

A New High Opening Trawl for Veraval Waters

K. K. KUNJIPALU, M. R. BOOPENDRANATH, K. GOPALAKRISHNAN* and
A. C. KUTTAPPAN**

Veraval Research Centre of Central Institute of Fisheries Technology, Veraval - 362 265

The newly developed 25 m high opening trawl possesses the properties of a high rising bottom trawl and a semi-pelagic trawl. The new gear is effective for the capture of demersal and semi-pelagic fishes. The net offered more horizontal opening and less resistance with significantly high catch of ribbon fish when compared with bulged belly trawl.

Emphasis on more head-line height is for catching off bottom fishes also by a ground trawl. This is effected by using a kite (Takayama & Koyama, 1959; Nakamura, 1971) or by multiplication in the number of panels/seams of the net as in six-seam, eight-seam, or in the body of the gear as in the vertical twin body trawl (Nakamura, 1971; Koderia, 1971). The high opening ground trawls (Garner, 1967, 1978) and multi-purpose semi-pelagic trawls (Brandt, 1971) have been so designed to give more head line height while keeping contact with the sea-bed. Suitability of a six-seam trawl along the north west-coast has been reported by Deshpande *et al.* (1970) and a dual purpose trawl on the south-west coast by Kartha & Sadanandan (1973). Kunjipalu (1980) observed a good percentage of ribbon fishes in the trawl catches off Veraval. A net to catch these semi-pelagic species is therefore designed on the lines of an eight panelled multi-purpose and semi-pelagic type trawl net and the results of investigations are detailed in this communication.

Materials and Methods

The 25 m high opening trawl was operated from the Central Institute of Fishery Technology vessel *Fishtech viii* (15.2 m OAL fitted with 165 hp engine) during 1978-80. The gear was operated

along with 25 m bulged belly trawl described by Kunjipalu *et al.* (1979), in combination with flat rectangular otter boards of 1524 mm x 762 mm size and 100 kg weight each (Kuriyan *et al.*, 1964) and double

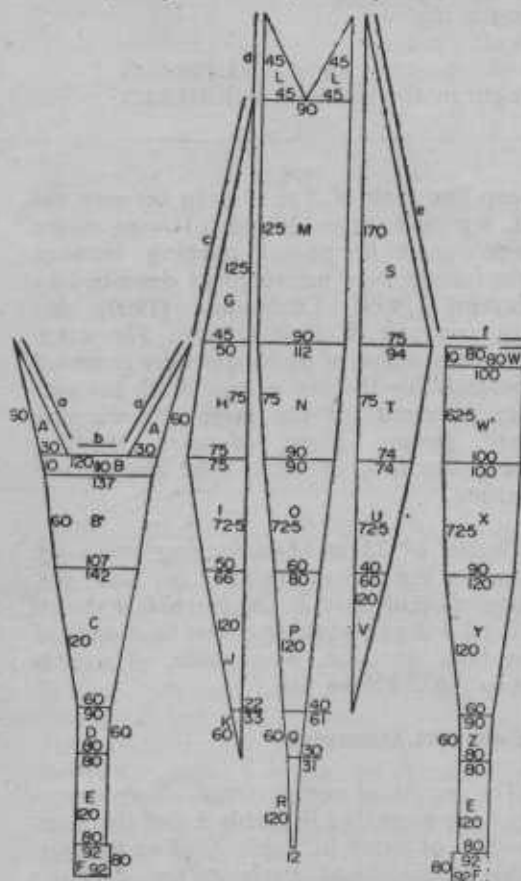


Fig. 1. 25 m high opening trawl

*Present address: Goa Base of Fishery Survey of India, Panaji, Goa

**Central Institute of Fisheries Technology, Cochin-682029

Table 1a. Details of lines and ropes

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>
Material		High density polyethelene				
Diameter, mm		18.....				
Breaking strength, kg		3460.....				
Length, m	4.0	2.25	8.2	2.8	11.0	3.0
Head rope, m	25					
Foot rope, m	32.25					
Rib lines	30 m x 4 Nos 6 mm HDPE (Breaking strength 425 kg)					

