

Fuel Saving Measures in Fishing Boats

Ravikumar T.¹, Emiema S.², Mariappan S.¹, and Velmurugan R.¹

¹Assistant Professor, Department of Fishing Technology and Fisheries Engineering, Fisheries College and Research Institute, Thoothukudi

²PG Scholar, Department of Fishing Technology and Fisheries Engineering, Fisheries College and Research Institute, Thoothukudi

SUMMARY

Fossil fuel is a lonely fuel used in operation of the fishing vessel besides wind energy around the world. Burning of fossil fuel leads to emission of CO₂ which is one of the greenhouse gas that leads to global warming and climate change. Hence reducing use of fossil fuel or finding an alternative fuel is the need of the hour. At present scientist around the world trying hard to tap the solar energy and electrical energy to use as an alternative fuel in fishing sector. However, no immediate breakthrough is achieved so far. So, reducing fuel consumption in fishing vessel is very much essential to prolong the availability of fossil fuel. Hence, the present paper aimed to provide an insight on the reduction of the use of fuel in fishing vessel.

INTRODUCTION

Fisheries play an important role by providing food and employment to billions of people all over the world. The estimated world fisheries production in the year 2020 was 177.8 MT and the global marine capture fisheries were 78.8MT. India is third largest fish producing country in the world, it contributes 3.71MT of marine capture productivity to the global production. The fishing vessels plays an immense role in development of fisheries sector. Hence, its number directly associates with the marine fish production. The estimated number of fishing vessels reported in the world was 4.1 million in 2020 where as in India, according to CMFRI census 2016, a total of 1,66,333 fishing crafts exists in marine fisheries out of which 42,985 (25.8%) fishing crafts are mechanized, 97,659 (58.7%) fishing crafts are motorized and 25,689 (15.4%) fishing crafts are non-motorized. Among the different types of fishing vessels, the mechanized and motorized vessels uses fuel for its operation. The motorized and mechanized fishing crafts consumes 1% of the total fossil-fuel which accounts about 1,220 million litres of fuel used and in turn results the release of 3.17 million tonnes of CO₂ into the atmosphere. On the basis of CO₂ release per tonne of fish capture, it has been estimated that about 1.13 tonnes of CO₂ is being released per tonne of marine fish (Boopendranath, 2009). Even though the carbon emission from fishing vessel is considered be less however, keeping the global warming in mind, reducing fuel consumption is very much essential and need of the hour. Hence, the possible ways to reduce the consumption of fuel by the different fishing vessels are discussed elaborately as under in various headings.

Types of fishing gear and its fuel usage

Fishing is defined as skill of capturing fish and other aquatic organism. Fishing gears are the tools used for capturing fish. Generally, the fishing gears are classified into two categories; active gear and passive gear. Active gear are dragged through water to chases and capture the targeted fishes examples are trawl net, dredge, purse seine, shore seine etc. Passive gears are stationary here the pray comes voluntarily to net and get caught in the fishing gear example includes traps, gill nets, entangling nets, and longlines. As per the energy intensive is concerned active gears are more energy intensive and the trawling consumes 5 times more fuel than gill netting and 11 times more fuel compared to purse seining. Today, trawling is one of the most important commercial fishing methods of India, which constitutes 50% of the total marine fish landings of the country. Hence, efforts needs to be placed to reduce the fuel consumption by the trawlers.

Fishing vessel wise fuel saving methods

There are different ways in which fuel can be saved in different fishing vessels (Table. 1) they can be achieved through using of passive fishing gears, reducing the running speed of the boat and use of wind energy through sails.

Table. 1 Fishing vessel wise fuel saving methods

S. No	Fishing	Method to save fuel
1.	Long line	Reduce the running speed of the engine Use of sails
2.	Purse seiner	Use fish finding equipment
3.	Gill net	Most fuel is consumed while running hence running speed should be reduced.
4.	Troller	Reduce the running speed Reduce the operating speed if fishes were other than tuna fishes
5.	trawl	Making trawl net with less drag resistance Use of otter board with less drag resistance Use of propeller in accordance with OAL of the boat Ensuring hull is free from foulers and borers Use of large mesh sized nets to lower the drag resistance of fishing net

Common way of reduce consumption of fuel in fishing vessels

- Reduce running speed of the engine,
- Make hull surface must be free from foulers
- Regular maintenance of propeller
- Change over from a petrol outboard engine to a diesel engine inboard engine
- Use fuel efficient fishing gears and designs
- Reducing the overall weight carried by the boat for easy traveling of boat construct the hull of the boat, while keeping fuel construction in mind
- Regular maintenance of the engine (ix)
- Adopt multi-day fishing
- Use appropriate otter board while operating trawl net (xii) Adopt mother ship concept in deep sea fishing.

