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# Environmental Benefits due to Adoption of Satellite-based Fishery Advisories

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## Abstract

Fishing operations in India consume large amount of fuel mostly for scouting operations by vessels. The satellite based Potential Fishing Zone (PFZ) advisories have provided an effective solution for making the fishing operations more profitable by reducing search time and hence reducing fuel consumption, which in turn reduces the $CO_2$ emission to the atmosphere. In order to quantify the amount of reduction in the $CO_2$ emission, the data collected from the 69 ring seine operations off Kerala coast have been utilized. The average $CO_2$ emission within PFZ and outside PFZ advisories are found to be 0.161 t and 0.959 t respectively, resulting in reduction of 0.8 t. The total reduction in $CO_2$ emission due to usage of PFZ advisories by these 69 experiments is found to be 55.052 t. The quantification of these results clearly shows that the PFZ advisories are helpful in reducing the $CO_2$ emission to the atmosphere and making it environment friendly.

**Keywords:** $CO_2$ emissions, PFZ, fish catch, diesel consumption, ocean remote sensing

## Introduction

Fishing is becoming expensive with the increasing amount of time spent in search for the fish shoals. Possibilities of bringing down the search time for pelagic shoaling fishes assume great significance, since it can bring down the cost of fishing operations by savings on fuel and human effort and also reduces $CO_2$ emissions due to burning of fossil oils. In the second half of the 20$^{th}$ century, the greenhouse gas emissions have increased markedly as fleets expanded and search time increased due to declined stocks (Tyedmers, 2004).

With the advent of the ocean remote sensing in eighties, fishery forecast research got the much needed thrust. The linkages between satellite-derived sea surface temperature (SST) and chlorophyll with fish aggregation was established by Lasker et al. (1981); Laurs et al. (1984); Fiedler et al. (1984); Narain et al. (1990); Nath et al. (1991). In India, Indian National Centre for Ocean Information Services (INCOIS), Hyderabad, provides the PFZ advisories on daily basis in an operational mode except during fishing ban periods. The use of PFZ advisories for locating pelagic fish concentrations along the Kerala coast was established by Pillai et al. (1996; 1998; 2000). The benefits in terms of higher CPUE, higher profit and higher percentage of success of fishing operations, derived by the fishermen using PFZ advisories was also discussed in detail by Tummala et al. (2008).

Tyedmers et al. (2005); Thrane (2004); Tyedmers et al. (2005); FAO (2007); Schau et al. (2009); Winther et al. (2009); Runarsson (2008) have studied the variation in fuel consumption rates for different vessels and the associated factors of variation. Vivekanandan (2013) studied the differences in $CO_2$ emissions by different craft types and the amount of $CO_2$ emitted for every tonne of fish caught which varied from 0.50 to 1.02 t for every tonne of fish caught. Fuel consumption for active pelagic gears like trawls is generally high in relation to the quantity of catch. The vessels often spend significantly more time and fuel for searching schools than actually catching fish. The present work is an

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attempt to quantify the benefits derived by the fishing community in terms of saving fuel and also reduction in emission of $CO_2$ by using potential fishing zones advisories.

## Materials and Methods

Sixty Nine (69) Potential Fishing Zone (PFZ) advisories generated by INCOIS thrice a week between April 2008 and June 2011 (cloud free months) were disseminated to active fishermen groups along the Kerala coast between Vizhinjam in the south and Kannur in the north by fax/telephonic messages and digital display boards. The feedback was gathered immediately on arrival of the vessel, undertaking ring seine operations at the landing centre on completion of fishing activity. The data gathered using the feedback form such as (i) location of fishing, (ii) type of craft, (iii) type of gear, (iv) fishing operation details, (v) catch details and (vi) expenditure details (vii) duration of operations, (viii) fuel used, etc. were used to estimate the use of PFZ advisories in terms of saving of fuel and to estimate reduction in emission of $CO_2$.

The difference in diesel consumption between vessels using PFZ and non-PFZ advisory location, was used for calculating the reduction in $CO_2$ emissions. The reduction in $CO_2$ emission was calculated using the standard conversion factor that one litre of diesel produces 2.67 kg of $CO_2$ (Reuter et al., 2005).

## Results and Discussion

The details of the total savings in the fuel consumption and reduction in $CO_2$ due to usage of PFZ along with the average, minimum and maximum values were tabulated in Table 1. Usage of PFZ advisories reduced the time taken and fuel consumed to reach the location of fishing shoals, since scouting was very less or none in such cases. Whereas, in case of a vessel carrying out the random fishing operations, the vessel may end up in increased searching time and diesel consumption and with less or no catch. The observations made from all the 69 experiments conducted were presented considering the calculations with respect to every tonne of fish caught in the respective regions. The average diesel consumption in the PFZ and non- notified regions were observed as 60.61 and 360.09 l respectively. Experiment wise diesel consumed by the vessels that used PFZ and without using PFZ is shown in Fig. 1. Also in the PFZ regions, the $CO_2$ emission was estimated to be ranging from 0.015 – 0.575 t whereas outside PFZ region, it varied from 0.213 - 3.836 t. The average $CO_2$ emission within PFZ and outside PFZ is 0.161 and 0.959 t respectively. It is observed that use of PFZ advisories has resulted in enormous saving of diesel that varied from 21.47 l to 1293.53 l resulting in reduction of $CO_2$ emission from 3.45 to 0.06 t. This variation is attributable to the reduced duration of fishing and distance travelled.

