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Operational Efficiency of Suberkrub and Polyvalent Otterboards for Target specific In-shore Semi-pelagic Trawling

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Otterboards, the stabilizing devices for trawl nets while under tow, function as hydrodynamically dependent means for holding the trawl mouth open. To be optimally effective, shearing power attained by them should be as high as possible and their resistance to motion should be as low as possible. As bent or moulded doors meet these requirements, 1407x982 mm Polyvalent and 1350x1000 mm high aspect ratio Suberkrub doors were rigged and experimented with 18.0 m RMT 8P semipelagic trawl having 80% side panels and 20.0 m double bridles to assess the functional efficiency of these combinations in inshore semipelagic trawling practices in the waters off Cochin, onboard 17.5m OAL stern trawler (277 hp). Design and operational details of these boards are described along with the catch composition obtained. The catch data analysed using ANOVA technique and done separately for quality fish and other catches, indicated no significant difference between these two designs of otterboards at 5% level, leading to a conclusion that both the designs experimented were equally efficient in combination with 18.0 m semipelagic trawl for the capture of inshore off-bottom resources.

Keywords : **Semipelagic trawling, high aspect ratio Suberkrub otterboards, Polyvalent doors, inshore off-bottom resources**

Many improvements in the designs of otterboards have come into being to meet the demands of factors like the type of ground to be trawled, method of fishing, sizing of trawler and its towing power. Their ability to spread the trawl is derived from interaction of external forces while under tow and the magnitude of these forces depends mainly on their size and shape, their angle of attack, towing speed and density of seawater. The size of the otterboard selected should be matched to the trawl gear operated, rather than to the vessel's horse power, which in effect means the amount of twine that has gone into the construction of the net in m^2 (Ferro, 1981).

Different designs of otterboards have been tried for pelagic and semipelagic trawling and due to their stability in operation with higher towing speed and versatility in midwater operations along with ease in handling, high aspect ratio vertically curved otterboards (Suberkrub, 1959) are considered highly effective. Polyvalent doors perform the dual purpose of 'on' and off-bottom fishing and being a combination of oval and cambered doors, they have the efficiency to traverse the hard ground with increased spreading efficiency (Anon, 1974). An efficient pair of otterboards will have large spreading force (CL – Lift co-efficient) and a low drag force. (CD – drag co-efficient). The efficiency of a pair of otterboards in graphical form is presented in terms of CL/CD. The higher the value, the otterboard is considered more efficient by way of achieving a reduced drag force leading to a sizeable reduction in fuel consumption. On an average, 25% of the total drag of a gear system and 16% of the total fuel cosumption are due to resistance offered by the otterboards during trawling operations (Anon, 1993). Both polyvalent and high aspect ratio Suberkrub otterboards are best suited for semi-pelagic trawling and are capable of achieving a 15% drag reduction and a minimum of 3 to 5% saving in fuel consumption (Anon, 2001).

Designing trawl gear and accessories capable of lowering the towing resistance was not given due attention in the past when fuel prices were relatively low and fish prices rather high. This situation has changed completely and modified designs which will maintain the catch potential but reduce fuel cost have become an absolute necessity at present. This communication deals with the efficiency assessment of high aspect ratio Suberkrub as well as polyvalent otterboards for inshore semipelagic trawling.

Materials and Methods

Polyvalent and Suberkrub types of otterboards designed and selected for the present study are cambered doors which offer significantly greater spreading force for a given projected area when compared with flat or 'V' form doors having identical board area. The use of camber can also produce improved water flow around the otterboard which is considered instrumental to reducing drag and hence the potential for improved functioning. A camber of about 10% is usually considered to be a good compromise (Anon, 1993, op. cit.). Polyvalent doors (1407x982 mm, Fig. 1) experimented have a camber of 9%, being the maximum depth of curvature of the main plate expressed as a percentage to the breadth of the board. Providing a slot in polyvalent doors allows smooth water flow around the doors and improve their hydrodynamic performance. For this purpose, two slot one each on the upper and lower middle sections were provided in the experimental polyvalent boards.

Aspect ratio (H/L) in the case of Suberkrub doors (1350 x 1000 mm, Fig. 2) experimented is 1.35 and when this ratio is progressively increased from the conventional 0.5, the efficiency is improved but instability at lower towing speeds can occur.

