ranges from ₹10000-15000 per month and in some cases when the attack is severe, up to ₹ 300000/- is spent for repair. Loss of fishing days for repair is another associated loss.

Conclusion

Depredation by Cetaceans is a growing problem not only in ring seines but also in other fishing gears and have serious economic implications on fisheries. Several studies such as experimenting with other acoustic deterrent/ harassment devices and *in situ* underwater studies regarding the behaviour of depredating organisms are necessary to reduce the problem such as depredation. Pingers did not adversely affect fish catch. Nets equipped with functional pingers suffered less damage, both in terms of catch loss and net damage. In this scenario the use of pingers will help the fishermen to reduce Cetacean attack and incidental entangling in fishing net.

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Fuel saving through material substitution in trawls

Remesan M.P., Madhu V.R., Sayana K.A., Prabeesh Kumar, M.V., Harikrishnan K.R. and Leela Edwin

ICAR-Central Institute of Fisheries Technology, Cochin

Fishing consumes 15 to 20 times more energy than it produces (Endal, 1980) and the average fuel consumption by the fishing industry is estimated at 15-21.5x10^6 t (Thomson, 1988). Increased use of fuel intensifies the carbon foot print and green house gas effect which leads to global warming, climate change, etc. Fuel consumption assumes prime importance to fishermen due to hike in operational costs apart from its environmental effects. According to Tyedemers *et al.* (2005), world fishery fuel consumption is 50 billion (5 x 10^9) liters. There is an 8% increase in the contribution of fuel cost to the total operating expenses within a time of two years (Fødevareøkonomisk Institut, 2011). Annual fuel consumption of mechanized and motorized fishing

sector of India is estimated to be 1220 million liters (Boopendranath, 2000) and about 60-80% of the operational cost is contributed by the cost of fuel consumed.

Trawling is the most energy intensive fishing activity and trawlers are one among the most fuel consuming fishing systems. Compared to passive fishing methods like gillnetting and long lining, trawling consumes five times more fuel and it is 11 times more compared to purse seining. To catch one kilogram of fish, trawling requires 0.8 kg of fuel while for gillnetting 0.15 kg, for long lining 0.25 kg and for purse seining 0.07 kg are required (Gulbrandsen, 1986). The fuel consumption of trawlers which depends on installed engine horse power and duration of voyage constitute 45 to 75% of operational expenditure. The resistance offered by the gear has a large effect upon speed of vessel and fuel consumption.

Even though the fuel price is in an increasing trend, its usage is also increasing due to the increasing size and power of vessels. Fuel consumption is the factor which contributes more than 60% to the total economics of the trawler. Hence reducing the fuel consumption will optimize the economics and carbon footprint of the fishing industry and it is the reason for intensification of research on energy efficiency.

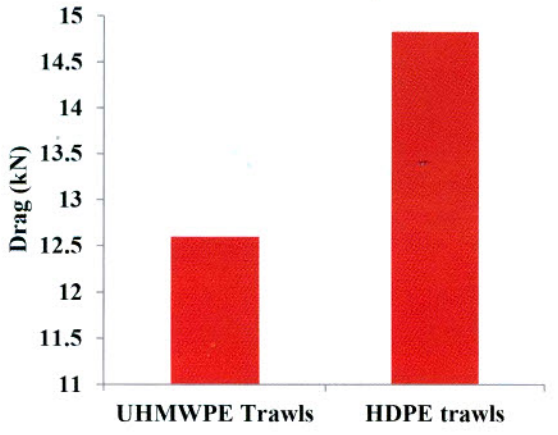
Under the National Agricultural Science Funded (NASF) project on Green Fishing Systems for Tropical Seas (GFSTS), ICAR-CIFT designed and fabricated low drag trawls for fish and shrimp of head rope length 24.47 m and 3.00 m, respectively. The drag reduction measures included in the design are increased mesh size and new material. The material used is ultra high molecular weight polyethylene (UHMWPE). As UHMWPE provides same strength at a lower diameter, the twine size was reduced which results in reduced twine area. For evaluation of new designs, trawl nets using conventional material, high density polyethylene (HDPE) is also fabricated and used as control. The experiments for evaluating the new design were conducted onboard M.V. Matsyakumari II. Data regarding drag and fuel consumption experienced for each operation were recorded using Warp tension meter and Fuel flow meter fitted to the fuel line of the vessel. The depth of operation ranged from 10 to 20 m, the fishing speed was 3 to 4 kn and the warp length varied from 40 to 100 m.

Warp tension meter in use

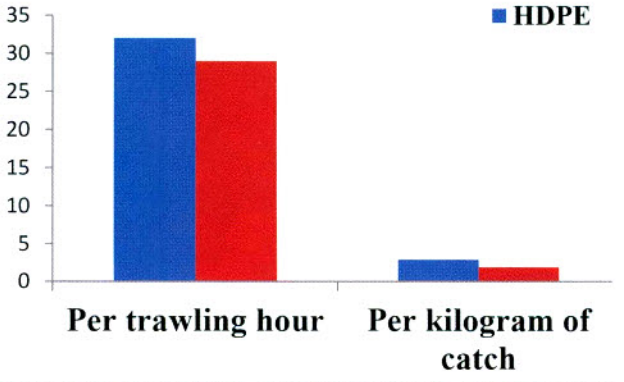
Operation of UHMWPE trawl nets onboard M.V. Matsyakumari II

From the trials conducted, the average reduction in drag of new design is estimated to be 17%. The drag of control and experimental gears at different operational parameters was also analyzed and UHMWPE trawls showed lesser drag than HDPE trawls.

The average fuel consumption per hour of



Average drag of HDPE and UHMWPE trawls during one hour of trawling



Comparison of fuel consumption of conventional and low drag trawls

trawling for HDPE trawls was estimated to be 30 L and for UHMWPE trawls 26 L. The average reduction in fuel consumption was found to be 10%. The fuel consumption per kg of fish captured estimated was 2.9 L. for HDPE trawls and 1.9 L. for UHMWPE trawls and the average reduction was 35%.

The drag and the fuel consumption of low drag trawls are 17% and 10%, respectively lower when compared to conventional HDPE trawls. Hence it is evident from the study that, use of energy saving material like UHMWPE will reduce the drag and thereby fuel consumption of trawlers considerably.

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Handmade wooden boats of Gujarat: Craftsmanship for the ocean

Prajith K.K., Paradva J.B. and Pungera H.V.

Veraval Research Centre of ICAR-Central Institute of Fisheries Technology, Veraval

Indian boat technology and navigational knowledge dates back to the IIIrd Millennium BC. Historical records show that Harappans not only built unique docks but also provided facilities for handling cargo. In Gujarat, Traditional wooden fishing boats and cargoes building takes place mainly in Kutch, Valsad, Mangrol and Veraval. Mandvi is the one of the oldest place synonymous