ON THE COMPARATIVE EFFICIENCY OF CONVENTIONAL AND BULGED BELLY FISH TRAWLS

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To ensure a greater vertical opening while under tow, a trawl net with a bulged belly was made and compared with a conventional design under actual fishing conditions. It was found that the new design landed 31.8% more fish. Since the percentage lateral spread was relatively less for the bulged belly net, it was inferred that this net had higher head line height, while under operation and this was further substantiated by a greater catch of off-bottom fishes. Further, half the quantity of twine can be saved by changing the conventional trawl to that of bulged belly type.

INTRODUCTION

The height of the head line in bottom trawls is both critical and important so as to ensure greater catch of fish that swim near the bottom, yet not actually on it. (Parrish and Blaxter, 1964). Lifting devices, the use of materials having favourable characteristics and the power of towing boat are probably some of the methods hitherto adopted to increase the vertical opening of a trawl net (Okonski and Sadowski, 1959). Takayama and Koyama (1958 and 1959) experimented with trawl kites and gussets and concluded that the vertical height of the net mouth could be increased twice by using both these accessories. Similarly the upthruster floats described by Phillips (1959) could also be used for increasing the height of the head line. However, at a relative high velocity of tow, normally required for fish trawls, the efficiency of these lifting devices are adversly affected. Benyam-(1959) made a preliminary attempt to increase the fishing height by improving the design of the net. A similar approach has been made by the present authors and the findings of these experiments are incorporated in this paper.

GEAR AND THEIR OPERATION

Hamuro (1964) stated that the conventional trawl net during operation "take a bulky shape in the fore body with a pronounced narrowing in the after belly. The billowing of the fore part of the net is caused by choking up of water which cannot flow freely through the net". Based on the above view, two net designs of the four seam type were made. Text Figures 1 and 2 give the design and rigging

details of the two nets. In the first (OY net) the belly part is of the conventional pattern, while in the second (BD net) it has a more pronounced funnel shape which in turn would facilitate bulging out while under tow. Table-1 presents the details of materials required for the webbing of the two nets. Otter boards used for experimentation were similar to the ones described by Mukundan *et al.* (1967), but slightly larger in dimensions.

Trawling experiments* with the two nets were conducted in the grounds off Cochin for one fishing season (1966-67). Keeping as far as possible the depth, warp and duration of tow constant, four hauls (two with each net) were made each day of operation on the same ground. The horizontal spread between the doors was estimated by the method suggested in the communications of Benyami (*loc. cit.*) and Deshpande (1960) and the tension on the warps measured with the Tension Meter described by Satyanarayana and Nair (1965).

Results and Discussion

The data gathered were analysed for towing tension, horizontal opening and total catch by the analysis of variance technique. The results so obtained are presented in Tables II, III and IV.

It would be evident from Table II that there were no significant differences in the tension offered by the two net designs at 5% level. The haul to haul variation was also not significant. Further, the horizontal spread between the doors (vide Table III) was also not significant at 5% level. However, there were significant differences in the landings of the two nets (Table IV) at 5% level. When the catch values were converted into logarithm values, it was apparent that the BD net had landed 31.8% more fish than the OY net. The haul to haul variation was also significant at 5% level.

Although the lateral spread between the doors was not significant at 5% level the averages presented in Table – V reveal that the BD net had relatively less percentage opening than the OY net. The reduction would have in turn helped to increase the head line height of the BD net. This was further substantiated by catch composition of the two nets. While the catch contents of the OY net were bottom forms like prawns, soles, skates, rays, the BD net, in addition to the above, landed off-bottom fishes like *Lactarius* sp., *Synagris* sp., *Pampus* spp., *Leognathus* spp. Benyami (1959) is of opinion that the top of the net may act as a kite when it meets the water flow at some angle of attack. The flow of water would have helped the BD net to bulge out and thereby land more off-bottom fishes. In the OY net, however, as opined by Binns (1959), due to its shape and weight, the resistance of the cod end falling on the square would have pulled the head line back, thus giving less chance for a higher vertical opening.

