Energy Consumption of Small Scale Fishing Vessel Operations in Indonesia
A Case Study in Palabuhanratu, Indonesia

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Introduction

- Energy intensive food production
  - Fuel use for fishing:
    - Global: 1,2% of world fuel consumption and emitted 1.7 ton of CO2/ton landed catch;
    - Japan: third highest national consumption
    - Indonesia: 5,87% of national consumption
    - Major cost component

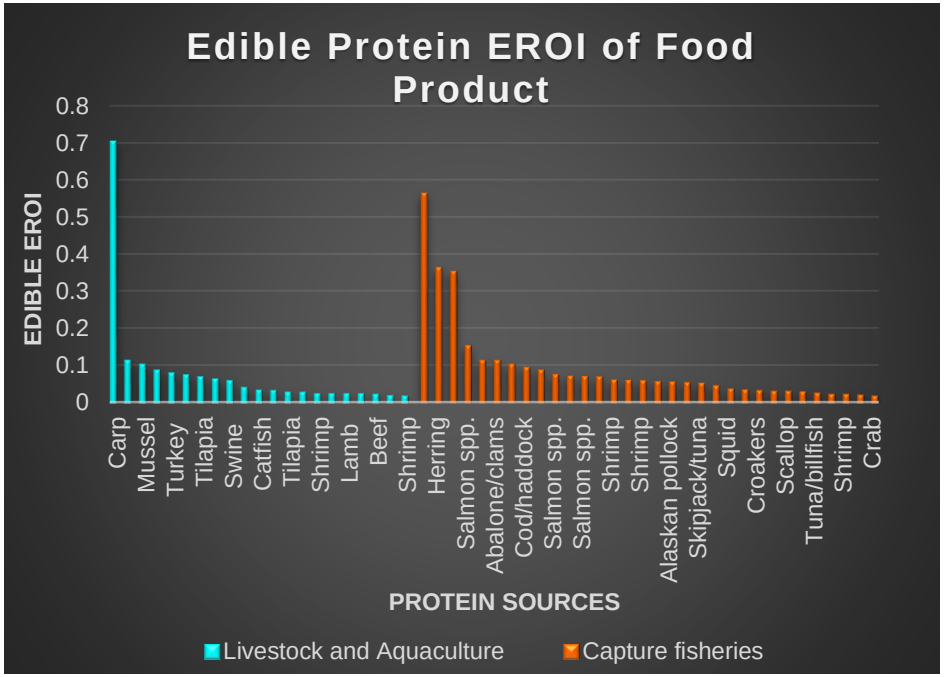


Fig. 1 Edible Protein EROI

  - Low edible protein energy return on investment (ep - EROI)

Introduction

- Small scale fishing vessels
  - Accounted for 79% of the global fishing fleet
  - Deal with uncertainty
  - Mostly operated in developing countries
- Indonesian fisheries:
  - 89% of fishing vessel less than 10 GT
  - supported 54% of animal protein intake
  - accounted for 2% of employment level
  - increased the fishermen's prosperity index by 2.44%



Introduction

- Objectives
  - Assess the energy consumed by small scale fishing vessel operation
  - Formulate improvement strategies
- Case study location
  - Palabuhanratu fishing port, West Java Province, Indonesia.

