

# A NEW ONE-BOAT MID-WATER TRAWL FOR INDIAN WATERS

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Eventhough the rich and variegated pelagic fishery resources of our West-coast is well known much has to be done for a judicial and systematic exploitation on a commercial scale. To fill up this lacuna the present paper describes in detail a new design of 10.5 m. four-equal panel mid-water trawl, its rigging and operation from a medium size vessel. Comprehensive comparative efficiency studies of this gear with a 10.5m. unequal panel mid-water trawl established the superiority of the new gear. From the results based on the mouth opening, resistance and the catch it is opined that this new gear can not only be used on a commercial scale in harvesting the seasonal pelagic fishery, but also as a secondary supporting gear in shrimp fishery in places like Veraval, where there is a commercially exploitable yield of quality fishes like hilsa, pomfret, seer etc., without much modification from conventional stern trawlers.

## INTRODUCTION

The concept of a mid-water trawl dates back to the beginning of the century. Much in this line has been reported by various authors (Akyuz, 1959; Barraclough and Needler, 1959; Grouselle, 1959; Larsson, 1959; McNeely, 1959; Okonski, 1959 & 1964; Parrish, 1959 & 1964; Suberkrub, 1959; Scharfe, 1964; Steinberg, 1964). The Scandinavians are the first to take up mid-water trawling during late forties followed by other countries. The use of the gear has increased greatly in recent years.

The one-boat type has also been operated from the same time but are yet to achieve the same degree of importance. Perumal (1966) and Sivan, *et al.* (1970), have described one-boat type mid water trawl operated off Cochin and Veraval, respectively. Lack of high powered vessels and electronic equipments essential for successful mid-water trawling seems to have come in the way of its adoption on commercial scale, in India. Efforts were made to evolve a simple design, rigging and operation technique, to convince the commercial fishermen about this type of

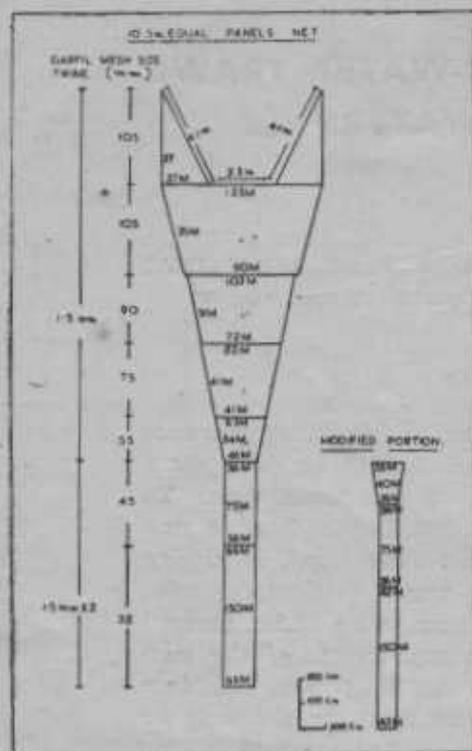


Fig. 1  
10.5 m. Four equal panel net.

fishing. The present investigations were carried out off-Veraval on the north-west coast of India.

#### GEAR AND ACCESSORIES

A 10.5 m. four-equal panel net was designed and fabricated specially to suit the conditions explained earlier. While designing, particular attention was paid for maximum vertical mouth opening, extension of lower bosom as much as the upper, smooth water flow, minimum visibility and minimum disturbance in the path of the fish. The design details of the net are given in Fig. 1. A 10.5 m. unequal panel net (Sivan, *et al.*, *op. cit.*) with 38 mm. meshes in cod-end was used as the control.

Though several designs such as 'Suberkrub' otterboards (Suberkrub, *op. cit.*) Wing-boards (Larsson, *op. cit.*), Dual-fin otterboards (Barracough, *et al.*, *op. cit.*) and Hydrofoil otterboards along with wing-boards "Phantom" (McNeely, *op. cit.*) have been successfully used by different workers, vertical curved "Suberkrub" type otterboards (Sivan, *et al.*, *op. cit.*) of 125 cm. x 60 cm. weighing 50 kg. were used due to the special characteristics such as very little or no turbulence and horizontal or slightly upward shearing action (Suberkrub, *op. cit.*).

