Towing Resistance of Ottar Trawls used for Shrimps from Small Mechanised Boats

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[Attempts have been made to determine the towing resistance of the shrimp otter trawls operated from small trawlers off Cochin and the actual resistance on the warps for eight different boats working under the normal fishing conditions. have been measured. Engine Horse Power utilised for towing the gear at normal speed and fishing conditions has also been estimated.]

Introduction

Despite the many studies undertaken elsewhere (Miyamoto, 1936, 1, 2, 3 ; Kawakami, 1959 ; Dickson, 1959 ; Takayama and Koyama, 1959 ; De Boer 1959 ; Scharfe, 1959) to measure the towing tension of trawls both in the full scale and model nets, the determination of the optimum size of the gear in relation to the power available for the fishing boat, is still a chief difficulty confronted in designing the trawling gear. When the net is small and light for the thrust force, it cannot utilise the full capacity of the boat. Likewise, when the net is large and heavy, the boat cannot tow the net effectively and efficiently. Therefore, the more suitable design of trawl including the size of twine, mesh of the net, size, shape and weight of otter board etc., which have a profound influence on the total towing tension of the gear are subjects of systematic study. The present communication, which is in no way complete or exhaustive, is based on a study conducted by the Authors to determine the towing tension of shrimp otter trawls as recorded from small trawlers engaged in fishing in the Cochin area. In specifying the size of the boats, the general classification as suggested by Gurtner (1959) has been adopted.

Experimental Procedure

The towing speed was estimated following the conventional method by taking into account the time taken for a floating object to cover the length equivalent to the boat. The towing tension were recorded by the use of a simple tension meter designed at this Institute. The description of the tension meter used is being published elsewhere. The approximate horizontal opening between the otter boards was calculated by the formula suggested by Deshpande, (1960). The main specifications of the eight trawlers and the details of the trawl gear and the accessories from which the towing tensions were measured are given below in Table — I.

TABLE I. Specifications of the trawlers and trawl nets with accessories.

Name of the trawler	Overall length of the boat in feet	Engine power (BHP)	Type of trawl net	Specification of the net			Specification of otter board				Details of warp used for towing
				Head rope in ft.	Foot rope in ft.	Length of legs on each side in ft.	Type of otter board	Length in inches	Breadth in inches	Weight of each board in air in lbs.	
Vaipeen Union 42	25	10 (Bukh)	Four seam over-hang (cotton)	35	35	6	Flat rect-angular.	38	24	42	Manila rope of 3/4" dia.
Shark	30	20	Four seam over-hang (cotton)	37.5	37.5	12	,,	40	20	56	,,
Bluebird	30	30 (Lister)	Four seam over-hang (cotton)	45	50	10	,,	42	23	80	,,
Fishtech No. 2	32	36 (Lister)	Two seam (Terylene)	42.5	52.5	15	,,	45	25	90	Flexible GI wire rope of 3/8" dia.
			Two seam with long wings (Terylene)	72.5	82.5	6	,,	45	25	90	
M. V. Tarpon	34	42 (Yanmar)	Two seam (cotton)	39.5	56.5	72 sweep on each side.	Oval shaped hydrofoil, single slitted (Russian origin)	47.25	29.50	110	,,
M. V. Samudra	34	42 (Yanmar)	Four seam with separate over-hang (cotton)	56	56	18	Flat rect-angular	60	28	135	,,
M. V. Durga	36	56 (Yanmar)	Four seam non-overhang (cotton)	60	60	10	Oval shaped, hydrofoil, single slitted (Russian origin)	47.25	29.50	110	,,
Pamba	36	62 (Lister)	,,	60	60	36	Flat rectangular	60	30	135	,,

TABLE II   The towing resistance and horizontal spread between the ottr boards of the different trawls working under normal fishing conditions.

Name of the Boat	BHP of the engine	Bottom nature of fishing ground	Depth of the fishing ground in fathoms	Warp released in fathoms	Towing speed in (m/sec.)	Horizontal spread between otter doors in % of HR length + legs & sweeps	Towing resistance in (kgms.)	Estimated horse power for towing the net
Vaipeen 42	10*	Muddy	7	40	0.76	63.8	141	1.43
Shark	20	,,	7	50	0.76	54.1	234	2.37
Bluebird	30	,,	7	40	0.83	57.7	336	3.53
Fishtech No. 2	36 (i)	,,	8	60	0.88	53.2	355	4.20
	* (ii)	,,	8	50	1.05	60.5	385	5.39
M. V. Tarpon	42	,,	8.5	50	1.04	42.5	405	5.60
M. V. Samudra	42	,,	10	50	0.82	53.5	459	5.04
M. V. Durga	56	,,	10	50	0.96	53.3	490	6.24
Pamba	62	,,	12	65	0.96	45.0	530	6.80

* Data for the net in (i) with extended wings of 15′ on each side.

Results

The towing resistance for each of the boats, which were operating under the normal commercial fishing conditions, with respect to the depth of water at the fishing ground, the corresponding length of warp released and the usual towing speed are presented in Table II. The estimated utilisation of power in towing the gear under the above said conditions are also indicated in the last column of the Table.

