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Target Specific 51.0 m Long Wing Semi-pelagic Trawl for Off-bottom fishing in Indian EEZ

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Target specific 51.0 m long wing semi-pelagic trawl developed for optimum exploitation of off-bottom resources in the Indian EEZ was tested onboard FORV Sagar Sampada in combination with 1.5 t 'V' form otter board and 50.0 m double bridles in the depth range of 43.0 to 68.0 m employing three different speeds of tow. The area of experimentation extended between 20° 39' to 21° 37' N Latitude and 69° 11' to 70° 16' E Longitude. Design details of the trawl along with rigging particulars of the gear system are described. A total yield of 3.65 t was realized from 24 hauls made and the average and maximum catch per unit effort amounted to 123.6 and 151.0 kg respectively. 4.0 knot trawling speed was assessed to be the optimum for this gear system. Semipelagic species consisting mainly of *Tachysurus* sp., *Sphyraena* sp., *Trichiurus* sp., *Priacanthus hamrur, Megalaspia cordyla, Protonibea diacanthus, Nemipterus japonicus, Polynemus indicus, Saurida tumbil, Scomberomorus* sp., *Chirocentrus* sp., *Chorinemus tol, Pseudocaranx dentex,* squid and cuttlefish and miscellaneous off-bottom fish constituted over 85% of the total catch, establishing the target specificity of the gear system in landing semi-pelagic fishery resources.

Key words: Target specificity, semi-pelagic trawl, towing speed

The technique of semi-pelagic trawling as an effective eco-friendly harvesting system is gaining momentum with its capability to exploit off-bottom resources that are generally not accessible to conventional bottom trawls (Anon, 1987). Many successful attempts have hitherto been made by different workers to enhance the effectiveness of pelagic and semi-pelagic trawls (Larsson, 1964; Dickson, 1971; Mohr, 1971; Vijayan *et al.*, 1985; Mathai *et al.*, 1996). Incorporation of optimum mesh size in the fore part, lighter foot rope rigging, thinner gear material in the design and method approach along with employment of optimum towing speed, enhance the functional efficiency of semi-pelagic trawls. Absolute catching capacity of the trawl or the ratio of the amount of captured fish to the quantity available in the zone of operation for the trawling period rises with the increase of trawl size and towing speed (Freedman, 1971). Semi-pelagic trawls to be effective should develop an optimum vertical height and this can be achieved only with optimum wing length, towing speed and forked wing ends. Increase in the resistance of trawl under tow is proportional to the square of speed (Jack Phillips, 1959). Total drag and horizontal opening developed by the mid water trawl or a semi-pelagic trawl have definite correlation with speed of tow and the co-efficient of correlation have been worked out (Kuttappan *et al.*, 1989). Towing speed being an important parameter, an attempt was also made to arrive at an optimum speed of tow for semi-pelagic trawling in off-shore waters. Manoharadoss *et al.* (1999) have enumerated the effect of towing speed in inshore semi-pelagic trawling. The versatility of 'V' form doors provides scope for using these boards efficiently for semi-pelagic fishing (Garner, 1978).

The design details, rigging and functional characteristics of 51.0 m long wing semi-pelagic trawl based on fishing experiments conducted onboard FORV Sagar Sampada during cruise No.181 are described in this communication.

Materials and Methods

The investigations were carried out in the NW coast, off Saurashtra onboard FORV Sagar Sampada (71.5 m OAL; 2285 hp) during February, 2000 with 51.0 m semi-pelagic trawl having a pronounced lengthier wing, intended to obtain an optimum vertical opening which is an absolute necessity for effective off-bottom functioning. The design details of the trawl gear are shown in Fig. 1. The rigging pattern was similar to the one described by Mathai *et al.* (1996). The net was uniformly fastened with 35 nos of 200 mm diameter deep sea plastic floats (3.5 kg extra-buoyancy each) along the head rope apart from 3 nos of 300 mm diameter floats (4.5 kg extra-buoyancy each) attached one each at the wing ends and the third to the center of the head line, to attain the required extra-buoyancy (136 kg) necessary to lift the net to an optimum level. 100 kg of 12 m diameter GI link chain was attached as a ground rig to the foot rope in the method depicted in Fig. 2. A front weight/depressor weighing 36 kg each (bunched, 12 mm diameter GI link chain) was rigged to the distal ends of the foot rope, where it is connected to sweep lines. Increasing the vertical height of a variable depth trawl is effected by adding light double bridles (Scharfe, 1963) and their length restricted to 50 m established to be the optimum by Vijayan *et al.* (1985).

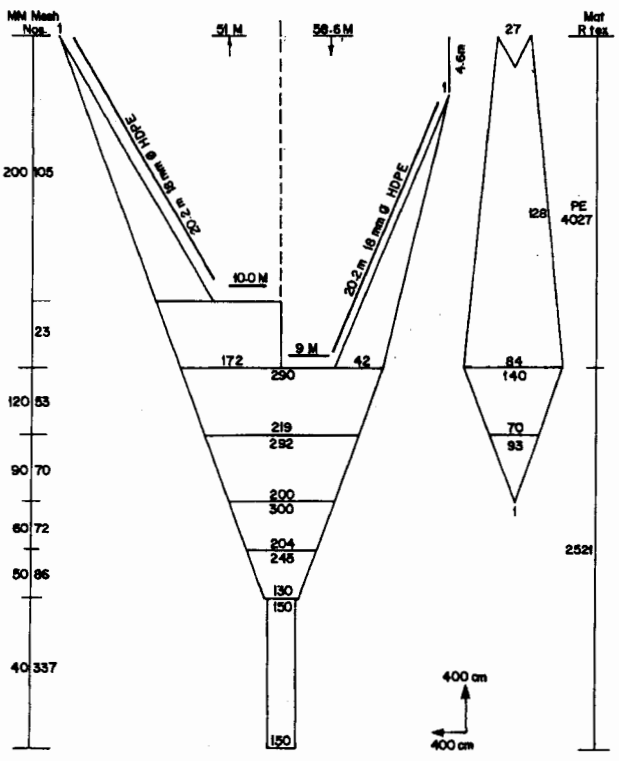

Fig. 1. Design details of 51 m long wing trawl.