The rigging of the gear and its accessories was more or less similar to the conventional bottom trawling with double bridles except for the extra length and the specially designed depressors on the foot-rope bridles almost mid-way as shown in Fig 2. The length of the foot-rope bridles were slightly longer (0.5m. to 1m.) than the head rope bridles. This feature as well as the positioning of depressors were expected not only to give proper vertical opening but also to keep the otterboards slightly above the centre line of the net. No traces of scurrying on the base of the otterboards against the sea-bed was observed any time justifying the anticipated effect.

21 numbers of spindle shaped lead sinkers, each weighing 225 gm., were introduced in a coir rope of 19mm. dia. and was attached to foot rope in loops of 62 cm. length. No extra devices other than the spherical aluminium floats of 12.7 cm. dia. used to lift-up the head rope.

The 10.5 m. equal panel net was modified slightly by reducing the width of the cod-end and by adding an extra piece in the belly depth to get the same tapering as before (Fig. 1). This was necessitated as the cod-end was badly

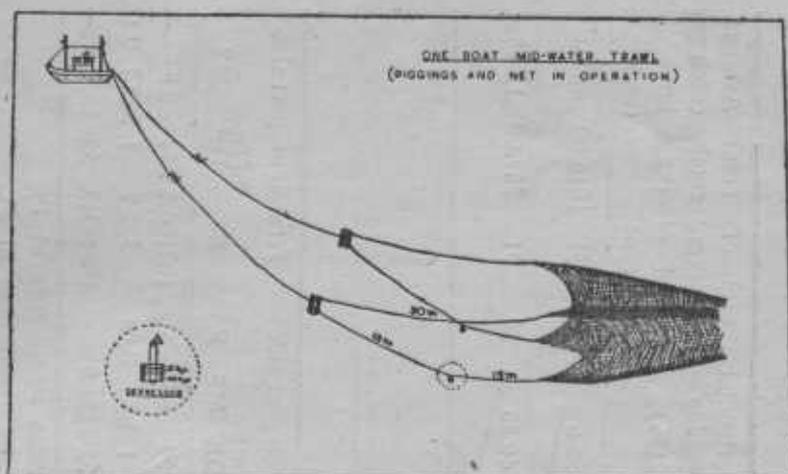


Fig. 2.

One boat mid-water trawl (Rigging and net in operation).

damaged after a few initial operations, by the fishes, due to the availability of free swimming space inside the cod-end.

#### DETAILS OF OPERATION

The gear in question was operated on each day by rotation keeping the fishing parameters including the weight of depressors, length of bridles as well as otterboards constant for both the nets. A first set of 33 paired hauls were taken during December, 1971 to April, 1972 and a second set during February and March 1973 from the departmental vessel 'Fishtech No. 8' (L. O. A. 15.2 m. with 82/102 H P. engine). The data for tension and horizontal opening were collected by methods described by Satyanarayana, *et al.* (1965), Benyami, (1959) and Deshpande (1960).

#### RESULTS AND DISCUSSION

The first set of data were spread over 20 fishing trips and the second confirmatory set over 12 fishing trips. The nets were randomised over the fishing days

throughout the experiment. The two sets of data collected were analysed separately.

The data of the first set of operations clearly indicate a better efficiency of the equal panel net over the unequal panel net without any significant difference in the resistance though a better horizontal spread was noticed in case of the latter (Table I). The data were analysed statistically also using the analysis of variance technique by converting the figures to their corresponding logarithmic values. Table II, showing the analysis of variance clearly indicates a significantly higher efficiency of the equal panel net ( $P \leq .01$ ) in respect of the catch. It also indicates a significantly higher ( $P \leq .05$ ) horizontal spread in case of unequal panel and no significant variation in tension. This significantly higher catch at a lower degree of horizontal spread can be attributed to the higher vertical opening of the new gear and near to equal resistance offered by both can be explained as the effect of higher horizontal spread in the control net.

