Reduction in carbon emission by small scale fishing boats off Alappuzha coast, Kerala during COVID-19 pandemic

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Small scale fisheries involve a range of practices but are typically traditional activities require less capital investment and energy for operation, comparatively simple gear and small fishing vessels which makes short fishing trips close to shore (Ben-Yami and Anderson, 1985). There are 1,99,141 fishing vessels operates in marine fisheries sector of India, in which 36.9% comes under motorised which accounts for 23% of total landed catch (CMFRI, 2012; 2015). Since recent past the price of fuel and other energy sources had considerably increased. In 2001, fuel was estimated to account for 21% of revenue from landed fish catch, whereas in 2008 this increased to about 50%. Profitability and livelihoods are potentially highly sensitive to energy costs (FAO, 2015).

With this background a study was conducted to estimate reduction in fuel consumption and carbon emission by small-scale fishing boats during nationwide lockdown due to COVID 19 pandemic. Three landing centres of Alappuzha district namely; Punnapra, Paravur and Thottapally were selected for the data collection. More than 30 respondents who were using kerosene/petrol operated outboard engine of 9.9 hp,were contacted around fishing villages over telephone during the period, for gathering continuous data about fuel consumption before and during pandemic period for comparison. The details of the fishing systems are given in Table 1. The information was collected about voyage during the four different phases of nationwide lockdown period of 68 days (25 March 2020 to 31May 2020). Due to strict measures to curb the transmission of disease, hardly 10-15% of total fishing vessels were allowed to operate from landing centres during the period which resulted in drastic reduction of fuel consumption. Earlier in order to find out daily fuel consumption by fishing boats of similar L_{OA} and engine power, systematic data of 72 fishing operationswere recorded from small scale fishing vessel engines of same horsepower through personal interview method, and later it was validated with present study.

Data collected analysed statistically and it was found that the fuel consumption of out-board motor was 2.38±0.3 litres of kerosene/hour (for propulsion) and 1.1±0.3 litres of petrol/trip (for ignition). Fuel consumption for cruising (reaching to fishing ground and back to shore) and towing were different, but in the analysis two were combined and average was taken for analysis since fishing trips were single day type. Assuming 5 h of operation per day, the Kerosene consumption would be 2.38*5=11.9 litres/day and petrol consumption would be 1.1*1=1.1 litres/trip which will be equal to 13.0 litres of total fuel/day/vessel. There are about 7000 motorized boats operating off Punnapra, Paravoor and Thottapilly, but during pandemic 700-1000 (10-15% of total) were in operation. Assuming 7000 vessels in operation fuel consumption would be 7000* 13.0=91000 litres/day (consumption before lockdown), but operating only at 10-15% (750-1000 number of boat) fuel consumption will be 700-1000*13.0=9100-13000 litres/day (consumption during lockdown period). So, there is a reduction in

fuel consumption by motorized fishing vessel to about 78000-81900 litres/day which is equal to 18,72,000-19,65,600 litres/month (assuming 24 days of active fishing in a month). So as a whole there is reduction of fuel consumption by motorized vessels of Alappuzha coast was about 37.4 to 39.0 lakh litres/month during the period. This corresponds to 89.76 to 93.6 lakh kg of CO_2 emission due to burning of the same quantity of fuel (assuming one litre fuel combustion results 2.4 kg of carbon di-oxide emission). This indicates the enormous reduction in carbon emission during COVID-19 pandemic time by motorised fishing vessels from selected landing centres only. This reduction in carbon emission would have positive impact on environment, resources and human health. Generally, fuel consumption and carbon emission are on rising trend over the period of time, mainly due to overcapacity. In Indian marine fisheries, the boosted fishing effort and efficiency in the last five decades has led to in considerable increase in fuel consumption, which is equivalent to CO_2 emission of 0.30 million metric tonns (MMT) in the year 1961 to 3.60 MMT in 2010. The CO_2 emission has increased from 0.50 to 1.02 t for every tonne of fish caught during the period. In 2010, fishing boats with outboard motor emitted 0.59 t CO_2/t of fish caught. Emission of CO_2 equivalent is a measure to compare the emissions from various greenhouse gases on the basis of their global warming potential (Jha and Edwin, 2019).

Fuel consumption in small scale fisheries have been subjected to notable interest as it started to explore implications of fishing intensification. The significance of energy use in the small-scale fisheries sector along with their probable future trends and optimisation is needed to be reviewed. The detailed database along with its technical and economic comparison as well as optimisation of fuel consumption/energy use by out-board motors would lead to policy guidelines and better management for small scale fisheries.

***Table 1.** Description offishing system*

Item	Description
Engine type	Outboard motor
Power	9.9 hp
Fuel	Kerosene (for propulsion) and petrol (for ignition)
L_{OA}	8-13 m
Boat material	FRP/wooden
No. of crew	3-7
Gear used	Hand trawl/seine/gillnet/trammel net/line
Fishing area	Off Alappuzha/Kollam/Ernakulam
Fishing season	Round the year
Depth of operation	9-10 m
Cruising speed	6-7.5 Kn
Towing speed (in case of hand trawl)	2-3 Kn
Target catch	Shrimp
Net hauling method	Manual
Otter board dimension (in case of hand trawl)	81x43 cm

***NB:** The result showed here based on analysis of data which were purely base upon personal interview method and as reported by boat operators.*

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