Further, it would be evident from Table I that approximately half the quantity of twine can be saved by changing the conventional trawl to that of bulged belly type.

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*The boat used for the experiments was a 32'-0 (9 85 M) boat with 50 H. P. engine

Data Sheet

NAME OF GEAR: Conventional Fish Trawl (OY) | Main species caught: Sciaenida, Soles Prawns, Sharks | Vessels: Fish tech 2
TYPE: Otter trawl | | L.O.A.: 9·65M.
COUNTRY: India | Fishing conditions: All trawlable ground | Gross tonnage: 7·8
LOCALITY: Cochin | | Horse power: 50
REFERENCE: C.I.F.T. Cochin(1967) | | Crew: 5

WEBBING	A	B	C	D	E	F	G	H	I	J
Material	Nylon →									
Type of Knot	Double trawl knot →									
Preservation	0 →									
Colour										
Twine Size	210/7/3 →						→	210/9/3	→	210/12/3
Breaking Strength kg.	27·35 →						→	33·70	→	44·55
Stretched Mesh mm.	50·8 →						→	38·1	→	25·4
Upper Edge	60	1	430	1	80	370	80	200	50	100
Lower Edge	80	100	375	100	80	150	25	100	1	100
Depth	60	100	60	100	100	220	220	100	100	180
Boiling Rate Inner / Outer	1:6	1:1	1:2	1:1		1:2	1:8	1:2	1:6·5	
Take up %	20	22	37·4	22		40				
Selvedge										
Hanging	a 3·97 b 7·35 c 9·15 d 5·80		a 2·90 b 5·80 c 6·17 d 2·90							

LINES, ROPES	a	b	c	d	e	f	g
Material	Manila →						
Preservation							
Circumference							
Diameter mm	12·7 →		19 →				12·7
Breaking Strength kg							
Construction							
Lay							
Length M.	3·97	7·35	2·90	3·97	6·19	3·04	3·04

FLOATS, SINKERS	Floats	Sinkers		Otter Boards
Number	11 – 13	63		2
Material	Alu.	Lead		Iron & Wood
Shape	Sph.	Spl.		Horizontal Crd.
Diameter mm.	127	19		
Length mm.				1200x600w.
Static Buoyancy kg:	0·7			
Weight in air kg:		14·5		50
Weight Submerged				

Head Rope. 15·24M.
Ground Rope: 17·95M.
Total weight of the net: 60kgs.

