Further Investigations on the Relative Efficiency of Different Shaped Otter Boards

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Horizontal curved, vertical curved and V-shaped otter boards were studied to compare their relative efficiency under identical fishing conditions. The gear operated with V-shaped otter boards performed well followed by the gear fitted with horizontal curved boards. Vertical curved boards were found to be comparatively less efficient, but with slight modification, can be used advantageously for bottom and off bottom fishes. Fishing at various depths with horizontal curved and V-shaped otter boards at different scope ratios showed better performance of horizontal curved boards at a scope ratio of 1:6 and V-shaped otter boards at a scope ratio of 1:5.

The successful function of trawling gear depends on the type, size, shape and bridle attachment of the otter boards, which are the main net mouth opening devices. Flat rectangular boards having length, greater than that of breadth are universally employed. Studies to improve the otter boards to suit different boats and fishing conditions have been made by Yakoliev (1955), Mastrasov (1958 a, b), Suberkrub (1959), Sharfe (1959 a, b), Dickson (1959), Benyami (1959, 1964), Takayama & Koyama (1961), Hamuro & Ishii (1959, 1961), Dale & Moller (1963). In India Satyanarayana & Mukundan (1963), Mukundan *et al.* (1967), Deshpande *et al.* (1968, 1970) and Narayanappa (1968) attempted to study the relative efficiency of different otter boards.

In the present paper, the authors have attempted to compare the efficiency of some otter boards with that of horizontal curved types already proved to be efficient in their earlier studies.

Materials and Methods

Three different shaped otter boards, namely, horizontal curved, vertical curved and V-shaped as specified in Table 1 and figures 1, 2 & 3 were employed in this study. Vertical boards are based on the design of Suberkrub (*loc cit.*) while that of V-shaped ones are based on the design of Captain Loo chi Ho of Taiwan, as reported by Dick Brett (1962). The three types of boards were operated in rotation with an 18.26 m two seam trawl net having 20 m single sweep wire system on each side. Fishing operations

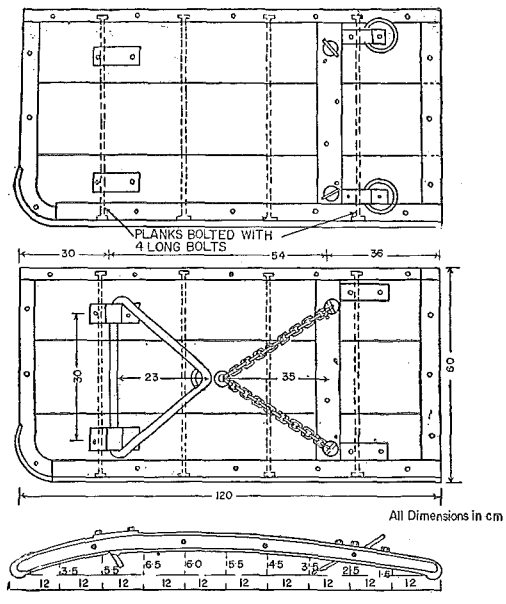

Fig. 1. *Design details of horizontal curved otter board (120 x 60 cm).*

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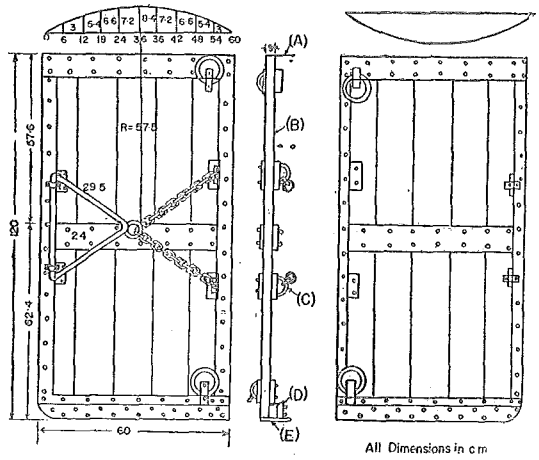

Fig 2. *Design details of vertical curved otter board (120X60cm)*

A–Circular iron plate; B–Iron strap; C–Shackles; D–Shoe and additional shoe plate; E–Circular bottom iron plate.