Reduce running speed of the engine

Reducing the speed of the vessel is the most commonly used method to save fuel. Depending upon the size and type of the boat, fuel saving differs, we can use an engine tachometer (Figure 1.) and a GPS, to estimate how much fuel we can save by reducing the engine rpm. Sala et al. (2011) observed that fuel savings as much as 15% could be achieved by reducing a vessels speed by just half a knot. Thus reduction of fuel consumption is possible by reducing the running speed of the vessel.



Figure 1. Tachometer

Keep the hull free from foulers

The most important part of the fishing boat is hull. Attachment of barnacles, slime, weeds settle on the hull makes it heavy and roughness (Figure. 2). This external settlement add upon an extra weight, which will increase frictional resistance up to by 50% by making the boat difficult to sail. Hence appropriate technique should be used to remove attachments on the hull eg. Anti-fouling paint can be done to avoid foulers.



Figure. 2 Hull having attachment of foulers

Maintenance of the propeller

Propeller is a most significant item in the fishing vessel. The poor design and specification directly leads to higher fuel consumption. The fixing of a controllable-pitch propeller can reduce fuel consumption thus enable the propeller to operate efficiently while both towing and free running condition. However, its operation requires both skill and knowledge otherwise result in significantly increased fuel consumption. Further if a properly designed controllable-pitch propeller is correctly operated, it can reduce fuel consumption up to 15 percent compared with a fixed-pitch propeller. A propeller covered with marine growth (Figure. 3a) will result in a considerable reduction in boat speed and thus results in increase in fuel consumption. The best fuel efficiency is achieved by cleaning propeller regularly (Figure. 3b) and operating propeller at low rpm. Also the position of fixing the propeller plays an important role.



(3a) Propeller with fouler



(3b) Propeller after cleaning

Change over from a petrol outboard engine to a diesel engine

Petrol engines results in wastage of fuel due to incomplete combustion where as in diesel engines very less amount of wastage of fuel is possible. Moreover diesel engines are more rugged and reliable and are suitable for fishing in sea. Hence to reduce fuel wastage diesel engines are preferred than petrol engines.

Use of appropriate otter board

Otter board keeps the mouth of the trawl net to open horizontal direction while the net is dragged through the water. Central Institute of Fishing Technology (CIFT-ICAR), has developed a V form double slotted otter board which helps in reducing the fuel consumption (Figure. 4). It is found to be effective in creating less drag as the mouth opening of the trawl permit water to flow through more freely, reducing the resistance of the gear. Apart from this there are many fuel efficient otter boards are used in many countries.

Use fuel efficient fishing gears and designs

In fishing vessels, fuel efficiency can be achieved through modifying the gears and their designs. While using trawl net, to reduce fuel consumption, gear could be low dragged but results end up with low catch of

fishes. Hence square cod end mesh net or large mesh size nets could be used. Thereby, water flow through the gear easily and the resistance offered by the gear reduced thus subsequently fuel is saved.



Figure. 4 ICAR-CIFT V form double slotted otter board

Reducing the overall weight carried by the boat

To save fuel in fishing vessels one must reduce the overall weight of the boat. This can be achieved by discarding unnecessary stored materials such as old fishing nets and other materials. Further, we can also reduce the boat weight during its initial stages of construction by opting low weight materials for hull construction like FRP, Aluminum etc. Thus by reducing the weight of the boat, it is easy for a fishing vessel to sail in the sea smoothly than a heavy loaded fishing vessel. The overloading will lead to overload on engine and thereby fuel consumption. Hence, by care need to be taken to reduce the weight of the boat thereby fuel.

Shape of the hull

Shape of the hull (Figure. 5) determine comfortable, safe of the boat besides its fuel efficiency. Flat bottom hull is the most efficient type of boat works well on rivers and small lakes where the waves are small, and especially where shallow draft is important. However this boats pound severely and are uncomfortable even in mild sea conditions. Hence, the hull sharper than a flat bottom hull i.e deep-vee shaped hull which can reduce the wave resistance of the sea and easy sailing of the ship can be done however, deep-vee shaped hull boat normally travels at high speed hence consume more fuel. Therefore, a shallow- or modified-vee hull boat is best suit for fuel saving and offers better ride than a flat-bottom and producing better fuel economy than a deep-vee.

