Evolution of Suitable Trawl Nets for Medium Size Trawlers. 1 - Comparative Fishing Efficiency Between 32 m Bulged Belly, Long Wing and Four Panel Trawls

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Comparative studies of the efficiency of 32 m bulged belly, long wing and four panel trawls have shown that the bulged belly trawl to be superior to the other nets in catching bottom fishes and column fishes. 40% of the bottom fishes and 48% of the column fishes were caught by the bulged belly trawl. However, for prawn catch, the long wing trawl appears to be better as it landed 52% of the total prawn catch of the three nets. Bulged belly trawl was found to be next only to long wing trawl in this respect.

Ever since the introduction of trawling in Indian waters, emphasis was laid on the development and improvement of trawl nets suitable for smaller boats operating between 10–25 m depth. Deshpande (1960) introduced a beam trawl with standard size beams. In order to achieve more of horizontal mouth opening of the net, otter trawling with two seam trawls was introduced which was soon followed by the four seam trawls aimed at catching shrimps and off bottom fishes (Deshpande *et al.*, 1968). Further investigations with the four seam trawls resulted in the development of more improved types of trawls, namely long wing trawls, bulged belly trawls and four panel trawls (Varghese *et al.*, 1968; Kartha & Sadanandan, 1973). The six seam trawls (Deshpande *et al.*, 1970) and high opening trawls are recent additions suitable for catching column fishes in the event of failure of the prawn fishery. The present accent is on medium size boats suitable for fishing upto 50 m depth with diversified fishing methods. In this connection, the need for development of suitable trawls for prawns and fishes, to be operated from these boats assumes importance and the present paper reports the attempt of the authors in that direction.

Materials and Methods

Three different design concepts of trawl nets, namely, bulged belly trawl, long wing
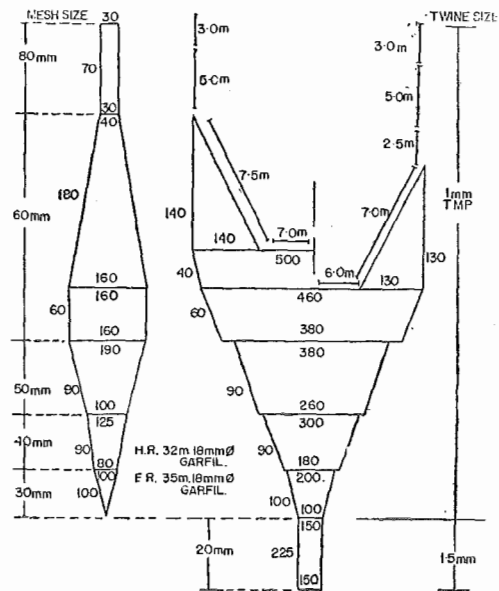

Fig. 1 *32 m Bulged belly trawl*

trawl and four panel trawl each having a head rope length of 32 m was employed in the study. The design details of these three nets are given in figures 1, 2 and 3 and that of otter boards in figure 4. The details of the net such as requirement of twine, rope, number of meshes and cost are presented in Table 1. Fishing was carried out from the CIFT research vessel Sindhukumari of 15 m overall length. All the three nets were operated on each day giving equal chances for all the three nets. Parameters such as depth, length of rope, trawling speed, duration of each haul were kept constant for the three nets while fishing. Trials were carried out at depths 20–25 m, 25-30 m,

30–35m, 35–40m off Cochin from October to May of each year from 1972–1976. The data on the catch of prawn, column fishes and bottom fishes were recorded separately depthwise, for each net (Table 2) and analysed statistically (Tables 3, 4 & 5)

Results and Discussion

A total of 10,433 kg of fish and prawns were caught by the three nets, out of which 40% of the catch were accounted by the bulged belly trawl. The long wing trawl and four panel trawls caught only 33% and 27% of the total catch respectively (Table 2)

Table 1. *Details of the three nets*

Net	Total meshes	Quantity of rope and twine kg	Cost Rs/kg	Fabrication charges Rs	Total cost of net Rs
Bulged belly	4,10,000	Twine 30	26.00 24.00	1690	2758.00
Long wing	2,15,000	Twine 16 Rope 12	26.00 24.00	900	1614.00
Four panel	3,90,000	Twine 29 Rope 12	26.00 24.00	1610	2652.00