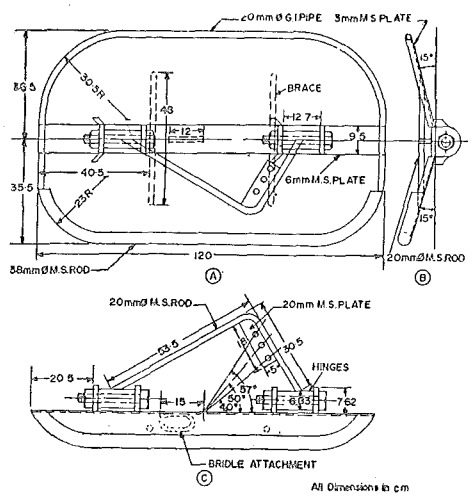

Fig. 3. *Design details of V-shaped otter board*

were carried out from 'Fishtech' No. 7 (12.76 m overall length wooden boat with 60 H. P. engine) off Kakinada during 1970 and 1971.

Results and Discussion

The details of fishing are presented in Table 2.

Table 1. *Specification of otter boards*

Type of board	Material	Length cm	Breadth cm	Area sq. m	Wt. in air kg	Wt. in water kg	Angle of attachment of bridle
Horizontal curved	Wood and iron	120	60	0.770	43.5	15.50	30°
Vertical curved	Wood and iron	121	65	0.780	48.5	21.00	28°
V– shaped	Iron	122	74	0.835	61.0	52.00	40–57°

Table 2. *Details of fishing with the three types of otter boards*

Type of otter board	Depth of operation m	Warp length m	No. of hauls	Towing time h	Average towing speed knots	Average spread between otter boards m	Average warp tension kg	Catch/ haul/h kg
Horizontal curved	15–45	90–220	65	65	2	21.63	454.72	50.45
Vertical curved	15–45	90–220	65	65	2	22.74	459.62	42.98
V-shaped	15–45	90–220	65	65	2	20.99	468.92	52.85

The data were analysed statistically and the analysis of variance presented in Tables 3, 4 and 5.

The horizontal curved and V-shaped steel otter boards found to be effective, were further studied to ascertain their behaviour at different scope ratios. These boards were operated at 15 m, 25 m and 35 m depth with scope ratios (Depth:Warp length) of 1:4, 1:5 and 1:6 keeping the fishing conditions constant and trawling speed at 2 knots. The results are presented in Table 6.

Table 3. *Analysis of variance*

	Catch											
	HC, VC, Vst				HC & VC				HC & Vst			
Source	DF	SS	MS	F	DF	SS	MS	F	DF	SS	MS	F
Total	194	19.8132	..	..	129	14.5355	..	..	129	12.4484	..	..
Between hauls	64	12.6332	0.1974	3.77*	64	10.7255	0.1676	2.92*	64	9.5084	0.1486	3.35*
Between otter boards	2	0.4794	0.2397	4.58*	1	0.1455	0.1455	2.54*	1	0.0984	0.0984	2.22
Error	128	6.7006	0.0524	..	64	3.6645	0.0573	..	64	2.8416	0.0444	..

HC–Horizontal curved VC–Vertical curved Vst–V shaped steel

**Significance at 1% level ($p < 0.01$)
*Significance at 5% level ($p < 0.05$)

Table 4. *Analysis of variance*

	Horizontal spread											
	HC, VC, Vst				HC & VC				HC & Vst			
Source	DF	SS	MS	F	DF	SS	MS	F	DF	SS	MS	F
Total	185	12556.55	..	..	123	7967.82	..	..	123	7286.33	..	..
Between hauls	61	6622.74	107.57	2.71	61	5702.86	93.49	3.08**	61	4522.76	741.44	1.72**
Between otter boards	2	1048.02	524.01	13.08**	1	410.31	410.31	13.05**	1	137.85	137.85	0.32
Error	122	4885.79	40.05	..	61	1854.64	30.40	..	61	2625.72	430.45	..

HC–Horizontal curved VC–Vertical curved Vst–V shaped steel
**Significance at 1% level ($p < 0.01$)

It is seen that out of the three scope ratios the horizontal curved board had the maximum scope ratio 1:6 and that for V-shaped 1:5 with an exception at 15 m depth.