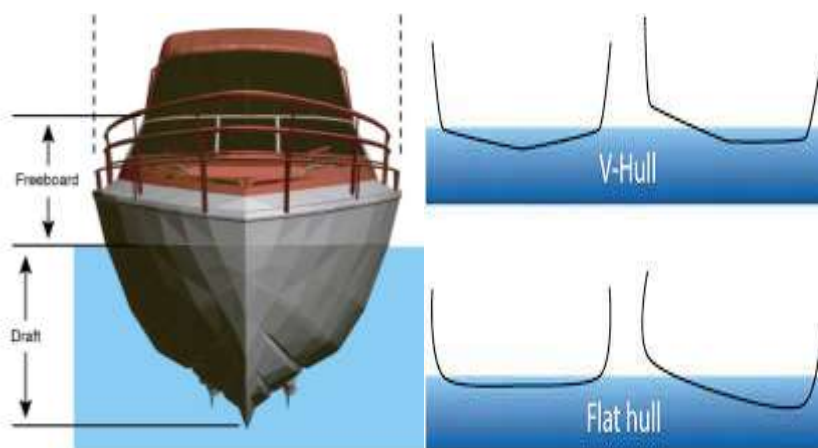


Figure. 5 Shapes of hull

Proper maintenance of the engine

Proper maintenance of the engine includes, by strictly following the guidelines of manufacturer instruction manual besides periodical checking of the engines, oil and the oil filters and regular service. The clean fuel plays a vital role in keeping the fuel pumps and injectors in a good condition. Hence, use of unpolluted and clean fuel is very important in reducing the carbon emission.

Multi day fishing

Instead of daily fishing multi fishing can be done to conserve or reduce the fuel. In multi day fishing the fuel spent on running speed will be less than the fuel spent on daily fishing. Thus multi day fishing increases

catch and is economical. Hence multi day fishing can be done.

Adoption of deep sea fishing

Fishermen can follow multi day fishing in deep sea areas for catching tunas, deep sea squids etc. In addition to this, Mother ship concept will also help the fishermen to reduce the fuel of their boat. As mother ship can reduce the daily fuel spent on running speed of the fishing vessel.

New inventions that help reducing fuel consumption

Autopilot system and modern electronic navigational system to comply shortest route to fishing ground and back thereby to save fuel. There are several apps like FFMA, mKRISHI, PFZ etc. provides information on fishing grounds which saves search time of fish shoal and fuel. Indian National Centre for Ocean Information Services (INCOIS) provides these advisories on a daily basis on cloud free days to fishermen. Construction of green vessels to reduce fuel consumption like the one constructed by CIFT in Goa and the vessel is named as Sagar Haritha. This vessel has a hull which is made up of low weight marine grade steel and has a capacity of 400HP engine power; 600-watt solar panel for lightning and a bulbous bow to reduce the wave resistance enabling easy sailing of the ship.

Supplementary tips to reduce fuel consumption

Record your trip in a log book. In that, record your engine speeds, boat speeds, weather condition, sea conditions, net shooting speed, net hauling speed and fuel consumption. Periodically spend time on log book and review the performance which will help to recognize trends and lapses. Apart from it will help to identify the fault and make necessary correction to increase efficiency. Further, fix a fuel flow meter and use it to adjust speed of the bait. Experiment with different trim system for the most miles per litres. Keep propulsion unit tuned, valves adjusted, fuel filter changed and air filters changed.

CONCLUSION

Although fishing contributes to 1% of fuel consumption in India, However, the decrease in use of the fuel leads to extend their availability in the earth and save our environment. Further, by adapting new technologies in fishing sector like use of modern electronic navigation equipments, mobile apps, advanced engine technology, solar energy and satellite technology can tremendously reduce fuel consumption and thereby carbon emission. Reduction in fuel consumption leads to reduced carbon emission thereby preventing global warming.

REFERENCES

- Amala Shajeeva, J., Neethiselvan, N., Sundaramoorthy, B., Masilan, K., Arunjenish, D., Rajakumar, M., Ravikumar, T. and Baiju, V., 2017. Carbon emission due to excess fuel consumption by the trawlers of Thoothukudi, Southeast Coast of India. *Carbon Management*, 8 (5-6), pp.393-398.
- Anon (2022) Annual report 2021-2022. Ministry of fisheries, Animal husbandry and dairying, Government of India.
- Anon. 2021 Annual report 2021. Central Marine Fisheries Resource Institute, Cochin.
- Boopendranath M.R. (2000). Studies on energy requirement and conservation of selected fish harvesting systems. Cochin University of Science and Technology, Cochin, India
- Vivekanandan. E., V. V. Singh and J. K. Kizhakudan. (2013). Carbon footprint by marine fishing boats of India. *Current Science*. 105 (3), pp 361-366.
- Gulbrandsen O. Fuel savings for small fishing vessels – a manual. Food and agriculture organization of the United Nations, Rome, pp 56–58 (2012).
- Sala, A., De Carlo, F., Buglioni, G. and Lucchetti, A., 2011. Energy performance evaluation of fishing vessels by fuel mass flow measuring system. *Ocean Engineering*, 38(5-6), pp.804-809.
- Sharada Balasubramanian (2017) How green fishing reduces carbon footprint.
- T.Ravikumar, N.Neethiselvan and Amala Shajeeva () Need for reducing carbon emission from Indian Fishing Vessels. Department of Fishing Technology and Fisheries Engineering, Fisheries College and Research Institute, Thoothukudi.