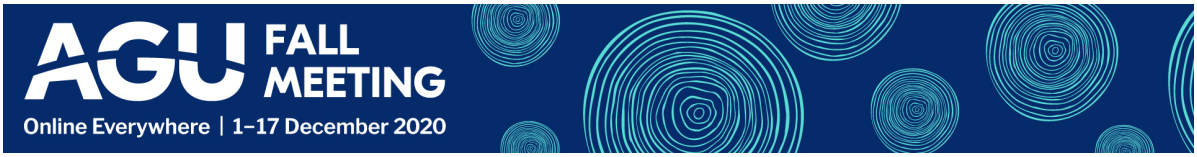
Impacts of Shifts in Commercial Fishing Techniques on Coastal Zones and Climate Change

P Pallavi*, Sindhuja Kasthala, D Parthasarathy, P Kalbar

Indian Institute of Technology Bombay

PRESENTED AT:



INTRODUCTION

Over the few decades, the fishing sector has undergone major changes due to several factors such as fuel usage, equipment used, availability of fish, the market competition which led to the shift in the most dominant techniques.

We identified the *most dominant techniques* prevailing across India along with reasons for such a shift followed by a *Life Cycle Cost Assessment* (LCCA) of the prevailing fishing methods to verify the need of such shift. *Aquaculture* and *Mechanised fishing* methods which are found to be the most dominant techniques are assessed for Carbon footprint to understand their effect on climate.

Worli, a predominant fishing village in Mumbai, is selected for the data on mechanised fishing. Aquaculture farms in the West Godavari district of Andhra Pradesh, predominant in Aquaculture, are considered for sample data on Aquaculture ponds. The impact of the fishing sector on the coastal zone is discussed. The discussion is supported by highlighting the deterioration of coastal zone triggered by the fishing industry in the case study areas.

MARINE FISHING IN INDIA

- Fisheries have a contribution of 1.07% of the total GDP of India.
- Some ***14 million people*** are employed in the fishing sector.
- The marine fishery is a *poor dependant sector* with a majority of artisanal fishermen using the traditional or mechanised fishing method. They contribute around *8% to the fishery pool* of the country (ICAR, 2004).
- In recent decades, there is an increase in ***motorized boats and trawlers*** in the sea with alternative methods that evolved for supplementing the existing fish products such as ***aquaculture***.
- This increase in mechanised fishing is the product of *incentivisation of fishing trawlers* by Indian Govt of which ***$174 million*** is believed to contribute to destructive fishing practices (Sumaila et al., 2019).
- Blue Revolution in India brought changes to the fishing industry and provided a scientific base for aquaculture. This is currently a major economic sector, making India the ***second-largest country in aquaculture production***.
- Aquaculture provided a supplement to prevailing common fishing techniques. There is a sharp increase in inland fishers and aquaculture from *46% in the 1980s to 85% in the recent past*.

METHODOLOGY

Here is the methodology followed for the work.

The work is based on two study areas-

1. Worli- a fishing village in the west coast of Mumbai- for the case of mechanised and motorised fishing
2. Eluru of West Godavari District, Andhra Pradesh- for the case of aquaculture

Based on the data from these two areas, we calculated the LCCA to understand how much is the profit from these techniques and why there is a shift in the techniques.

After this, the impacts of the dominant techniques have been identified through literature and from field survey. We also calculated CFP to understand how much carbon emission come from these techniques.

In order to calculate LCCA, we have used the PAS 2050 method and the conversion ratios used are as per FAO, 2017. The system boundaries for both the techniques have been presented later.

