Int.J.Curr.Microbiol.App.Sci (2018) *7*(10): 593-598

International Journal of Current Microbiology and Applied Sciences
***ISSN: 2319-7706* Volume 7 Number 10 (2018)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2018.710.066

A Recent Overview of CO_2 Footprint by the Mechanised Fishing Trawlers of Kerala, India

Arnab Bandyopadhyay, Suchismita Saha, Sandipan Mondal*, Mosaraf Hossain, B. Manoj Kumar and Anu Gopinath

Kerala University of Fisheries and ocean Studies

**Corresponding author*

Keywords

Marine fisheries of India, Overexploitation, CO_2 emission, Important fishing harbours of Kerala, CO_2 footprint, Fuel efficiency of marine fishing vessels

Article Info

Accepted:
06 September 2018
Available Online:
10 October 2018

A B S T R A C T

Marine fisheries of India has been witnessed with substantial increase of fishing effort and fishing efficiency during the last five decades which resulted in overexploitation of fish stocks together with the increase of fossil fuel burning and CO_2 emission into the atmosphere. The present study covered three important fishing harbours of Kerala to reveal an estimation of CO_2 footprint (considering the emission of CO_2 only during the fishing operation) by the mechanised fishing trawlers which showed a considerable higher value than the previous studies. There is a huge scope to reduce the level of CO_2 emission by implementing proper scientific policies and also by improving fuel efficiency of marine fishing vessels.

Introduction

Marine fish production in India has registered a phenomenal growth from 0.5 MMT to 3.63 MMT in 2016.

The rapid upliftment of commercial fisheries sector was characterised by the mechanisation of propulsion, gear and catch handling along with the introduction of synthetic gear materials, development of acoustic fish detection and satellite based remote sensing techniques and advances in electronic navigation and position fixing equipment (Hameed and Boopendranath, 2000). The advent of motorisation and mechanisation enabled the Indian fishing fleet to increase the area and depth of operation, to use new and larger gears (trawls with long head rope) more effectively and to provide sufficient speed for propulsion and gear handling during loading and unloading operations.

One of the important characters of this fisheries sector is its extreme dependence on fossil fuels and the resultant emission of Green House Gases (GHGs). The utilization of fossil fuels has increased the accessibility

of the marine resources to the sector while simultaneously threatened the marine environment and ecosystem by causing climate change and ocean acidification. Violation of scientific policies and effective controls has led to an increase of the size of the fleet in terms of number and size of the crafts as well as the engine power which has ultimately made the situation more critical and the environment-friendliness, economic viability and sustainability of the marine fisheries sector are at stake.

Materials and Methods

During the above study conducted in 2017-2018, three major fishing harbours of Kerala were selected namely- Kalamukku, Munambam and Beypore.

A number of 30 trawlers were surveyed from these harbours and the data regarding the Length Overall (L_{OA}) of the trawler, hp of engine installed, duration of fishing hrs. /day, total fuel consumption per fishing trip and quantity of catch harvested per fishing trip had been collected through structured questionnaire and direct observation.

The emission of CO_2 has been estimated by considering the standard conversion factor that 1litre of diesel produces 2.64kg of CO_2 (1 liter of diesel weighs 835 gram. Diesel consists of 86.2% of carbon, or 720 gram of carbon per liter diesel. In order to combust this carbon to CO_2, 1920 gram of oxygen is needed. The sum is then 720 + 1920 = 2640 gram of CO_2/liter diesel) or in other words, 1 ton of diesel combusts to evoke 3.16 ton of CO_2 into the atmosphere.

Results and Discussion

The present study showed that the average CO_2 emission intensity (t CO_2/t catch) by all the mechanised fishing trawlers operated in Beypore, Kalamukku and Munambam fishing harbours were respectively 2.64, 1.95 and 2.62 respectively. This study has been conducted on the trawlers having a wide range of L_{OA} of 8-35m operated by marine engines of different hp (68-550hp). Vivekanandan *et al.,* (2013) reported that in 1961, only 5.7% of the boats were of large category (OAL > 40'), whereas in 2010 about 30% of the boats were of large category and at present, this category exceeds up to 70-80%. This unwieldy increase of fishing fleet in terms of number and size of the craft coupled with the indiscriminate installation of high powered diesel engines have contributed to the absolute increase in diesel consumption resulting in excess emission of GHGs into the atmosphere.

It can be shown from table 1–3 that the vessels installed with engines having horse power of 411-550 are responsible for high (>2) CO_2 emission intensity. During the course of study, it has been shown that these trawlers operated with newly imported high speed diesel engines have already been unscientifically overpowered (according to the standard table recommended by Baiju and Boopendranath, 2014). Increase in fishing efficiency and fishing power have helped the marine fisheries to increase the catch but simultaneously, overexploitation and depletion of few stocks have made the situation more critical. In this communication, the menace of overpowering has ultimately led to tremendous elevation of fishing expenditure by increased fuel cost (Fuel cost accounts for 50–54% of operating cost of mechanized boats) thereby making the operation uneconomical and also increased CO_2 emission.

