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Research Note

Estimation of Optimum Engine Power of Fishing Craft with Reference to Length

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Marine fish production in India has increased from 0.5 million t in 1950 to 3.07 million t in 2010 (CMFRI, 2011). Development of industrial fisheries sector was characterized by the mechanisation of propulsion, gear and catch handling along with introduction of synthetic gear materials; developments in acoustic fish detection and satellite based remote sensing techniques; and advances in electronic navigation and position fixing equipment (Hameed & Boopendranath 2000)

Mechanisation of Indian fishing fleet began with technical and financial assistance from international agencies under the Indo-Norwegian Project (INP) in the south west coast of India (Galtung, 1982). Main advantages that motorisation and mechanisation gave the Indian fishing fleet were the ability to increase their area and depth of operation; to use new and larger gears more effectively; and sufficient speed for propulsion and gear handling. Dearth of policies and effective controls has led to an unwieldy increase in the size of the fleet in terms of number and size of craft as well as the engine power. There is an excess capacity in the Indian fishing fleet (Sathianandan et al., 2008). Nearly 194 490 fishing craft of various sizes and classes are operating in the marine sector of which 72 559 are mechanised, 71 313 are motorised and 50 618 non-motorised (CMFRI, 2012). Existing mechanised vessels are already in excess by a factor of 3.8 and motorised boats by 4.8. Unscientific increase in fishing capacity has ultimately resulted in decreasing catch per unit effort thereby making operations uneconomical. Fishing power in terms of horse power of engines has also been rising over the decades. Competition to reach the fishing grounds for catching maximum fish as well as to unload the catch at the harbour has compelled the fishing boat owners to increase the engine power. The trend of installing high powered indigenous engines started with trawlers and spread to purse seiners and ring seiners. The influx of high power imported engines has been a recent phenomenon.

According to Mohamed et al. (2010), the depleted and declining stocks (particularly those close to the threshold of depleted status like sharks) need to be carefully monitored and plans for their conservation and rebuilding need to be made. Hence, there is a need to regulate the number of craft operating in fisheries sector and to down-size the craft, gear and engine power in various categories of craft to make the sector economically viable and sustainable.

This study was aimed to calculate the optimum shaft horse power for different length class of fishing vessels based on methodology of Holtrop (1984). The work was based on the premise that majority of fishing crafts have displacement hull form. A significant proportion of the hull resistance is contributed by wave making resistance and this is directly proportional to the speed-length ratio (SLR) (Gillmer & Bruce, 1982). Data on speed, length over all (L_{OA}), length at water line (L_{WL}) and displacement were collected from 23 trawlers, 5 purse seiners, 5 gillnetters and 18 long liner cum trawlers operating from Kerala, Karnataka, Goa, Maharashtra, Gujarat, Tamil Nadu, Andhra Pradesh, Odisha and West Bengal during 2012-13 through interview and direct observation. The vessels were grouped into five classes ranging from 15.0 to 20.6 m based on

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L_{OA}. Economical speed for each length class was determined using the formula,

$$SLR = v/\sqrt{g}L)$$

where, v = speed in m sec^{-1}, L= waterline length in meters and g = the acceleration due to gravity in m sec^{-2}.

Speed, L_{OA} and L_{WL} of vessels selected for analysis are given in Table 1.

Table 1. Speed and displacement of selected class of fishing vessels

L_{OA} (m)	L_{WL} (m)	Displacement (t)	Speed (kn)
15.0	13.9	34	8
16.0	14.8	40	8.3
17.8	16.5	48	8.8
19.0	17.1	58	8.9
20.6	19.6	70	9.6

Sustained sea speed in terms of economy of operation for normal displacement type boat hulls, is restricted by SLR and the ideal value lies in the range of 0.90 to 1.34 for fishing boats up to a length of 30 m (Gerr, 2001; Choudhury, 1991). Shaft horse power was calculated for the five length classes of important types of fishing vessels and is given in Table 2.

Engine power of gillnetter for L_{OA} upto 15 m is 90 hp and increases to 140 hp for 20 m L_{OA} (Table 2). For trawler and long liner cum trawler, the power ranges from 140 to 250 hp. This higher requirement compared to gillnetter is due to the power required for towing the trawl net. The purse seiner needs to encircle the fish shoal within the shortest time so that the fish do not escape and hence the free running speed is very critical. Therefore, purse seiner use higher horse power. Engine horse power of purse seiner currently in use ranged from 250 to 350 hp.

The estimated shaft horse power showed that the engine horse power currently in use was 30 to 80% more than the optimum power required for trawlers and 30 to 45% more for purse seiners (Table 2). The maximum excess power was found to be utilised in trawlers of L_{OA} 20.6 m. Over the years, the size of gillnetters and long liners did not increase like trawlers and purse seiners. So there was no disproportionate increase in the engine power of these vessels. Use of right sized engines reduces the initial investment, operational cost, size and weight of the fishing unit and fuel usage which eventually reduces the CO_2 emisssion. High fuel usage, besides polluting the environment, decreases the economic viability of operation.

Commercial fishing is an economic activity and is controlled by market factors. Fuel forms the major recurring input in fishing and is dependent on factors related to engine and size of the vessel. The speed length ratio is one of the most important factors that affects the resistance of the fishing vessel and the power requirement. Any change to optimize the engine power taking into account the speed length ratio will positively affect the economic viability of the fishing unit. The estimated shaft horse power for different classes of vessels worked out in this study will help policy makers and fishers to regulate the installed engine power of vessels for maximum economic viability.

Table 2. Existing and estimated shaft horse power of different types of fishing vessels

L_{OA} (m)	Shaft horse power (hp)							
	Trawler		Purse seiner		Gillnetter		Long liner cum trawler	
	Existing	Estimated	Existing	Estimated	Existing	Estimated	Existing	Estimated
15.0	140	140	250	190	90	90	140	140
16.0	240	180			105	105	180	200
17.8	240	200	350	240	Nil	120	Nil	200
19.0	330	220			Nil	130	Nil	250
20.6	450	250			Nil	140	Nil	250

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