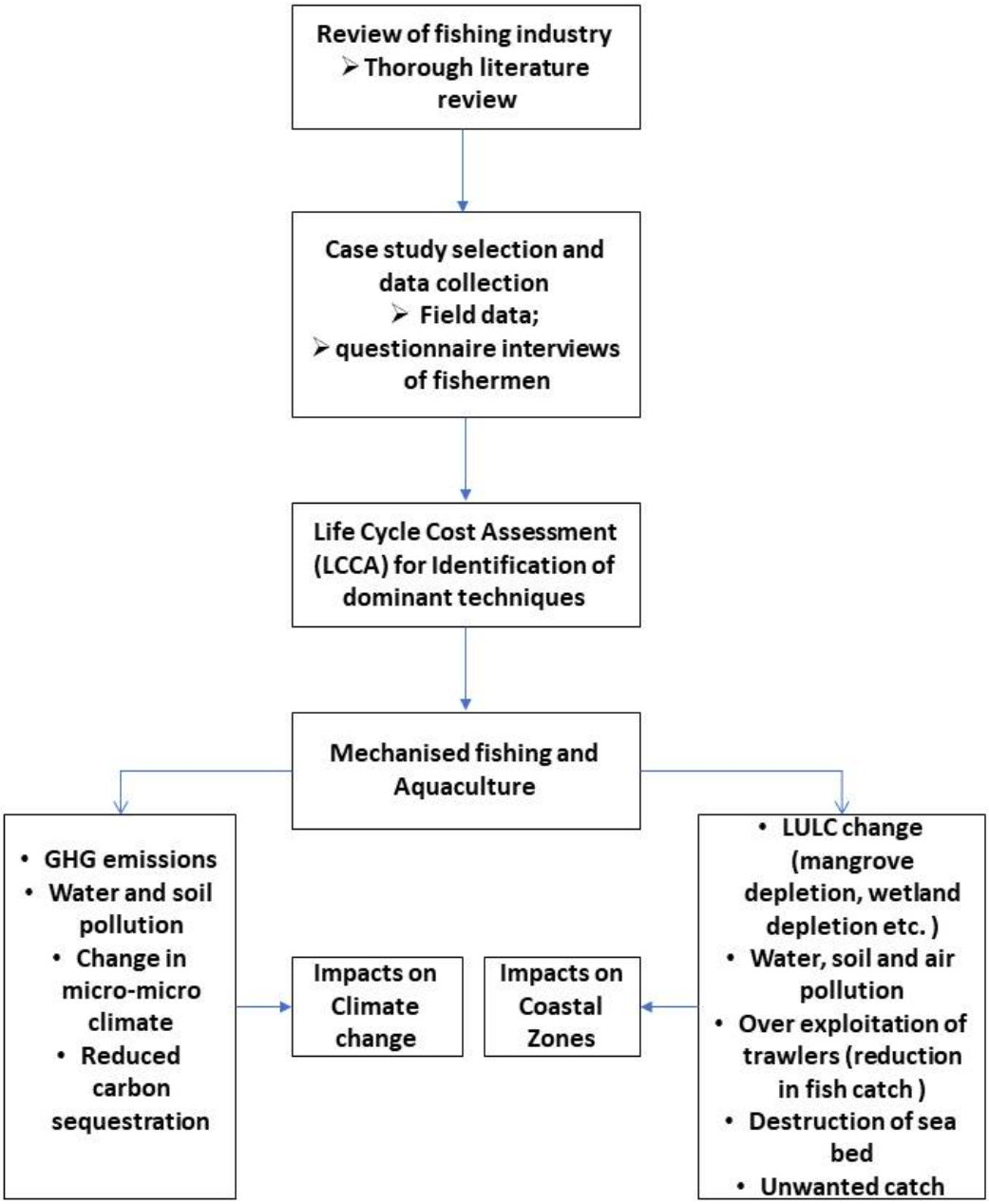


Figure 1 Methodology

LIFE CYCLE COST ANALYSIS

Table 1 LCCA of different techniques

Costs	Mechanised	Trawler	Aquaculture (for 20 acres pond)
Initial investment	6,25,000	60 lakh	29,30,000/-
Yearly maintenance + Fuel+ labour	3, 44,000	83,52,000	2,00,000
Income on Fish Catch per year	5, 40,000	2,16,00,000	44,00000
Profits per cycle	1,96,000		11,30,000
Profits per year	1,96,000	1,32,48,000	42,00000
Depreciation rate	20% (as per Income tax act,1961)	20% (as per Income tax act,1961)	30% (as per Income tax act,1961)
Salvage value= $P(1-i)^{year}$	64425	6,44,245	82,765
Time period	10 Years	10 Years	10 years
Life cycle cost analysis	-1.3×10^5	1.4×10^7	9.5×10^7