From Table — II, the relation between the total towing resistance and the BHP of the engine of the boat is graphically represented in Figure 1.
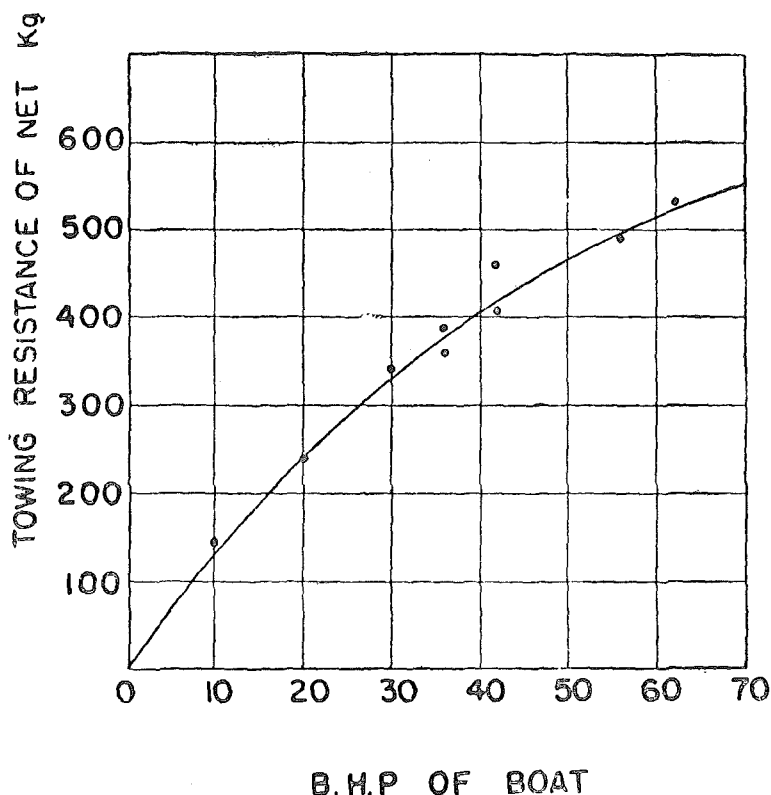

Fig. 1 : Relation between the towing resistance of the gear and Horse Power of engine of the boat.

The relationship between the Horse Power of engine utilized for towing the net and the Horse Power of engine of the boat is shown in Fig. 2.

Discussion

Figure 1 shows that the towing resistance of trawl per one H. P. of engine reduces gradually with the increase in the H. P. of the engine of the boat.

The relation between the total towing resistance of net and the H.P. of engine of boat is given by a curved line and this might be due to the fact that in this relation the towing speed of the net is not taken into consideration.

It would be evident from Fig. 2 that the relationship between the BHP of engine and the actual H.P. utilized follow a linear pattern suggesting that these factors are directly proportional. The experimental formula derived from the graph is as follows :-

Ht = 0.12 Hb where

Ht is the Horse Power required for towing the net and

Hb the break Horse Power of the engine of boat. Only 12% of the Horse Power of the engine of the trawler is found to be utilized for towing her trawl.
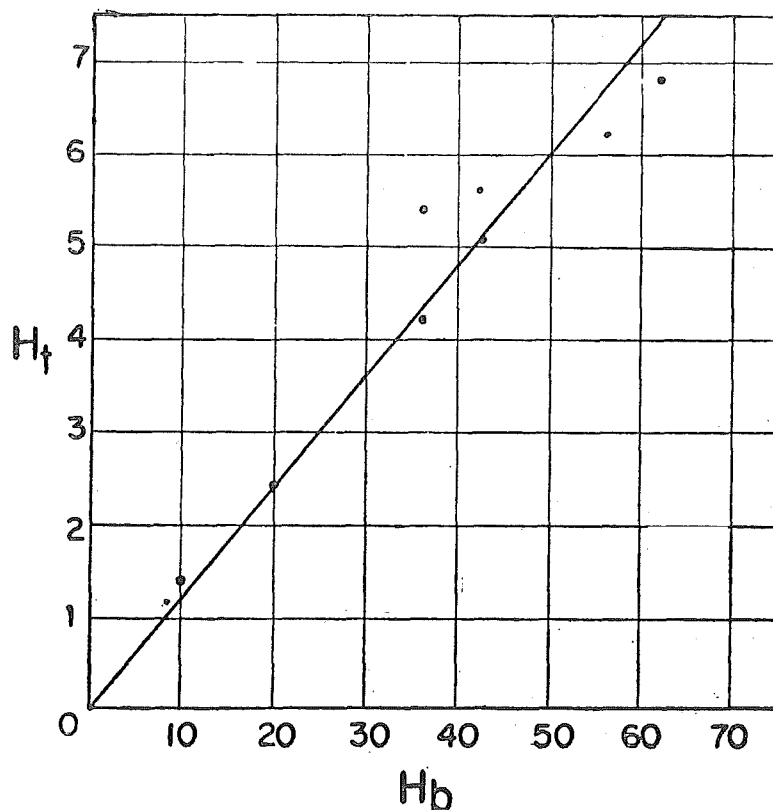

Fig. 2 : Relation between H. P. utilised for towing the trawl and H. P. of engine of the boat.

From the observations in the Table II, it is found that the horizontal spread between the otter doors was more or less between 50 to 60% of the total length of the head rope including sweeps or legs, which is the main character of these shrimp trawls where wide opening is, preferred rather than high vertical opening. The lower spread noticed in the boats Tarpon and Pamba, may be due to long sweeps.

It is significant to note that the difference in the towing resistance between the 42.5 ft. and 72.5 ft. trawls operated from Fishtech No. 2 was not great. The latter is a modification of the 42.5′ net by the provision of 15′ detachable wings at either side.

187

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