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Performance of a Rope Trawl in Deep Waters off North West Coast of India

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Design details of a newly developed 35 m rope trawl and the results of pre-feasibility trials conducted from FORV *Sagar Sampada* during November 1992 in the Exclusive Economic Zone off north west coast of India, are discussed in this paper. A total of 5.6 t of finfish and cephalopods were landed during the fifteen trial fishing operations realising an average catch rate of 396 kg h^{-1}. The salient feature of the rope trawl is the substitution of netting in the fore part of the trawl by ropes thereby reducing the drag which results in fuel economy. The advantage of using rope trawl as a dual purpose trawl for both pelagic and demersal fishing is also discussed briefly.

The world energy crisis has drawn attention of gear technologists to the need for designing fuel efficient trawls with low towing resistance. Drag of the netting is the most dominant drag component constituting nearly 60% of the total drag of the trawl gear. Possible means of reducing drag of netting are the use of large meshes in the leading sections of the trawl and appropriate use of thinner twine and knotless netting in the construction of the trawl (Wileman, 1984). Large meshes have been effectively used in leading sections of demersal fish trawls in an effort to reduce drag without affecting catching efficiency by making use of the herding effect on different finfishes (Kunjipalu *et al.*, 1979; Nayak & Seshappa, 1993). Rope trawl is a recent development which is so far mainly applied to commercial midwater trawling (Verbaan, 1977; Pelozarski *et al.*, 1979; Anon, 1981). The characteristic feature of rope trawl is the substitution of netting in the front panel sections with rope which results in considerable reduction of towing resistance, while still retaining the herding effect on many fishes. In India, as a part of fuel efficient trawl studies, rope trawl was operated for demersal fishing in shallow waters of Kakinada, Andhra Pradesh, with encouraging results (Rao and Narayanappa, 1994).

In this paper, design and construction details of a 35 m rope trawl are given along with results of pre-feasibility trials in the EEZ off north west coast of India.

Materials and Methods

Design and constructional details of the 35 m rope trawl (800 mm x 124 meshes) are given in Fig. 1. Fig. 2 gives details of rope arrangement on head rope, foot rope and side ropes. Fishing trials were conducted from FORV *Sagar Sampada* (71.5 m LOA, 2285 hp) with the new rope trawl in combination with "Perfect" V-shaped otter boards of 2850 x 1830 mm size weighing 1.5 t each during the cruise no. 105-A from 6th to 24th November, 1992, in the depth range of 60 to 130 m off north west coast of India (15°-21° 30' N lat.). Trawling speed of 4 knots was maintained for all the 15 hauls.

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Results and Discussion

The experimental rope trawl obtained a total catch of 5637 kg of finfish and cephalopods during the 15 demersal trawling operations with a total towing duration of 14 h 15 min (Table 1). Average overall catch rate worked out to be 395.6 kg h^{-1}.

Varieties of fish landed and their percentage composition are given in Table 2. *Nemipterus* sp. dominated the landings with 47.4% followed by Upeneoids 9.9%, *Priacanthus* sp. 7.4%, *Epinephelus* sp. 6.1%, *Decapterus* sp. 5.5%, *Saurida* sp. 5.2%, Cephalopods 3.6, *Trichiurus* sp. 2.6%, *Megalaspis* sp. 1.8% and miscellaneous

Table 1. *Details of fishing operations using rope trawl (Towing speed : 4 kn)*

Haul No.	Position Lat. N	Long. E	Depth, m	Course	Warp, m	Tow duration, min	CPUE, kg h^{-1}
1	15°01' 15°04'	73°08' 73°05'	137 148	339°	400	60	580.0
2	15°08' 15°10'	73°05' 73°03'	127 132	335°	400	45	173.3
3	16°47' 16°43'	72°23' 72°22'	90 91	181°	300	60	170.0
4	17°24' 17°19'	72°18' 72°19'	94 94	150°	300	60	140.0
5	17°16' 17°18'	72°19' 72°21'	94 94	150°	300	60	35.0
6	19°47' 19°51'	69°35' 69°35'	118 120	358°	350	60	273.0
7	20°41' 20°39'	69°48' 69°49'	79 76	131°	250	25	540.0
8	20°40' 20°42'	69°56' 69°52'	78 77	301°	250	60	594.0
9	20°53' 20°50'	69°52' 69°54'	62 62	138°	200	50	958.8
10	21°16' 21°13'	69°00' 69°03'	87 86	125°	300	75	623.3
11	21°13' 21°16'	69°03' 69°58'	88 89	305°	300	60	676.6
12	21°29' 21°26'	69°03' 69°06'	61 63	140°	200	75	380.0
13	16°41' 16°38'	72°21' 72°20'	93 93	180°	300	60	485.5
14	16°49' 16°54'	72°21' 72°20	90 94	360°	300	60	165.0
15	16°59 16°56'	72°36' 72°37	76 76	175°	250	45	122.7