CARBON EMISSIONS

Figure 2 System Boundary of aquaculture for CFP calculation

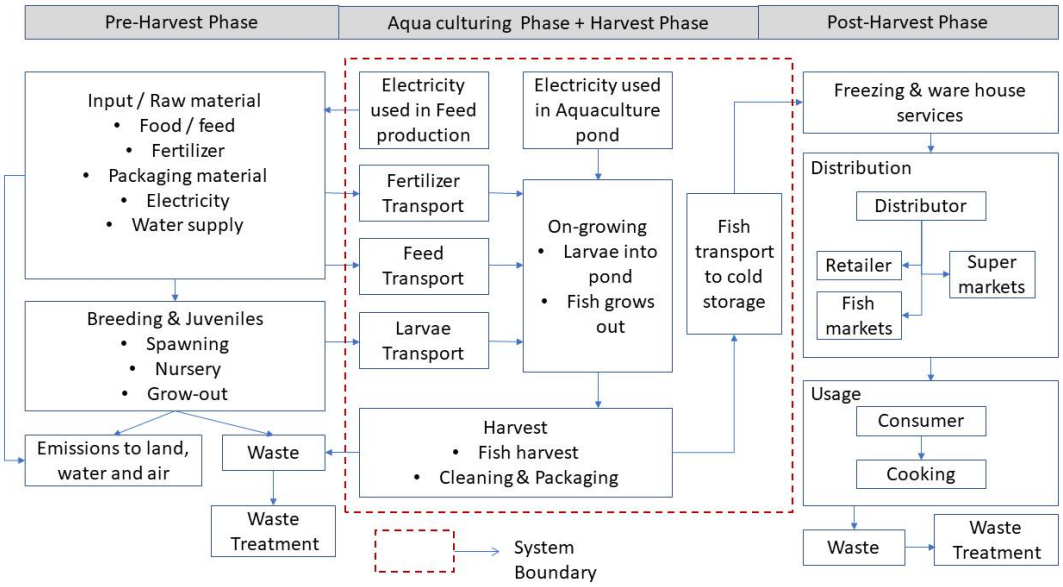


Figure 3 System Boundary of Mechanised Fishing

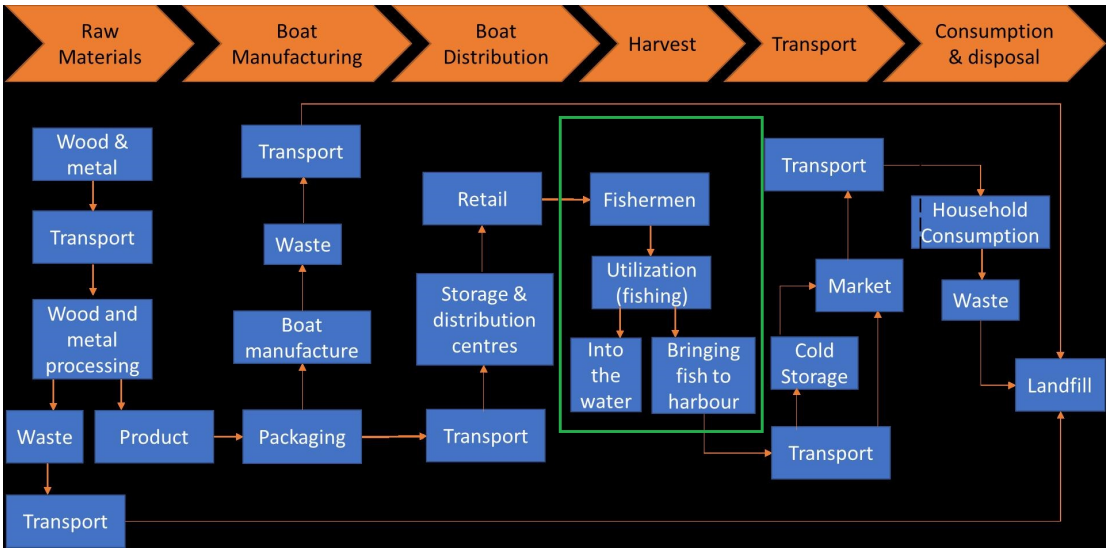


Table 2 CFP of Aquaculture

Activity	Consumption	Emissions (kg CO2 e/kg of fish)
Electricity (in kwh/ton)		
Electricity for feed production	996	0.95
Electricity used in aqua pond	83.3	0.08
Diesel (in liters/ton)		
Larvae transport	0.25	0.0006
Feed transport	0.25	0.0006
Fertilizer transport	0.0825	0.0022
Fish transport to cold storage/ local market	0.5	0.0013
Ice package*		
Total		**1.0347 kg co2 e/kg of fish**

Table 3 and 4 CPF of the trawler and motorized fishing

Table 3 CFP of Trawler and motorised boats

Methods	Fuel used (Litres/year)	Carbon Footprint (kg CO2 eq/kg of fish)
Motorised	3000	3.21
Trawlers	72000	48.6

