7.5	7.6
Rigidity g.	Dry	2.5	44.6	50.4
	Wet	—	54.0	60.0

TABLE II

CATCH PER HOUR OF OPERATION (kg.)

Net	A	B	C
Prawn	4.50	7.60	13.50
Fish	16.50	21.00	30.00
Total catch	21.00	28.60	43.50

TABLE III

ANALYSIS OF VARIANCE

Source	S. S.	D. F.	M. S.	F
Prawn catch				
Between nets	4.8595	2	2.4297	32.0118**
Between days	6.4865	28	0.2316	3.0513*
Error	4.2553	56	0.0759	
Total	15.6013	86		
Critical difference :	0.1476			
Fish catch				
Between nets	1.3278	2	0.6639	7.0402*
Between days	18.2074	27	0.6743	7.1505*
Error	5.0637	54		
Total	24.6289	83		
Critical difference:	0.1678			
Horizontal opening				
Between nets	0.0797	2	0.0398	1
Between days	94.0228	18	5.2234	31.6377*
Error	5.9459	36		
Total	100.0484	56		

Net	A	B	C
Prawn mean catch	0.4704	0.7310	1.0484
Fish mean catch	0.9692	0.9403	1.2203

*Significant at 5% level **Significant at 1% level

Though polyethylene monofilament is lighter than the other two materials, no significant difference was observed in the towing tension of the three nets. This is because rigging of accessories was similar for all the three nets. However, towing tension was found to vary between days which might have occurred due to the varying sea conditions.

The tape net recorded the highest catch, monofilament and nylon following in order. Data collected were analysed using the analysis of variance technique for the purposes of comparing the catch efficiency of the three nets and are presented in Table III.

TABLE IV

PERCENTAGE RETENTION OF STRENGTH

Net	A	B	C
Parts of net			
Upper belly	86.2	90.0	93.5
Lower belly	84.5	91.0	83.5
Upper throat	85.0	93.5	96.5
Lower throat	81.5	88.5	89.5

Prawn catch

Difference of prawn catch between nets was highly significant. The critical difference of prawn catch was found to be 0.1476. Hence for prawn catch all the three nets differ among themselves and net C was found to be most efficient.

Fish catch

Fish catch between nets was also significantly different. Critical difference for fish catch was 0.1678. There is no difference in fish catch as far as nets A and B are concerned where as net C showed better catch than A and B.

Horizontal spread

The horizontal opening is not significant between the three nets. The reason for the increased catch in the tape net can be attributed to the greater rigidity of the material which in turn enhances the vertical opening of the net in a more desirable form facilitating a less interrupted flow of water through the net. The floatability of polyethylene when compared to nylon may also have contributed to the upward thrust of the upper belly portion of the net. The loss in strength of the different parts of the nets showed that net A had great reduction. No marked reduction in strength was noticed for upper belly portions of nets B and C. The strength of lower belly and lower throat of nets A and C was seen more affected while in the case of net B only the lower throat region was found affected. It appears from the data presented in Table IV that nylon net is subjected to more wear than monofilament and tape. This can be attributed to the combined effect of abrasion, strain and weather action. Further, the wearing of the lower belly and throat region of the three nets can be due to the abrasion caused while trawling.

The investigations stress the importance of polyethylene as trawl gear material. In general, the results with tape nets give ample scope for the introduction of weaving tape in the fishing industry since the costly spinneret extrusion technique followed for the manufacture of monofilament is absent in weaving tape.

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REFERENCES

Carrothers, P. J. G. 1957. *Industrial Memorandum.*, 19, Fisheries Research Board of Canada.

Indian Standards Institution. 1971. IS : 5815, Part IV.

Kartha, K. N., V. C. George and K. Radhalakshmi. 1974. *Fish. Technol.*, **11**, 1 : 43.

Klust, G. 1955. *Wld. Fish. Abstr.*, **6**, 6 : 13.

Mugaas, M. 1959. *Modern Fishing Gear of the World* : 139. Fishing News (Books) Ltd., London.

Mukundan, M., A. V. V. Satyanarayana and H. Krishna Iyer. 1967. *Fish. Technol.*, **4**, 2 : 53.

von Brandt, A. 1956. *Wld. Fish. Abstr.*, **8**, 5 : 13.

von Brandt, A. and G. Klust. 1971. *Modern Fishing Gear of the World.*, **3** : 318. Fishing News (Boogs) Ltd., London.