Table 2 *Catch details of the three nets at different depths*

| Depth of operation	No. of hauls taken	Bulged belly trawl				Long wing trawl				Four panel trawl			
		Prawn kg	Column fish kg	Bottom fish kg	Total kg	Prawn kg	Column fish kg	Bottom fish kg	Total kg	Prawn kg	Column fish kg	Bottom fish kg	Total kg
20–25 m	24	44	12	200	256	111	8	121	240	33	34	205	272
25–30 m	54	39	5	963	1007	55	1	1140	1196	24	4	839	867
30–35 m	36	30	486	396	912	48	152	483	683	20	424	220	664
30–35 m	24	Nil	183	614	797	Nil	29	546	575	Nil	95	366	461
35–40 m	45	Nil	39	1084	1123	Nil	22	725	747	Nil	25	608	633
Total (kg)		113	725	3257	4095	214	212	3015	3441	77	582	2238	2897
Catch/hour					66				56				47
Catch (%)		28	48	40	40	52	14	35	33	20	38	25	27
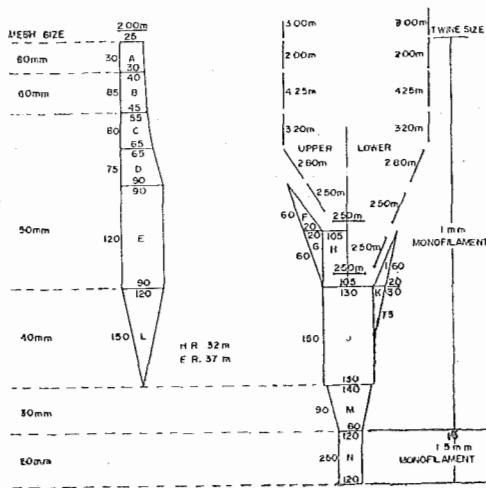
Fig. 2. *32m Long wing trawl*

The bulged belly trawl was found to be more efficient in comparison with the other two, so far as the catching rate and other performance are concerned.

The results also show marked differences in the catch composition at various depths. At 20-25m depth prawn catch was more and a decrease in prawn catch was evident when the depth increased and no prawns caught from a depth of 35 to 40m. 76% of the total prawn catch was from 20-30m,
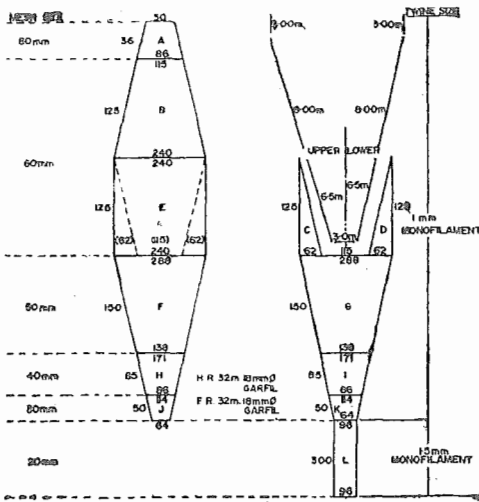

Fig. 3. *32m Four panel trawl*

while the maximum fishes caught were from 25-35 m. The analysis of variance (Table 3) for total catch showed that between nets variation was highly significant ($p < 0.001$) and bulged belly was more efficient in the catching rate (Table 2) followed by long wing trawl.

The catch data of prawns, column fishes and bottom fishes were further analysed (Tables 4 & 5) to find out the suitability of each net for the different fisheries. Analyses of prawn catch at 20-25 m and 25-30 m depth have shown that the long wing to be more efficient for prawns compared to the other two nets. Table 4 shows that prawn catch at 20-30 m depth is significant ($p < 0.01$) between nets and significant ($p < 0.001$) between days. As can be seen from the catches, long wing trawl appears to be more suitable for prawns at 20-30 m depth. The efficiency of long wing trawls can be attributed to its specific design, such as extra long wings sweeping more area of the sea bed while trawling.
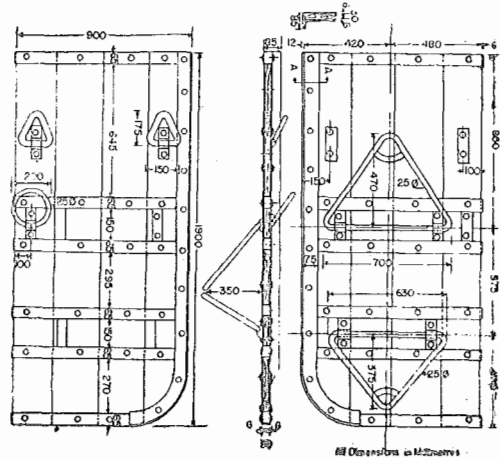