Data Sheet

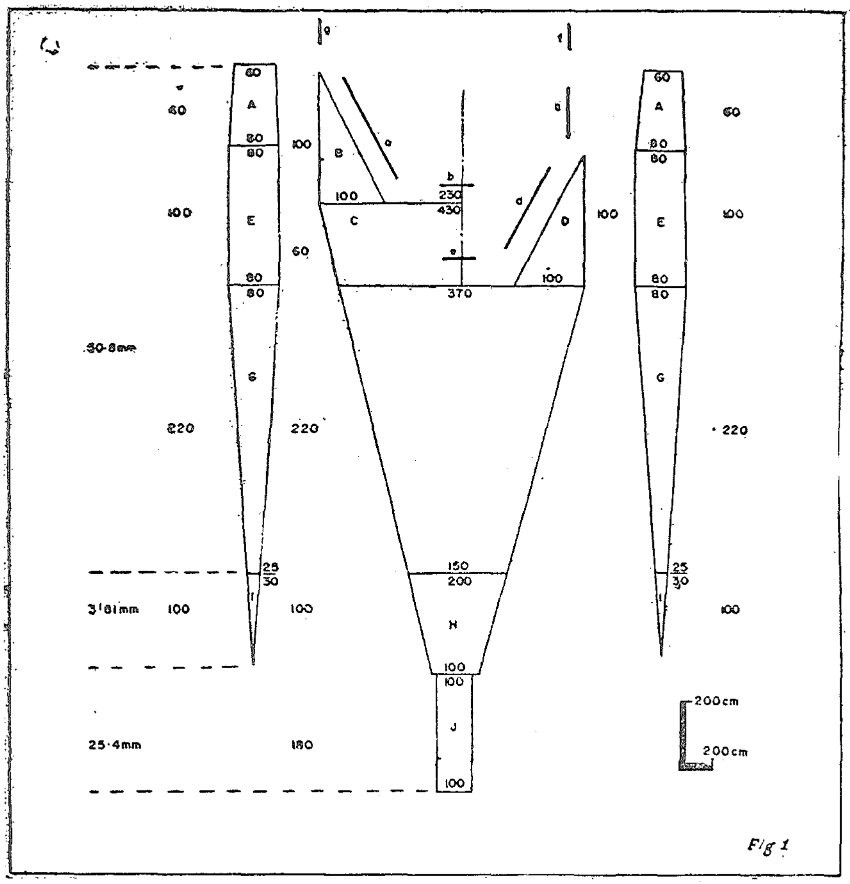
NAME OF GEAR. Fish Trawl (BD) | Main species caught: Lactarius species, Synagris Species, Sciaenids etc; | Vessels: Fish tech 2
TYPE: Otter trawl | | L.O.A.: 9·85M.
COUNTRY India | Fishing conditions: All trawlable ground | Gross tonnage: 7·8
LOCALITY Cochin | | Horse power: 50
REFERENCE C.I.F.T. Cochin(1967) | | Crew: 5

WEBBING	A	B	C	D	E	F	G	H	I	J	K
Material	Nylon →										
Type of Knot	Double trawl knot →										
Preservation	0 →										
Colour											
Twine Size	210/7/3 →					→	210/9/3	→		→	210/12/3
Breaking Strength kg:	27·35 →					→	33·70	→		→	44·53
Stretched Mesh mm.	50·8 →						→	38·1	→	→	25·4
Upper Edge	60	1	1	288	80	90	80	90	60	60	75
Lower Edge	80	90	90	90	80	68	45	60	50	1	75
Depth	90	90/180	90/180	90	90	30	30	30	30	60	150
Boring Rate Inner / Outer											
Take up %		32·5	32·5	47							
Selvedge											
Hanging	a 6·17 b 9·15	a 2·90 b 5·80	c 6·17 d 9·15	d 2·90							

LINES, ROPES	a	b	c	d	e	f
Material	Manila →					
Preservation						
Circumference						
Diameter mm.	12·7	12·7	19	19	12·7	19
Breaking Strength kg						
Construction						
Lay						
Length M.	6·17	2·90	6·17	2·90	3·04	3·04

FLOATS, SINKERS	Floats	Sinkers		Otter Boards
Number	7 – 9	56		2
Material	Alu.	Lead		Iron & Wood
Shape	Sph.	Spl.		Horizontal Crd.
Diameter mm.	127	19		
Length mm				1200x600w.
Static Buoyancy kg	0.7			
Weight in air kg		10·5		50
Weight Submerged				

Head Rope: 15·24M.
Ground Rope: 15·24M.
Total weight of the net. 33kgs.