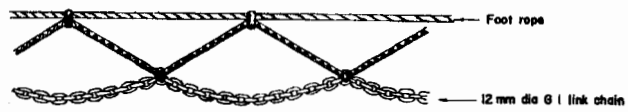

Fig. 2. Foot rope-ground rig.

Field tests to assess the efficiency of the trawl gear in combination with perfect 'V' form otter-boards of dimension 2850 x 1800 mm, weighing 1.5 t each were conducted in the area between 20° 39' to 21° 37' N Latitude and 69° 11' to 70° 16' E Longitude off Saurashtra coast. The position of the otter boards with reference to the vessel was recorded with Sonar and the speed of two was measured with doppler speed long.

Results and Discussion

A total of 24 effective hauls of 29.5 h total duration to assess the functional efficiency of the gear system and the total catch realised amounted to 3.646 t. The average catch per unit effort was estimated as 123.6 kg. Maximum CPUE reached 151.0 kg and more than 85% of the total catch (Table 1) contained semi-pelagic species of fish indicating the target specificity of the gear system developed. Commercially important species of fish consisting of *Tachysurus* sp., *Sphyraena* sp., *Trichiurus* sp., *Protonibea diacanthus, Pseudocaranx dentex, Rastrelliger kanagurta, Megalaspis cordyla, Polynemus indicus, Saurida tumbil, Chorenemus tol, Chirocentrus* sp., *Scomberomorus* sp., squids and cuttle fish dominated the off-bottom resources caught.

Towing speed being an important factor contributing to the efficiency of a semi-pelagic trawl, three different speeds viz. 3.5, 4.0 and 4.5 knots were tested for assessment of the optimum towing speed (Table 2). 4.0

Table 1. Catch Composition

Sl. No.	Species	Weight (kg)	Percentage (%)
1	*Protonibea diacanthus*	315.2	8.6
2	*Sphyraena* sp.	252.0	6.9
3	Squid	229.8	6.3
4	*Pseudocaranx dentex*	160.8	4.4
5	*Tachysurus* sp.	159.28	4.3
6	Ghol	100.5	2.7
7	*Megalaspia cordyla*	84.9	2.3
8	*Selar cremnophthalmus*	82.4	2.2
9	*Trichiurus* sp.	81.0	2.2
10	*Otolithus cuiverii*	70.70	1.9
11	*Epinephelus malabaricus*	53.17	1.4
12	*Rastrelliger kanagurta*	43.00	1.1
13	*Chorenemus tol*	46.30	1.2
14	*Saurida tumbil*	42.00	1.1
15	*Priacanthus hamrur*	38.37	1.05
16	*Ray*	37.48	1.02
17	Shark	43.2	0.90
18	*Nemipterus japonicus*	24.2	0.62
19	Cuttle fish	21.8	0.60
20	*Atropes atropes*	14.8	0.40
21	*Upeneus vittatus*	14.3	0.39
22	*Rachycentron* sp.	12.6	0.02
23	*Trichinotus blochii*	7.2	0.19
24	*Alectus indicus*	7.0	0.19
25	Seer fish	6.0	0.16
26	*Polynemus indicus*	5.0	0.14
27	*Chirocentrus durab*	5.0	0.14
28	*Therapon jarbuva*	5.3	0.15
29	*Scomberomorus* sp.	2.0	0.05
30	*Lethrinus rebulosus*	4.3	0.12
31	*Carangoides chrysophyra*	2.6	0.07
32	*Psettodes erumi*	2.0	0.05
33	*Miscellaenous (mostly lesser sardines and ocaranx)*	1681.22	46.09
	Total	3646.44	100

Table 2. Total catch and CPUE in different towing speeds

I. 3.5 knots speed

Haul No.	Duration of tow	Catch in kg
1	1 h	267.50
2	1 h	288.61
3	1 h 25 min	58.01
4	2 h	54.35
5	1 h	126.70
6	1 h 25 min	251.80
7	1 h 30 min	304.20
8	2 h	95.60
9	1 h	148.60
10	1 h 5 min	25.26
Total	14 h 25 min	1620.72

CPUE = 120.02 kg

II. 4.0 knots speed

1	1 h	116.47
2	1 h	127.50
3	1 h 5 min	60.00
4	1 h	108.18
5	1 h 10 min	125.47
6	1 h	146.0
7	1 h 30 min	96.60
8	1 h 5 min	52.60
9	1 h	158.30
10	1 h	100.80
11	1 h 20 min	300.00
12	1 h 25 min	426.00
Total	13 h 30 min	1817.92

CPUE = 134.69 kg

III. 4.5 knots speed

1	1 h 40 min	69.1
2	1 h	138.2
Total	2 h 40 min	207.3

CPUE = 77.93 kg

knots was found best suited for this type of trawling operations with an average total CPUE of 134.69 kg closely followed by 3.5 knots (CPUE 120.0 kg).

From the experiment conducted, it could be conclusively established that 51.0 m long wing semi-pelagic trawl designed and developed for operation from a larger class of vessel like FORV Sagar Sampada in combination with 2850 x 1800 mm 'V' form doors and 50.0 m twin bridle system is suitable for harvesting off-bottom resources without detrimentally affecting the demersal ecosystem.

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