Fig. 4. *Flat rectangular otter board (1900x900)*

Altogether a total of 10,030 kg fishes were caught by the three nets which accounted to 96% of the total catch. The proportion of bottom fishes to that of column fishes was 1:6. 47% of the total column fishes and 40% of the total bottom fishes were landed by the bulged belly trawl thereby proving its efficiency over the other nets. The long wing caught more of bottom fishes (35%) and in this respect was superior to the four panel one which accounted only 25% of the

total bottom fishes, while in the case of column fishes four panel was better than the long wing trawl as it caught 38% of the column fishes. Table 5 shows that the catch between nets is highly significant ($p < 0.001$) and bulged belly to be more efficient. The four panel net also caught more column fishes but found to be next to bulged belly.

The difference between the catches is also highly significant ($p < 0.001$) thereby showing that bulged belly to be more suitable for bottom fishes. When compared to four panel net the long wing was found better for bottom fishes. The percentage difference of the different varieties (Fig. 5) of fishes caught by the various nets also shows

Table 3. *Analysis of variance of total catch*

Source	Sum of squares	Degree of freedom	Mean sum of squares
Between nets	0.48385	2	0.24193***
Between days	12.84781	60	0.21413***
Error	3.92429	120	0.03270
Total	17.25595	182	
Mean catch	Bulged belly	Long wing	Four panel
Logarithmic scale	1.72852	1.68597	1.60457
Original scale	52.52	47.53	39.24

*** Significant at 0.1% level (P < 0.001)

Table 4. *Analysis of variance of prawn catch at 20–30m depth*

Source	Sum of squares	Degree of freedom	Mean sum of squares
Between nets	0.490541	2	0.2452705**
Between days	14.727648	25	0.58910592***
Error	1.564203	50	0.03128406
Total	16.782392	77	
Mean catch	Bulged belly	Long wing	Four panel
Logarithmic scale	0.4116	0.5230	0.3295
Original scale	1.58	2.33	1.13

**Significant at 1% level (p < 0.01)
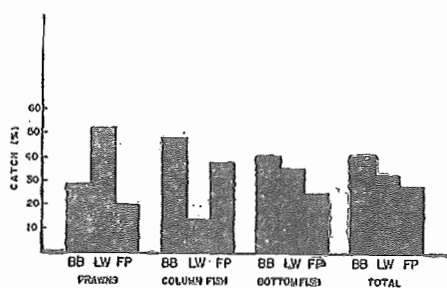***Significant at 0.1% level (p < 0.001)

Fig. 5. *Comparative catch details of the three nets*
BB- Bulged belly
LW- Long wing
FP- Four panel

better performance of the bulged belly trawl. It is concluded that the long wing trawl, 50% cheaper than the other two trawls (Table 1) can be employed up to a depth of 20 m for prawns. The bulged belly can be recommended for deeper waters. But its efficiency beyond 40 m is yet to be studied.

References

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Table 5. *Analysis of variance of column fish and bottom fish*

Source Column fish	Sum of squares	Degree of freedom	Mean sum of squares
Between nets	0.87684	2	0.43842***
Between days	56.06793	60	0.93447***
Error	5.28449	120	0.04404
Total	62.22920	182	
Mean catch	Bulged belly	Long wing	Four panel
Logarithmic scale	0.45417	0.29271	0.41829
Original scale	1.85	0.96	1.62
Bottom fish			
Between nets	0.90547	2	0.45273***
Between days	26.74270	60	0.44571***
Error	4.79908	120	0.03999
Total	32.44725	182	
Mean catch	Bulged belly	Long wing	Four panel
Logarithmic scale	1.60795	1.57540	1.44509
Original scale	39.54	36.61	26.87

***Significant at 0.1% level ($p < 0.001$)