Table 2 shows that the net operated with V-shaped otter board caught more fish when compared to nets fitted with horizontal and vertical curved boards by 4.64 and 18.67% respectively. Table 3 shows that the difference between the catches is significant ($p < 0.05$).

Table 5. *Analysts of variance*

	Warp tension											
	HC, VC, Vst				HC & VC				HC & Vst			
Source	DF	SS	MS	F	DF	SS	MS	F	DF	SS	MS	F
Total	188	230855.7784	..	..	125	164818.8016	..	..	125	165287.3016	..	..
Between hauls	62	133569.7784	2154.35	2.93**	62	117096.8016	1888.6581	2.49**	62	110915.3016	1788.9565	2.29**
Between otter boards	2	6242.1276	3121.06	4.25**	1	748.0079	748.0079	0.99	1	6062.5079	6062.5079	7.78**
Error	124	91043.3724	734.22	..	62	46973.9921	757.6450	..	62	48309.4921	779.1854	..

HC–Horizontal curved VC–Vertical curved Vst–V shaped steel

**Significance at 1% level ($p < 0.01$)

Table 6. *Catch per hour (kg) of horizontal curved and V-shaped steel otter boards at different scope ratios*

Depth (m)	15			25			35		
Scope ratio	1:4	1:5	1:6	1:4	1:5	1:6	1:4	1:5	1:6
Horizontal curved	7.0	26.5	39.0	12.0	29.0	36.0	13.0	37.0	92.00
V-shaped steel	16.0	14.0	10.1	48.5	59.3	46.3	64.8	100.0	84.00

Table 7. *Percentage composition of catch*

	Prawns big	Prawns small	*Lactarius* sp. & *Caranx* sp.	Sciaenids	*Synagris* sp. & *Upenoides* sp.	Silver bellies	Soles	Rays & Skates	*Saurida tumbil*	Miscellaneous	Total (kg)
Horizontal curved	1.10	1.92	9.85	13.25	25.25	10.95	6.75	11.37	14.96	4.60	3,299.25
Vertical curved	1.29	1.04	9.35	15.82	26.65	14.25	7.70	8.44	12.76	2.70	2,794.00
V-shaped	1.15	2.52	12.75	9.18	22.06	12.15	8.35	12.44	15.53	3.87	3,435.50

The percentage composition of catch has been worked out as shown in Table 7.

Examination of Table 7 reveals that there is no appreciable difference in the catch composition. However, it is interesting to note that the percentages of off bottom fishes are slightly more in the net with vertical curved boards. This suggests its use for both bottom as well as off bottom fishes, with minor variation in fishing techniques even though these boards are intended for mid water trawling.

The analysis of variance with respect to horizontal spread (Table 4) indicates that the variation between the three otter boards is significant ($p<0.01$), the average spreads being at 21.63m, 22.74m and 20.99m. The differences in spread between horizontal curved and vertical curved boards also exhibited high significance ($p<0.01$), whereas the difference between horizontal curved and V-shaped doors, is not found to be significant.

The average horizontal spread of the trawl mouth (Table 2) shows vertical curved otter boards developed more mouth opening horizontally but with less catch rate. Hence a further attempt was made to correlate the catch rate with horizontal opening of the net in each case. The percentage frequency of spread has been worked out and presented in Table 8. Figure 4 shows the corresponding catch per trawling hour.

Table 8. *Percentage frequency of horizontal spread*

Ranges of horizontal spread m	% Frequency Horizontal curved otter board	Vertical curved otter board	V-shaped steel otter board
15.5–17.0	1.6	3.2	3.2
17.1–18.5	9.5	3.2	14.3
18.6–20.0	11.1	6.5	14.3
20.1–21.5	25.4	15.8	31.8
21.6–23.0	30.2	23.4	15.8
23.1–24.5	14.3	30.1	14.3
24.6–26.0	7.9	9.8	6.3
26.1–27.5	..	4.8	..
27.6–29.0	...	1.6	..
29.1–30.5	..	1.6	..