Table 1b. Details of floats, sinkers and otter boards

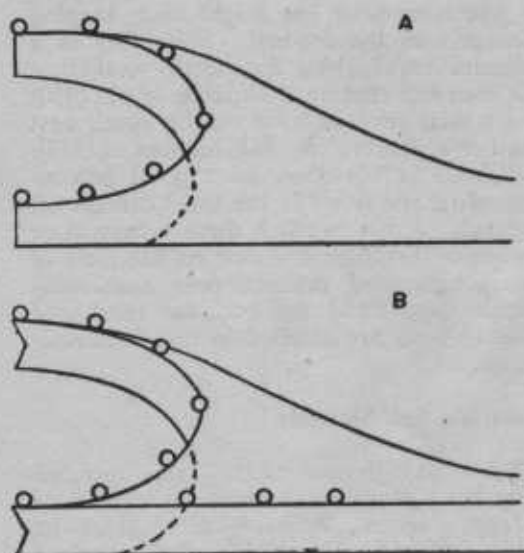
	Floats	Sinkers	Otter boards
Number	19 (13+6)	—	2
Material	Hard plastic	Iron	Iron and wood
Shape	Spherical	Link chain	Rectangular flat
Diameter, mm	150	6	—
Length, mm	—	—	1524
Breadth, mm	—	—	762
Static buoyancy, kg	1.550 each	—	—
Weight in air, kg	0.300 each	30.00	100.00 each

sweep line each of 5 m long in between the net leg and otter board. Towing warp tension and horizontal opening between otter boards were measured as described by Benyami (1959), Deshpande (1960) and Satyanarayana & Nair (1965). The catch and composition of each haul were recorded separately for the two gears. Both the nets were operated on the same day keeping depth, ground, length of warp, trawling speed, duration of each haul and course constant.

Details of 25 m high opening trawl are shown in Fig. 1 and Tables 1 (a) and (b). Attachment of floats in the two nets is shown in Fig. 2. Fifty seven comparative hauls each of one hour duration, were made. The nets landed 8672.256 kg fish.

Results and Discussion

The results of comparative fishing operations are presented in Table 2 and the composition of catch in Table 3. For the purpose of statistical analysis, the data on horizontal opening was taken as such but

**Fig. 2.** Distribution of floats in traditional (A) and high opening bottom trawls (B).

data on tension and catch were converted to log values. The variance ratio test (F) was employed for comparing the variability and paired 't' for testing "no

Table 2. *Results of comparative fishing operations with 25 m bulged belly trawl and 25 m high opening trawl*

	25 m bulged belly trawl	25 m high opening trawl
Number of hauls	57	57
Fishing effort, h	57	57
Depth range, m	26-50	26-50
Range of warp, m	130-250	130-250
Trawling speed, knots	2.5	2.5
Horizontal opening, m		
Average	13.93	16.11
Range	12.00-20.00	13.84-22.00
Warp Tension, kg		
Average	604.160	596.560
Range	530-684	506-658
Catch, kg		
Total	3881.400	4790.850
CPUE, kg/h	68.095	84.050
Range, kg/h	7.1-159.3	9.0-305.0

Table 3. *Composition of catch in 25 m bulged belly trawl and 25 m high opening trawl*

	25 m bulged belly trawl		25 m high opening trawl	
	weight kg	%	weight kg	%
Quality fish	69.8	34.0	135.4	66.0
Ribbon fish	813.0	34.5	1543.0	65.5
Lactarius	458.0	48.0	493.0	52.0
Elasmobranchs	49.0	83.0	10.0	17.0
Cephalopods	160.0	52.3	146.0	47.7
Prawns	7.1	56.3	5.5	43.7
Sciaenids	196.0	50.0	196.0	50.0
Miscellaneous fish	2128.5	48.5	2262.0	51.5
Total	3881.4	44.8	4790.9	55.2

differences" in the mean horizontal opening, tension and catch. The variance of the two nets, the variance ratio (F), degree of freedom, the modulus of the mean difference $\bar{d}$, unbiased estimate of the population, standard deviation (S) and the paired 't' values are given in Table 4.