TABLE I  
Details of operation and results

Nets	No. of hauls	Depth range (m.)	Scope ratio	Towing speed per hr. (kw.)	Total duration (hr.)	Tension on warps(kg.)		Horizontal opening (%)	Length of bridles (m.)		Total catch (kg.)	Average catch per hour (kg.)
						Port side	Starboard side		Head rope	Foot rope		
10.5 m. Equal panel net	33	25-35	1.5	2.75	25	303.6	302.6	38.6	30	31	1016.00	40.60
10.5 m. Unequal panel net	33	25-35	1:5	2.75	25	297.3	297.3	40.36	30	31	387.00	15.48

TABLE II  
Analysis of variance

Source of variation	SS	DF	Catch		F	Percentage horizontal opening				Tension on port side warp				Tension on port side warp			
			MS	F		SS	DF	MS	F	SS	DF	MS	F	SS	DF	MS	F
Total	23.3262	65	—	—	95.47	33	—	—	116149.6	53	—	—	102164.2	51	—	—	
Between nets	2.8279	1	2.8279	8.83**	12.57	1	12.57	4.85*	88.1	1	88.1	0.04	322.7	1	322.7	0.16	
Error	20.4983	64	0.3203	—	82.90	32	2.59	—	116059.5	52	2231.9	—	108141.5	52	1958.5	—	

Average logarithmic catch/haul

Equal panel net = 1.2707

Unequal panel net = 0.8567

\*\* Indicates significance at 1%

\* Indicates significance at 5%

TABLE III  
Details of operation and results

Nets	No. of hauls	Depth range (m.)	Scope ratio	Trawling speed per hr. (kw.)	Total Duration (hr.)	Tension of warps(kg.)		Horizontal opening (%)	Length of bridles		Total catch (kg.)	Average catch per hour (kg.)
						Port side	Starboard side		head rope	foot rope		
10.5 m. Equal panel net	22	25-35	1:5.25	2.75	18 45	315.7	312.9	42.46	20	20.5	766.50	40.88
10.5 m. Unequal panel net	22	25-35	1:5.25	2.75	18 45	305.5	307.4	45.19	20	20.5	446.55	23.80

TABLE IV  
Analysis of Variance

Source of variation	SS	Catch			% horizontal opening				Tension on port side warp				Tension on port side warp			
		DF	MS	F	SS	DF	MS	F	SS	DF	MS	F	SS	DF	MS	F
Total	6.3832	37	—	—	248.6991	37	—	—	23526.35	37	—	—	24635.06	37	—	—
Between nets	0.5167	1	0.5167	9.08*	69.3090	1	69.3090	20.13*	900.66	1	900.66	3.35	284.63	1	284.63	1.36
Between hauls	4.8419	18	0.2690	4.73*	117.4245	18	6.5235	1.89	17796.85	18	988.71	3.68*	20607.06	18	1144.83	5.50*
Error	1.0246	18	0.0569	—	61.9656	18	3.4425	—	4828.84	18	268.26	—	3473.37	18	207.96	—

Average logarithmic catch/haul  
 Equal panel net = 1.3427  
 Unequal panel net = 1.1095

\* Indicates significance at 1%

TABLE V (a)  
Catch composition (1st set of operations)

Species of fish	catch (kg.)	% of the total catch	% in equal panel net	% in the unequal panel net
<i>Sciaenids sp.</i>	684.00	48.75	70.39	29.61
<i>Trichiurus sp.</i>	245.00	17.46	70.20	29.80
<i>Chirocentrus sp.</i>	36.00	2.57	40.28	59.72
Rays	102.00	7.27	90.20	9.80
Eels	69.00	4.92	76.81	23.19
<i>Pellona sp.</i>	2.00	0.14	100.00	Nil
Bombay duck	22.00	1.57	95.45	4.55
Miscellaneous fish	243.00	17.32	74.07	25.93
Total	1403.00	—	—	—