50·8mm
3·81mm
25·4mm
200cm
200cm
Fig 1

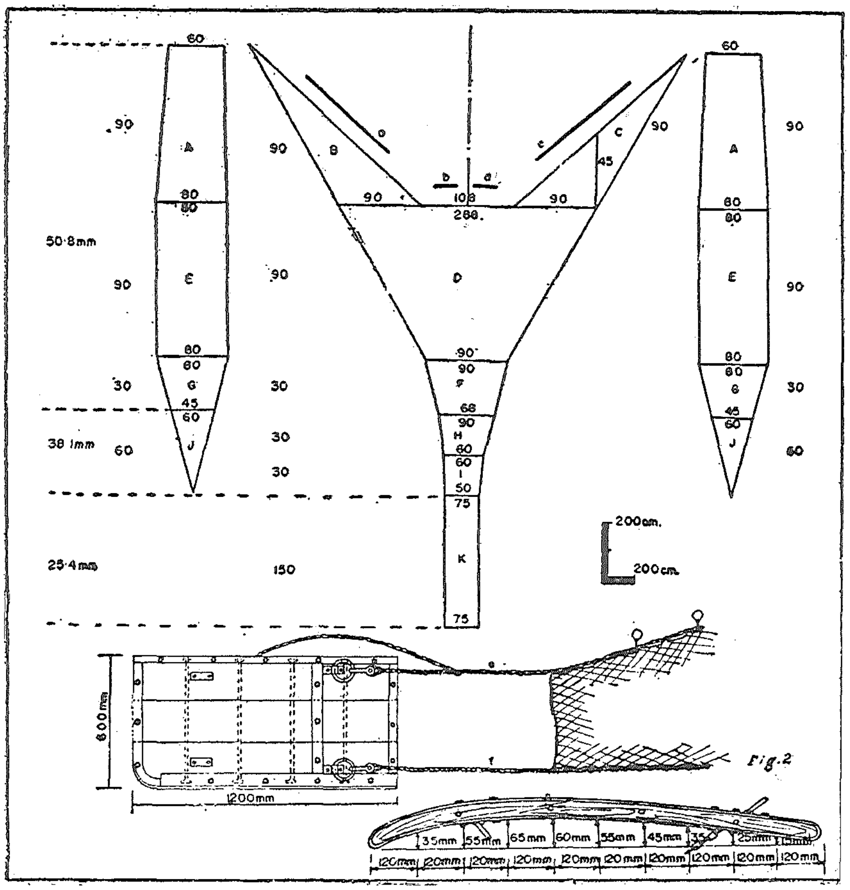

50·8mm
38·1mm
25·4mm
200cm.
200cm.
600mm
1200mm
Fig.2

TABLE I DETAILS OF WEBBING

Net	Part	Twine	No. of meshes	Weight of webbing kg.
BD	Belly region	210/7/3	77,220	
BD	Throat region	210/9/3	19,860	
BD	Cod end	210/12/3	22,500	
BD	TOTAL		1,19,580	20,500
OY	Belly region	210/7/3	2,35,680	
OY	Throat region	210/9/3	33,000	
OY	Cod end	210/12/3	36,000	
OY	TOTAL		3,04,680	43,200

TABLE II ANALYSIS OF VARIANCE

Towing resistance

Source	SS	DF	MS	F
Total	1,75,223.00	39		
Bet. Design	3,724.80	1	3,724.80	0.68 (N. S)
Bet. Hauls	66,813.00	19	3,516.40	0.63 (N. S)
Error	1,04,685.20	19	5,509.75	

TABLE III *Horizontal Opening.*

Source	SS	DF	MS	F
Total	1,38 321	45		
Bet. Designs	1.349	1	1.349	0.60 (N. S)
Bet. Hauls	88.288	22	4.013	1.81 (N. S)
Error	48.684	22	2.213	

TABLE IV *Total catch*

Source	SS	DF	MS	F
Total	4.8196	37		
Bet. Designs	0.7020	1	0.7020	7.14*
Bet. Hauls	2.3482	18	0.1304	1.33
Error	1.7694	18	0.0983	

*Indicate significant at 5% level.

TABLE V AVERAGE DATA OF THE COMPARATIVE OPERATIONS WITH THE DESIGNS

Net	Depth / warp	Percentage of opening	Tension in kg.	Total catch/hr.
OY	20/100	59.9	432	16
BD	20/100	57.3	390	21
OY	22/110	65.9	432	26
BD	22/110	57.9	312	50
OY	20/100	61.0	390	23
BD	20/100	54.9	312	44
OY	24/120	69.0	432	22
BD	24/120	68.2	412	45
OY	16/80	52.0	360	15
BD	16/80	50.0	360	17
OY	20/100	53.7	380	7
BD	20/100	66.6	390	6

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