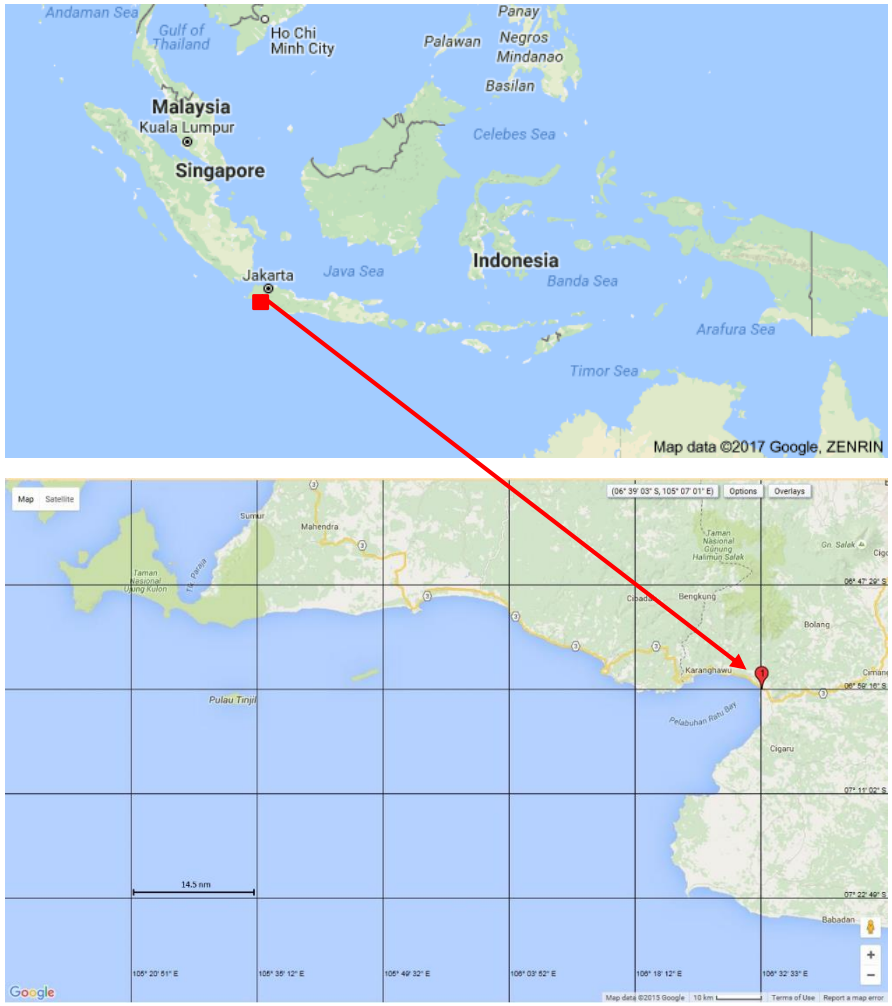


Fig 2. Case study location

Method

1) Main data sources:
   - Indonesian fisheries statistical reports
   - Statistical reports from location of study
   - Survey
2) Comparative studies
   - Pelagic Danish seiner
   - Hand liner
   - Trammel netter
   - Lift net ferry
3) Energy consumption

   (calculated in kJ/kg catch and kJ/GBP revenue)