The variance ratios (F) were not significant at 5% level in all the cases except in the quality fish, indicating equal variance of the experimental data at 5% level for both the nets. The paired 't' values for testing the difference in mean horizontal opening of the two nets were significant at 0.1% level.

High opening trawl has given significantly high horizontal opening compared to bulged belly trawl. But for the mean catch of ribbon fishes, there were no significant difference in total catch, catch of quality and miscellaneous fish and tension at 5% level, between the two nets. Though statistically not significant, data (Tables 2 and 3) indicate more of total catch, quality fishes and ribbon fishes in high opening trawl. Generally ribbon fish and quality fish swim away from bottom but the other fishes generally tend to be on the bottom or near the bottom. As the catch of ribbon fish and quality fish alone are more in the high opening trawl, it

Table 4. Statistical comparison of high opening trawl and bulged belly trawl

	Horizon- tal opening	Tension	Total catch	Quality fish	Ribbon fish	Lactar- ius	Cepha- lopods	Prawns	Sciaenids	Miscel- laneous
Variance (Bulged belly)	2.5427	0.0008	0.0880	0.0938	0.4164	0.4069	0.1725	0.0072	0.2358	0.2806
Variance (high opening)	2.6161	0.008	0.1275	0.1591	0.4678	0.4175	0.1583	0.0058	0.2386	0.2299
F	1.03	1.00	1.45	1.70*	1.12	1.03	1.09	1.25	1.01	1.22
Degrees of freedom	(56,56)	(56,56)	(56,56)	(56,56)	(56,56)	(56,56)	(56,56)	(56,56)	(56,56)	(56,56)
$ d $	2.1743	0.0054	0.0652	0.0682	0.1639	0.0115	0.0256	0.0095	0.0059	0.0358
S	1.2086	0.0208	0.2911	0.2980	0.5378	0.1819	0.2387	0.0614	0.2494	0.3277
t'	13.585***	1.946	1.691	1.727	2.301*	0.477	0.809	1.168	0.178	0.826
Degrees of freedom	56	56	56	56	56	56	56	56	56	56

* = $P < 0.05$; ** = $P < 0.01$; *** = $P < 0.001$

can be presumed that the new gear would have developed better vertical mouth opening and is suitable and efficient for the capture of semi-pelagic species. The extra panels, rib lines and floats in the high opening trawl might have offered a better vertical opening. High opening trawl also offered a better horizontal opening and lesser (Tables 3 and 4) warp tension compared to bulged belly net. It was not necessary to enhance the engine r.p.m to tow the high opening trawl at the required towing speed of 2.5 knots. The high opening trawl can be employed as a multi-purpose trawl for exploiting both bottom and semi-pelagic fishes without any additional requirements like increased r.p.m and fuel consumption of the engine, the two pre-requisites for mid-water and pelagic trawling.

The high opening trawl with its many sections and joints has 2,47,000 meshes when compared with 3,30,000 meshes of the bulged belly trawl. Additional rib lines offer a distribution of resistance at the mouth of the net and the triangular panels offer enough slack to offer better opening of the mouth. The net is so designed to develop a round mouth to give better flow through the water. Additional floats can be attached to the high opening trawl at the upper rib lines (Fig. 2) when compared with the traditional nets. The lower rib lines enhance the stability of the foot rope holding it to the bottom at all times, when the head line tends to lift up. The net is capable of giving greater spread, much better lift, while still firmly in contact with the sea-bed.

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