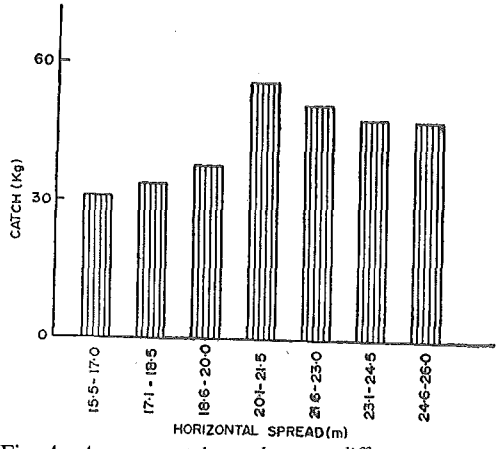

Fig. 4. *Average catch per hour at different ranges of horizontal opening of the net*

Table 8 shows that V-shaped board gave more frequency in the spread range of 20.1-21.5 m which in turn gave the highest catch rate as could be correlated with Fig. 2. Similarly the horizontal curved boards gave maximum frequency of horizontal spread at the ranges of 21.6-23.0 m which gave the catch rate next to V-shaped boards.

Horizontal spread of each otter board at various depths between 15 to 50m together with corresponding catch rate and warp tension are shown in figures 5, 6 and 7. These figures show that good catches were obtained, when the gears were operated between 30 to 40 m depths. The horizontal spread was also more at these depths. Within

these depth ranges, it could be seen that the horizontal spread and catch of gear with V-shaped doors were more, followed by rectangular curved doors.

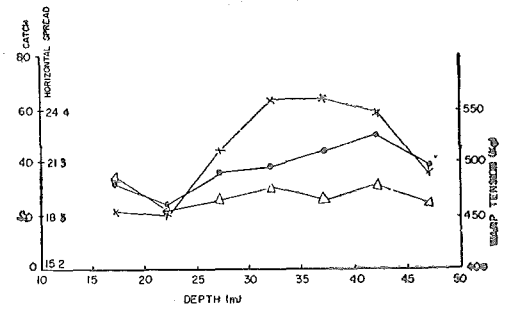

Fig. 5. *Catch, horizontal spread and warp tension at different depth ranges for horizontal curved otter boards*

×—× Catch

●—● Horizontal spread

▷—▷ Warp tension

Comparatively higher warp tension at lower depths (Figs. 5, 6 & 7) may be due to more bottom friction which in turn reduces the horizontal spread. At higher depths the tension appears to have been stabilised at 455, 450 and 475 kg for each of the otter boards. The variation in tension between gears is significant ($p<0.01$, Table 5) and their averages worked out to be 454.72, 459.62 and 468.92 kg respectively. It is also seen that warp tension between horizontal

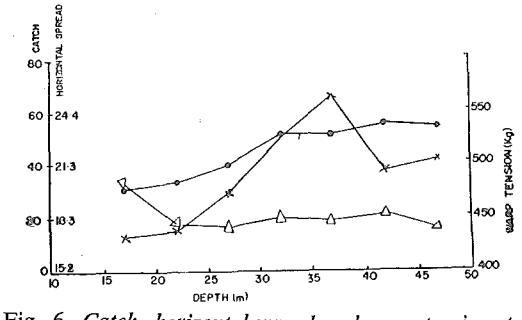

Fig. 6. *Catch, horizontal spread and warp tension at different depth ranges for V-shaped steel otter board.*

×—× Catch

●—● Horizontal spread

▷—▷ Warp tension

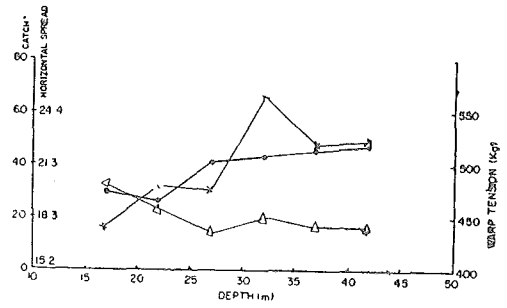

Fig. 7. *Catch, horizontal spread and warp tension at different depth ranges for vertical curved otter board.*

×—× Catch

●—● Horizontal spread

△—△ Warp tension

and vertical curved boards is not significant whereas warp tension between horizontal curved and V-shaped boards is significant, ($p<0.01$, Table 5).

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