Energy inputs on fishing

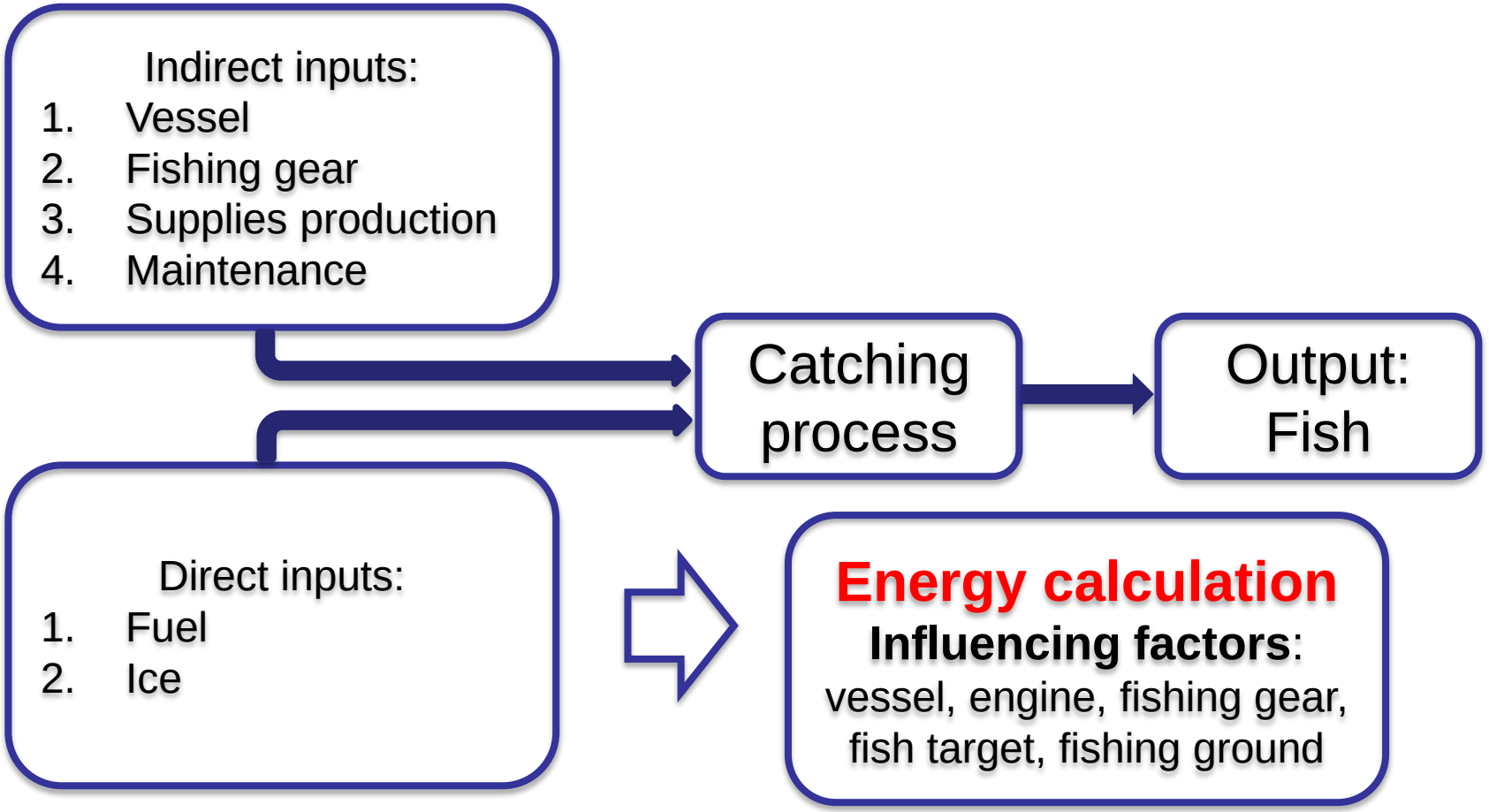


Fig 3. Pelagic Danish Seiner

Fig 4. Hand liner

Fig 5. Trammel netter

Fig 6. Lift net ferry

Characteristic of studied vessels

Fishing vessels	Pelagic Danish Seiner	Hand Liner	Trammel netter	Lift net ferry
GT	5	2	4	5
Power	Outboard 40 HP	Outboard 10 – 15 HP	Inboard 22 HP	Inboard 100 HP
Fishing gear	Pelagic Danish seine 1 unit	Hand line 2 units	Trammel net 1 - 2 units	Lift net 8 – 10 units
Operation profile	Day time Active	Mostly night time Passive	Day time Mostly Active	Night time Passive
Crew	10 – 15	1 – 2	3 – 4	1 – 2 / vessel 1 – 2 / platform
Main species caught	Small pelagic fish	Hair tail	Prawn, Lobster	Anchovies and paste shrimp
Fleet size	73	244	31	25