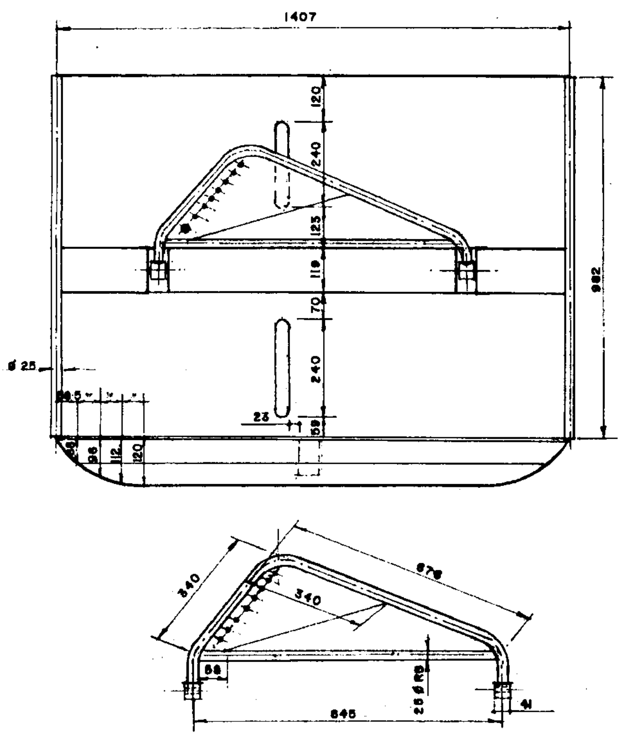

Fig. 1. 1407 x 982 mm Polyvalent Otterboard

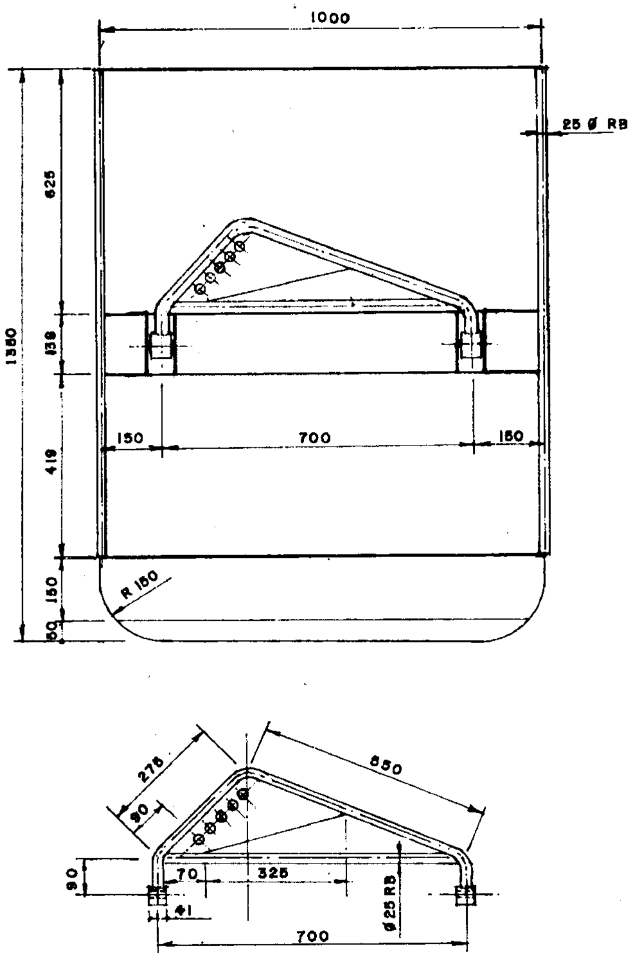

Fig. 2. 1350 x 1000 mm High - Aspect Ratio Otterboard

For this reason Suberkrub doors are found suitable for off-bottom as well as high speed demersal trawling where a higher towing speed is found essential. Mukundan and Hameed (1995) observed the high aspect ratio Suberkrub doors as efficient tools for inshore trawling with less of a drg force and a correspondinhg increase in shearing force in comparison to horizontally curved low aspect ratio doors.

The area and size of the experimental boards were selected, matching to the 18.0m RMT 8P semipelagic trawls (Fig. 3), calculated twine area and the weight of the board restricted to the level as calculated from the formula:

$W\ 75 \times B^{2/3}$ = Ferro (op. cit.)