The total diesel saved due to use of PFZ advisories by these 69 experiments was found to be 20,665 l. The total reduction in $CO_2$ emission is observed to be 55.052 t. There are about 2,200 seiners, 20,257 gillnetters in the country that can obtain the benefits of the PFZ advisories. If all the seiners and gillnetters utilize these PFZ advisories, about 17,965.6 t of $CO_2$ emission can be minimized for every tonne of fish caught by the vessels.

During the period April 2007 – March 2012, INCOIS released 4239 PFZ advisories for all coastal states of India. Tummala et al. (2008) reported the percentage of success of ring-seine fishing operations as 92%.

Table 1. Details of the total savings in the diesel consumption and reduction in $CO_2$ due to usage of PFZ

| No. of Experiments | Total Diesel consumed | | Total Diesel saved (litres) | Total reduction of $CO_2$ emission (metric tonnes) |
|---|---|---|---|---|
| | PFZ area | Non-PFZ area | | |
| 69 | 4181.46 | 24846.53 | 20665.07 | 55.05 |
| Average | 60.60 | 360.09 | 299.49 | 0.8 |
| Minimum | 5.63 | 80.00 | 21.47 | 0.06 |
| Maximum | 216.00 | 1440.00 | 1293.53 | 3.45 |

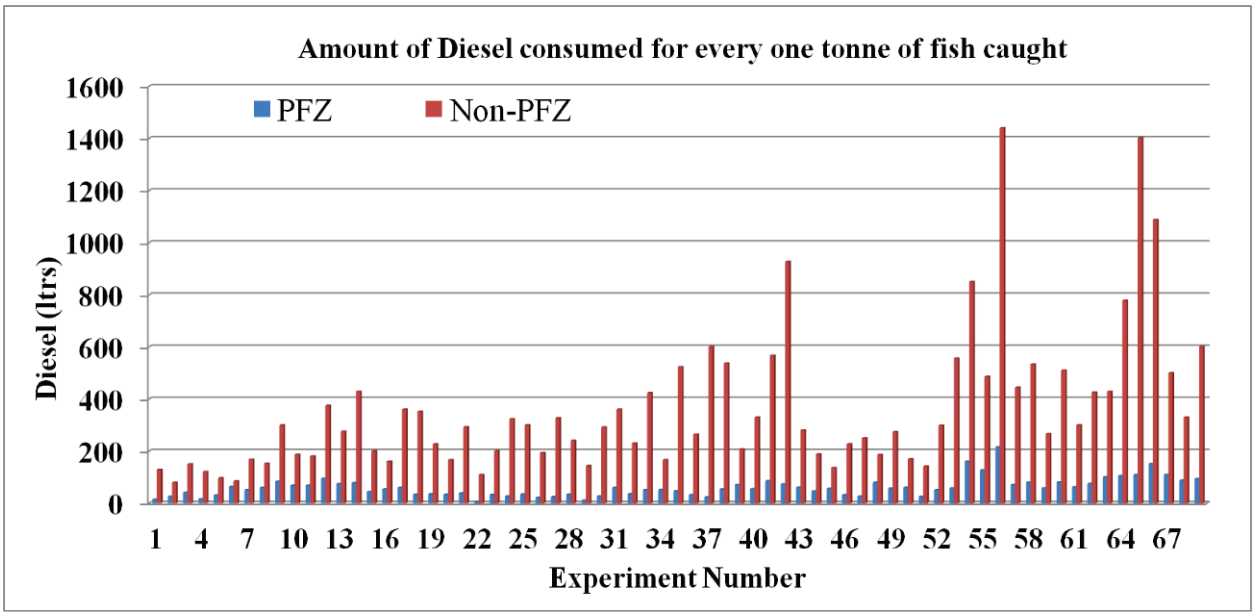


Fig. 1. Comparison of the diesel consumed between the vessels which used PFZ and which fished randomly without using PFZ

Extrapolating the amount of reduction in $CO_2$ emissions that could have been attained if all the 4239 advisories were used by the vessels, with an average reduction in $CO_2$ emission as 0.8 tonne and considering 92% of advisories are successful, about 3,119.9 t of $CO_2$ would have been reduced by the use of these PFZ advisories. In all the experiments conducted, it was found that the PFZ advisories lead to the reduction of the searching time which in turn resulted in the reduction of $CO_2$ emission to the atmosphere. This clearly indicated the effectiveness and usefulness of PFZ advisories towards reducing the stress on the environment through reduction of $CO_2$ emissions.

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