Hence, there is an urgent need to regulate the number and size of craft operating in marine 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.

Table.1 CO_2 footprint by the mechanised trawlers operated in Beypore Fishing Harbour, Kerala

L_{OA}(m)	Hp of engine	CO2 emission/fishing trip(kg)	Quantity of catch/fishing trip(kg)	Emission intensity (t CO_2/t catch)
9.3	68	184.8	100	1.848
10.5	68	184.8	100	1.848
10.5	68	184.8	100	1.848
10.97	106	316.8	150	3.16
11.6	68	792	125	6.3
18.9	236	4752	3500	1.35
19.8	300	5016	4000	1.25
19.9	427	11880	6000	2
19.9	427	9240	3800	2043
21.1	411	13200	5000	2.64
21.1	411	13200	5000	2.64
21.4	495	9504	5000	2
24.39	427	10560	4000	2.64
24.39	427	10560	4000	2.64
25	495	13728	3500	3.92
25.91	427	11880	4000	3
25.91	427	11880	4000	3.23
25.91	427	14520	4500	3.22
25.91	427	10560	4000	2.64
27	411	7392	7000	1.056
27	495	14520	4500	3.22
28.96	495	10560	5000	2.1
32.31	427	13200	4000	3.3
32.31	495	12672	7000	1.81
32.31	427	11880	5500	2.16
32.31	427	11880	5500	2.16
33.53	495	15312	6000	2.55
34.14	550	17952	7000	2.5

Table.2 CO_2 footprint by the mechanised trawlers operated in Kalamukku Fishing Harbour, Kerala

L_{OA}(m)	Hp of engine	CO2 emission/fishing trip (kg)	Quantity of catch/fishing trip (kg)	Emission intensity (t CO_2/t catch)
9.3	68	185	100	1.85
10.75	68	185	100	1.85
15.86	110	1584	2000	0.8
17.37	220	2640	1000	2.64
17.37	220	2640	1000	2.64
17.7	140	2244	1500	1.5
17.37	192	2376	1500	1.6
19.5	280	5148	2000	2.6
19.7	280	5280	3000	1.76
19.9	140	1980	1500	1.32
19.9	236	4488	2000	2.24
19.9	236	4488	2000	2.24
19.9	280	5280	3000	1.76
21.1	280	5544	3500	1.58
21.1	280	6864	3500	1.96
21.1	280	5544	3000	1.84
21.1	411	13200	5000	2.64
21.1	411	13200	5000	2.64
21.4	427	8844	5000	1.76
21.4	495	9240	5000	1.84
21.4	495	9240	5000	1.84
21.4	495	9240	5000	1.84
25	495	9768	4000	2.44
25	495	7524	5000	1.5
25.91	411	7656	5000	1.53
25.91	427	7656	5000	1.53
25.91	495	8976	3500	2.56
25.91	495	8976	4000	2.24

Table.3 CO_2 footprint by the mechanised trawlers operated in Munambam Fishing Harbour, Kerala

L_{OA}(m)	Hp of engine	CO2 emission/fishing trip (kg)	Quantity of catch/fishing trip (kg)	Emission intensity (t CO_2/t catch)
8.994	68	185	100	1.85
9.3	68	198	100	1.98
10.15	68	211.2	100	2.11
17.55	120	2640	2500	1.05
17.7	140	2376	1500	1.6
17.7	192	2376	2500	0.95
19.5	280	7392	3000	2.46
19.5	280	7392	3000	2.46
19.5	411	10560	4000	2.64
19.7	280	6600	3500	1.88
19.7	280	6600	3500	1.88
19.7	280	6600	3500	1.88
21.1	411	14520	5000	3
21.4	495	10032	3500	2.86
24.39	411	8712	3000	2.9
24.39	411	10560	4000	2.64
24.39	495	13200	3500	3.77
25	411	10560	3500	3.01
25	411	10560	3500	3.01
25	495	10560	3500	3.01
25	427	11880	5000	2.38
27	495	15312	4500	3.4
27	495	15312	4500	3.4
27	495	15840	4000	4
27	495	13728	3500	3.92
27	550	17424	5000	3.49
27	550	17160	5000	3.43

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How to cite this article:

Arnab Bandyopadhyay, Suchismita Saha, Sandipan Mondal, Mosaraf Hossain, B. Manoj Kumar and Anu Gopinath. 2018. A Recent Overview of CO_2 Footprint by the Mechanised Fishing Trawlers of Kerala, India. *Int.J.Curr.Microbiol.App.Sci.* 7(10): 593-598.
doi: https://doi.org/10.20546/ijcmas.2018.710.066