FIG. 1. DESIGN DETAILS OF CIFT ROPE TRAWL

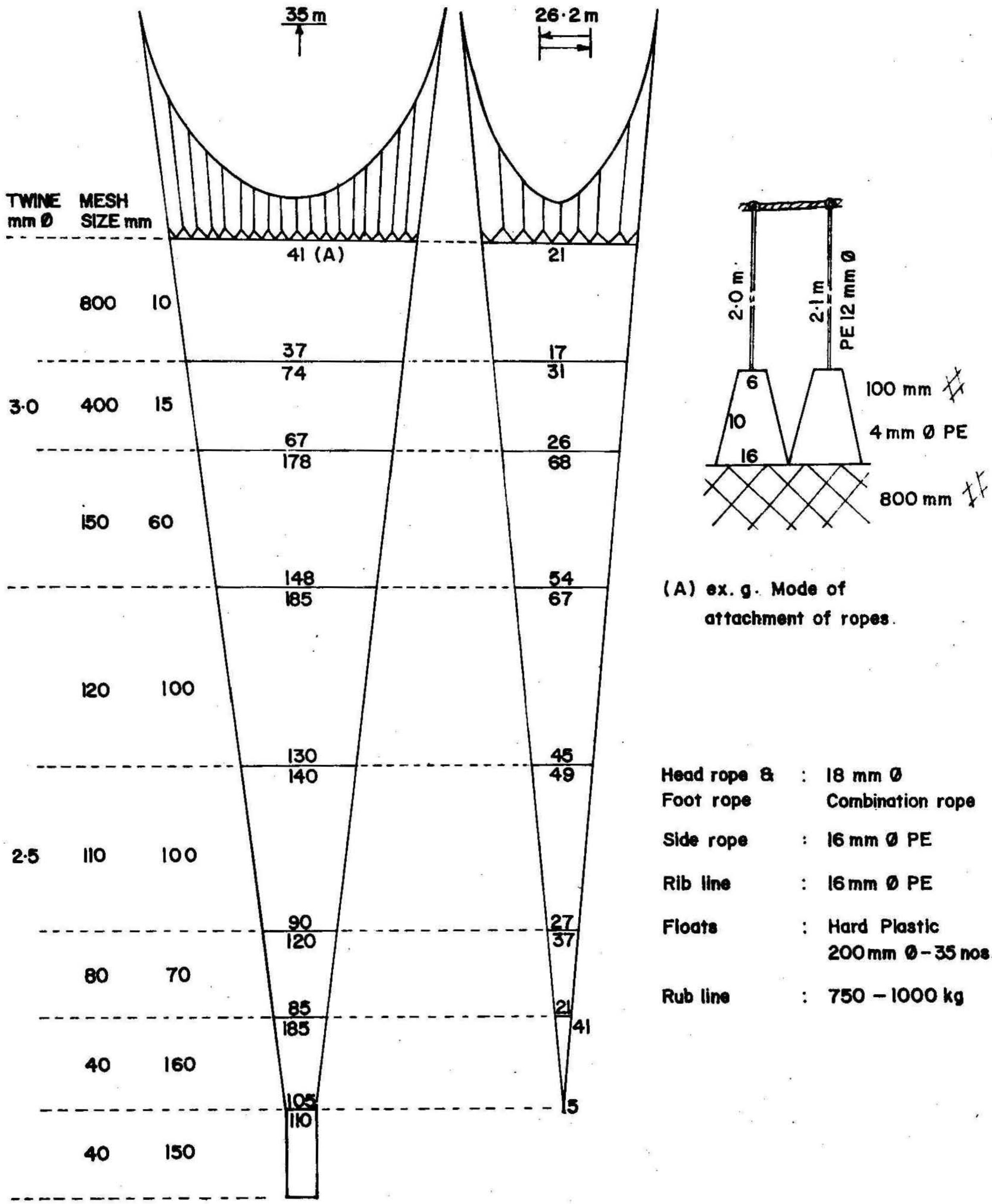

Fig. 1. Design details of 35 m CIFT rope trawl

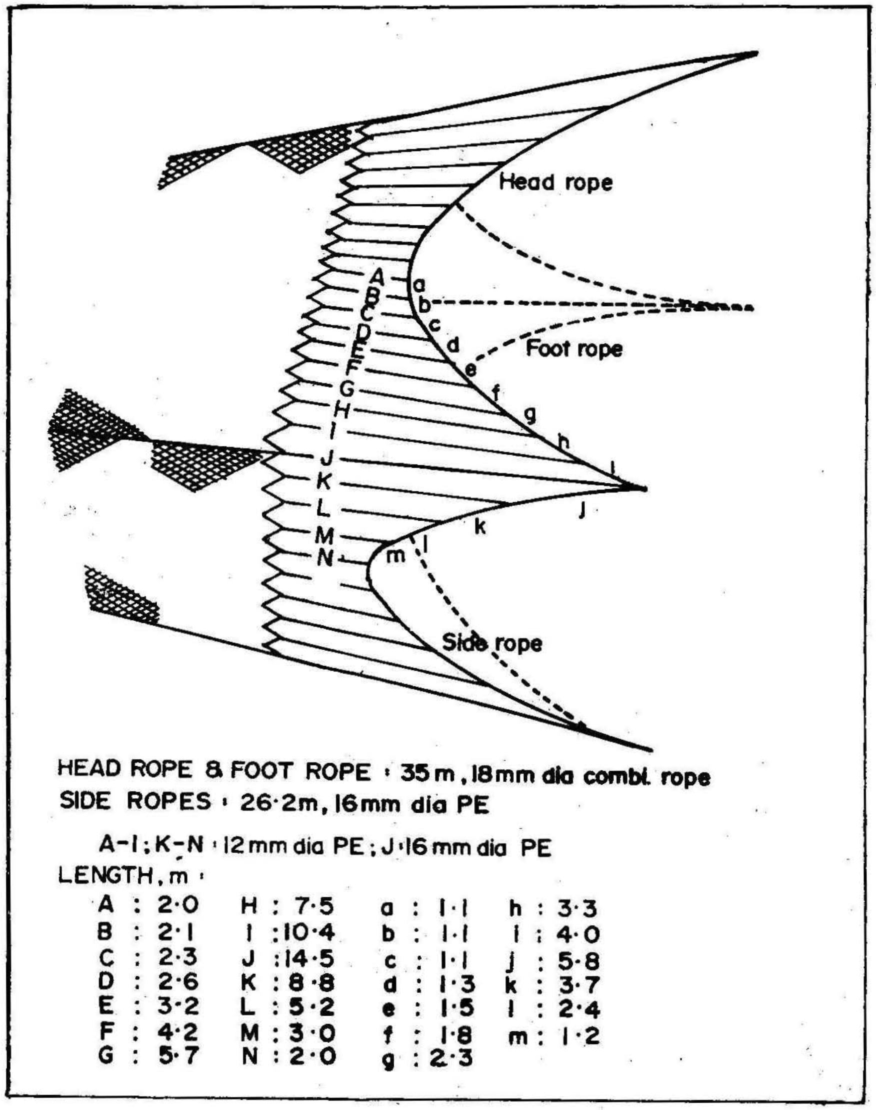

Fig. 2. Details of rope arrangements in 35 m CIFT rope trawl

fishes like *Arius* sp., *Sphyraena* sp. and Elasmobranchs.

During the fifteen demersal operations, haul-wise catch per unit effort (kg h^{-1}) ranged from 35 to 959 with a mean value of 394.5 and standard deviation of 265.7.

Significant reduction in drag is obtained by using ropes instead of netting of normal mesh size. Dutch fishing technologists have found that the drag per unit area of rope trawl is 26% less than conventional trawl at a speed of 4 knots and 33% less at 5 knots (Anon, 1981). This reduction in towing resistance offers possibilities for increasing the effective volume swept by the net in action either by allowing the net mouth area to be greatly increased or through enhanced towing speed. In addition, there is less wear and tear to ropes, than netting, when towing on the ground (Klust, 1983).

Table 2. *Composition of fish landings*

Species caught	Total catch, kg	Percentage
Nemipterus sp.	2672	47.4
Upeneoids	555	9.9
Priacanthus sp.	415	7.4
Epinephelus sp.	343	6.1
Decapterus sp.	309	5.5
Saurida sp.	294	5.2
Cephalopods	202	3.6
Trichiurus sp.	148	2.6
Megalaspis sp.	102	1.8
Arius sp.	32	0.6
Elasmobranchs	21	0.4
Sphyraena sp.	19	0.3
Miscellaneous fish	525	9.3
Grand total	5637	100.0

Blaxter & Parrish (1964) and Wardle (1983, 1986) have stressed the importance of visual stimulus of the peripheral parts of the trawl mouth in the fish capture process. In spite of rather wide distance between ropes incorporated in a rope trawl, many species like herring, mackerel, hake, blue whiting and saithe are known to be effectively shepherded into the funnel of the net.

So far, the concept of rope trawl has been mainly restricted to midwater trawling. During Indo-Polish Industrial Survey, 1976-78, a rope trawl was successfully operated from the stern trawler, MT *Murena* (69.34 m LOA; 1920 hp) in the north west coast from 15° to 24°N lat. (55-370 m depth). Main species landed were horse mackerel, ribbon fish, elasmobranchs and pomfrets. Based on this experience, Pelozarski *et al.* (1979) concluded that rope trawl appeared to be the best equipment since it can be used on grounds where sea bed can be bottom trawled, and also below the water surface or just above the bottom in areas of complicated bottom structure.

Successful application of rope trawl for demersal trawling during the present investigation and its proven commercial success in midwater trawling elsewhere, indicate its potential use as a dual-purpose gear for both demersal and midwater fishing operations.

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