Table 4 Carbon Footprint of all three fishing methods

	Motorised	Trawler	Aquaculture (for 20 acres pond)
Carbon footprint (kgCO2eq/kg of fish)	3.21	48.6	1.0374

Fishing Dock in Worli, Mumbai

Aquaculture ponds in East Godavari District, Andhra Pradesh

INFERENCES

- From the above calculations, it is evident that the profits are huge in trawler fishing as well as in aquaculture. This explains why there is a significant shift towards these techniques.
- Aquaculture is the most profitable technique among all which explains its popularity in India, especially in coastal areas.
- From The CFP, the maximum emission is from trawlers and least is from aquaculture.
- But despite the high profits and lower CFP numbers, it doesn't indicate that the aquaculture and trawlers are sustainable.
- Interviewing artisanal fishermen in the area and conducting a survey in these areas it became clear that these improved techniques are not sustainable and is impacting the livelihoods of artisanal fisherman
- These techniques are disturbing coastal ecosystem:

Aquaculture

Aquaculture involves land-use change which converts mangroves, wetlands and other eco sensitive areas into fishing ponds. such loss of mangroves changes the micro-climate of the region and also abridge the natural defence of the region towards climate hazards. Aquaculture also leads to water pollution in the nearby sea.

Trawlers

Competition from trawlers and other improved fishing techniques are impacting artisanal fishermen's livelihood. Bottom trawlers are one of the most destructive fishing technique which destroys the sea bed. trawlers also lead to ver fishing and unnecessary bycatch which disturbs the food chain of the ecosystem.

REFERENCES

Adhikari, S., Lal, R., & Sahu, B. C. (2013). Carbon footprint of aquaculture in eastern India. Journal of Water and Climate Change, 4 (4), 410-421.

CarbonTrust. (2008). Guide to PAS 2050. How to assess the carbon footprint of goods and services. London: BSI British Standards.

Csirke, J. (1984). Report of the Working Group on Fisheries Management, Implications and Interactions. Rome: FAO.

EPA. (2018). Emission Factors for Greenhouse Gas Inventories. Washington DC: U.S. Environmental Protection Agency.

FAO. (2016). The state of world fisheries and aquaculture. Rome: Food and Agriculture Organization of the United Nations.

FAO. (2017). Greenhouse gas emissions from aquaculture. A life cycle assessment of three Asian systems. Rome: Food and Agriculture Organization of the United Nations.

Ghosh, S., Rao, M. V., Kumar, M. S., Mahesh, V. U., Muktha, M., & Zacharia, P. U. (2014). Carbon footprint of marine fisheries: life cycle analysis from Visakhapatnam. CURRENT SCIENCE, 107, NO.3, 515-521.

Ghosh, Shubhadeep, & Rao. (2015). Carbon footprint in life cycle of marine fisheries at major fishing harbours of Andhra Pradesh, India. Indian Journal of Fisheries, 62 (4), 37-44.GoI. (2008).

INCOME-TAX ACT, 1961 (43 of 1961) [AS AMENDED BY FINANCE ACT, 2008]. New Delhi: Government of India.

Ronnback, P., Troell, M., Zetterstrom, T., & Babu, D. (2003). Mangrove dependence and socio-economic concerns in shrimp hatcheries of Andhra Pradesh, India. Environmental Conservation, 30(4), 344-352.

Singh, V. (2018, May 19). Retrieved from DNA India web site: https://www.dnaindia.com/mumbai/report-worli-koliwada-has-its-own- development-plan-2616626

SRINATH, M., JACOB, V., KANAKKAN, A. M., & KARBHARI, J. P. (1987). An appraisal of the marine fisheries of Maharastra. Cochin: Central Marine Fisheries Research Institute.

U. Rashid Sumaila, Naazia Ebrahim, Anna Schuhbauer, Daniel Skerritt, Yang Li, Hong Sik Kim, Tabitha Grace Mallory, Vicky W.L. Lam, Daniel Pauly, Updated estimates and analysis of global fisheries subsidies, Marine Policy, Volume 109, 2019, 103695, ISSN 0308-597X, https://doi.org/10.1016/j.marpol.2019.103695.

Vivekananda, E., Singh, V., & Kizhakudan, J. (2013). Carbon footprint by marine fishing boats of India. Current Science, Vol 105, No-3, 361-366.