TABLE V (b)  
Catch composition (2nd set of operations)

Species of fish	Catch (kg.)	% of the total catch	% in equal panel net	% in the unequal panel net
<i>Sciaenids sp.</i>	600.60	49.51	61.20	38.80
<i>Lactarius sp.</i>	296.00	24.40	66.89	33.11
<i>Trichiurus sp.</i>	201.50	16.61	65.01	34.99
Eel	31.00	2.56	61.29	38.71
<i>Chirocentrus sp.</i>	50.25	4.14	57.21	42.79
Rays	2.00	0.16	100.00	Nil
<i>Pellona sp.</i>	11.50	0.95	54.35	45.65
Seer	2.50	0.21	80.00	20.00
Pomfret	3.50	0.29	57.14	42.86
Miscellaneous fish	14.30	1.18	69.93	30.07
Total	1213.05	—	—	—

To confirm the above results, a second set of data were collected keeping all the parameters of the earlier set same, except for the bridle length. In this case the bridle length was 20 m. instead of 30m. employed earlier. The results are given in the Tables III & IV. For the purpose of analysis the catch per haul figures were converted to their corresponding logarithmic values. It could be concluded that the significantly higher catch at 1% level of the new gear was in conformity with the first series.

Tables V (a) & (b) show the catch composition of both the nets in the two series. There is no significant difference in the composition of the catch except for the higher quantum of all the species in case of the equal panel net. The difference in the length of the bridles in the two series seemed to have a significant effect on the efficiency of the gears (Table I & III). This may be an indication for further systematic study on the optimum bridle length for a particular design.

#### CONCLUSION

The present investigations were aimed at evolving a suitable mid-water trawl, its rigging and operational technique. The analysis of the data collected clearly indicates the superiority of the new gear in increasing the efficiency at 1% level.

The gear evolved and the rigging can be introduced for commercial fishing from medium vessels.

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#### REFERENCES

- Akyuz, E. F. 1959. *Modern Fishing Gear of the World*; 357. Fishing News Books, London.
- Barraclough, W. E. & A. W. H. Needler. 1959. *Modern Fishing Gear of the World*; 351. Fishing News Books, London.
- Benyami, M. 1959. *Modern Fishing Gear of the World*; 213. Fishing News Books, London.
- Deshpande, S. D. 1960. *Indian J. Fish.* 7, 2:458.
- Deshpande, S. D. & S. V. S. Ramarao. *Fish. Technol.* 7, 207.
- Grouselle, Y. 1959. *Modern Fishing Gear of the World*; 361. Fishing News Books, London.
- Larsson, K. H. 1959. *Modern Fishing Gear of the World*; 344. Fishing News Books, London.
- McNeely, R. L. 1959. *Modern Fishing Gear of the World*; 363. Fishing News Books, London.
- McNeely, R. L. 1964. *Modern Fishing Gear of the World*; 240. Fishing News Books, London.
- Noel, H. S. 1959. *Modern Fishing Gear of the World*; 348. Fishing News Books, London.

- Okonski, S. 1964. *Modern Fishing Gear of the World*; 229. Fishing News Books, London.
- Okonski, S. & S. Sadowski. *Modern Fishing Gear of the World*; 348. Fishing News Books, London.
- Parrish, B. B. 1959. *Modern Fishing Gear of the World*; 333. Fishing News Books, London.
- Perumal, M. C. 1966. *Fish Technol*; **3**, 1:72.
- Satyanarayana, A. V. V. & R. S. Nair. 1965 *Res. & Ind*; **10**, 8:229.
- Scharfe, J. 1959. *Modern Fishing Gear of the World*; 300. Fishing News Books, London.
- Sivan, T. M., S. D. Deshpande & S. V. S. Ramarao. 1970 *Fish. Technol*; **7**, 2:207.
- Steinberg, R. 1964. *Modern Fishing Gear of the World*; 235. Fishing News Books, London.
- Suberkrub 1959. *Modern Fishing Gear of the World*; 359. Fishing News Books, London.
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