(where W = wt. In kg; B = board area in m^2)

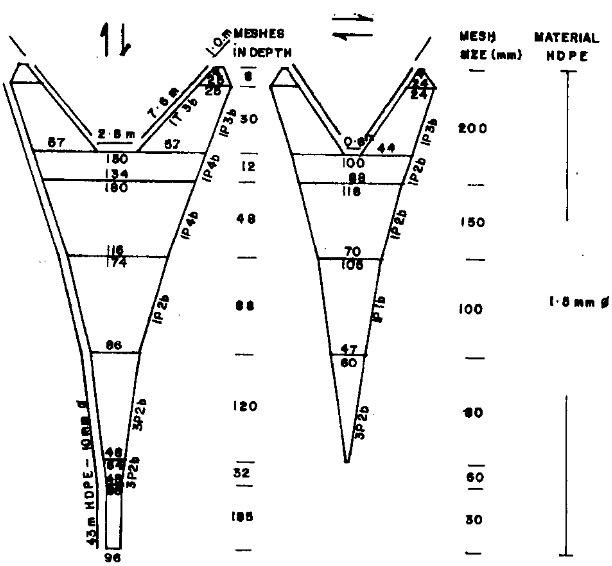

Fig. 3. 18.0 m RMT 8P Semipelagic Trawl

During the course of the investigations, the two experimental pair of otterboards were operated giving equal chances and keeping the various parameters such as fishing ground, gear, length of bridles, depth of operation, depth to warp ratio, trawling speed and duration of tow, constant. 64 comparative hauls of 1 h duration each were made with both pairs of otterboards during the span of 54 fishing days undertaken onboard MFB Matsyakumari (17.5 m OAL; 277 hp) capable of developing a trawling speed range of 2.4 to 3.7 knots while towing against and with the current at 700 rpm.

Results and Discussion

Details of fishing operations conducted along with the experimental gear systems are given in Table 1 and the particulars of specieswise catch obtained are presented in Table 2. Higher aspect ratio Suberkrub doors allow a large spreading force (Zygmunt, 1998) and Polyvalent doors are cambered to

Table 1. Details of fishing experimental operations

	1407x982 mm Polyvalent doors	1350x1000 mm High aspect ratio Suberkrub doors
No. of fishing cruises	25	29
No. of experimental hauls	64	64
Total towing duration	64 hrs	64 hrs
Depth of operational range (in m)	8-15 m	8-15 m
Depth warp ratio	1:5	1:5
Range of towing speed in knots	2.4-3.7	2.4-3.7
Range of vertical opening developed by the gear system (in m)	3.8-4.5	3.8-4.5
Catch of quality fish in Kg. &	321.0	399.75
Percentage composition	38.4	40
Total fish catch in kg.	1233.5	1638.75
Average catch per unit effort in kg	19.0	23.7

Table 2. Particulars of catch

	1407x982 mm Polyvalent doors	1350x1000 mm H.A. ratio Suberkrub doors
Pampus sp.	106.5	83.0
Megalaspis sp.	201.0	123.0
Trichiurus sp.	2.0	3.5
Polynemus sp.	2.0	1.25
Scomberomorus sp.	4.5	20.5
Sardinella sp.	–	3.0
Pellona sp.	–	122.0
Rastrelliger sp.	5.0	38.5
Parastromateus niger	–	5.0
Caranx sp.	462.5	802.0
Other miscellaneous fish	450.0	437.0
Total	**1233.5**	**1638.75**

influence the hydrodynamic spreading efficiency per unit area, suitable for use in bottom as well as off-bottom trawling practices (Anon, 1974).

Table 3. ANOVA of Quality fish

Source	Ss	Df	Ms	F
Total	8911.2128	140	–	–
Between otterboards	44.9953	1	44.9953	1
Error	8866.2175	139	63.785	

The percentage of quality fish caught was 38.4 while operating polyvalent doors whereas it was 40% when the gear system was rigged with high aspect ratio Suberkrub doors. 8.7% of the total fish caught when the gear was attached to polyvalent doors consisted of Pampus sp, which is a high quality catch component and the same was 5% when rigged with Suberkrub doors. The gear when rigged with both the designs of otterboards could develop a vertical opening in the range of 3.8 to 4.5 m well over 20% of the head rope length of the experimented gear which is considered to be optimum.

Table 4. ANOVA of other fishes

Source	Ss	Df	Ms	F
Total	118560.1680	140	–	–
Between otterboards	383.5280	1	383.5280	1
Error	118176.6400	139	850.1916	

Statistical analysis of the log transformed data were carried out separately for quality fish and rest of the catch, using the analysis of variance technique (Table 3 and Table 4). The results of the analysis show that there is no significant difference between doors at 5% level. Therefore, it could be reasonably concluded that both designs of otterboards experimented are efficient accessories for the capture of quality as well as other target species of fish in combination with 18.0m semipelagic trawl for off-bottom trawling in inshore waters.

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