Characteristic of studied vessels

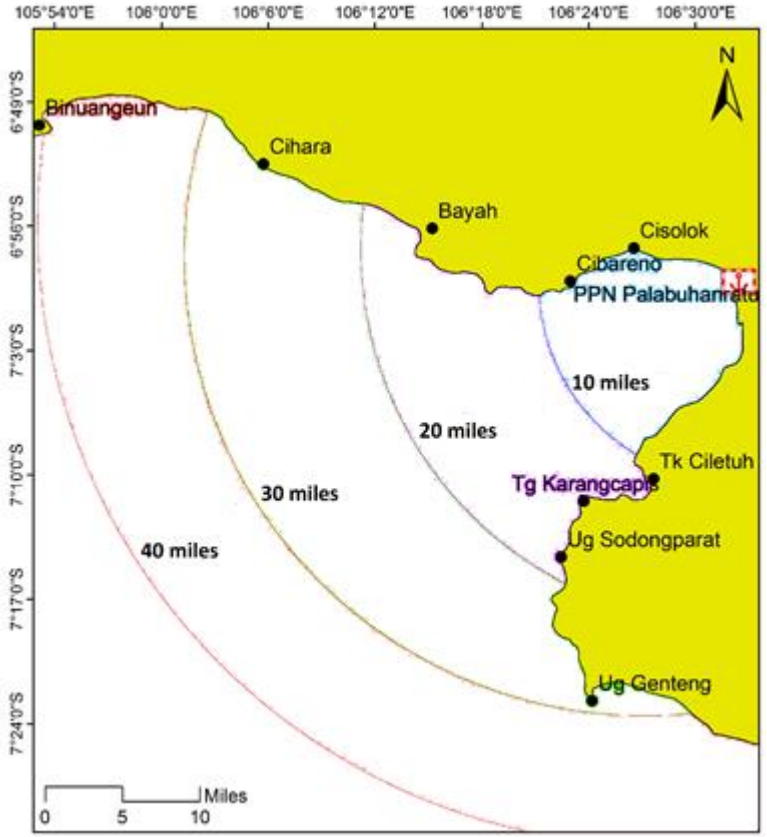


Fig 7 Fishing grounds

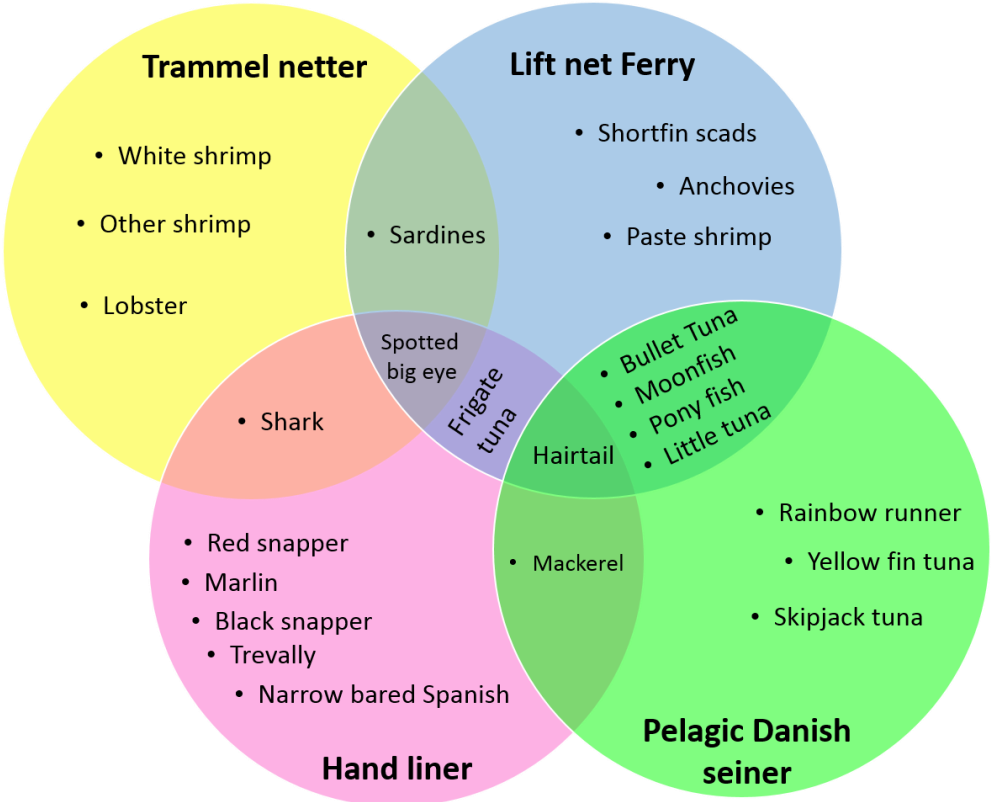
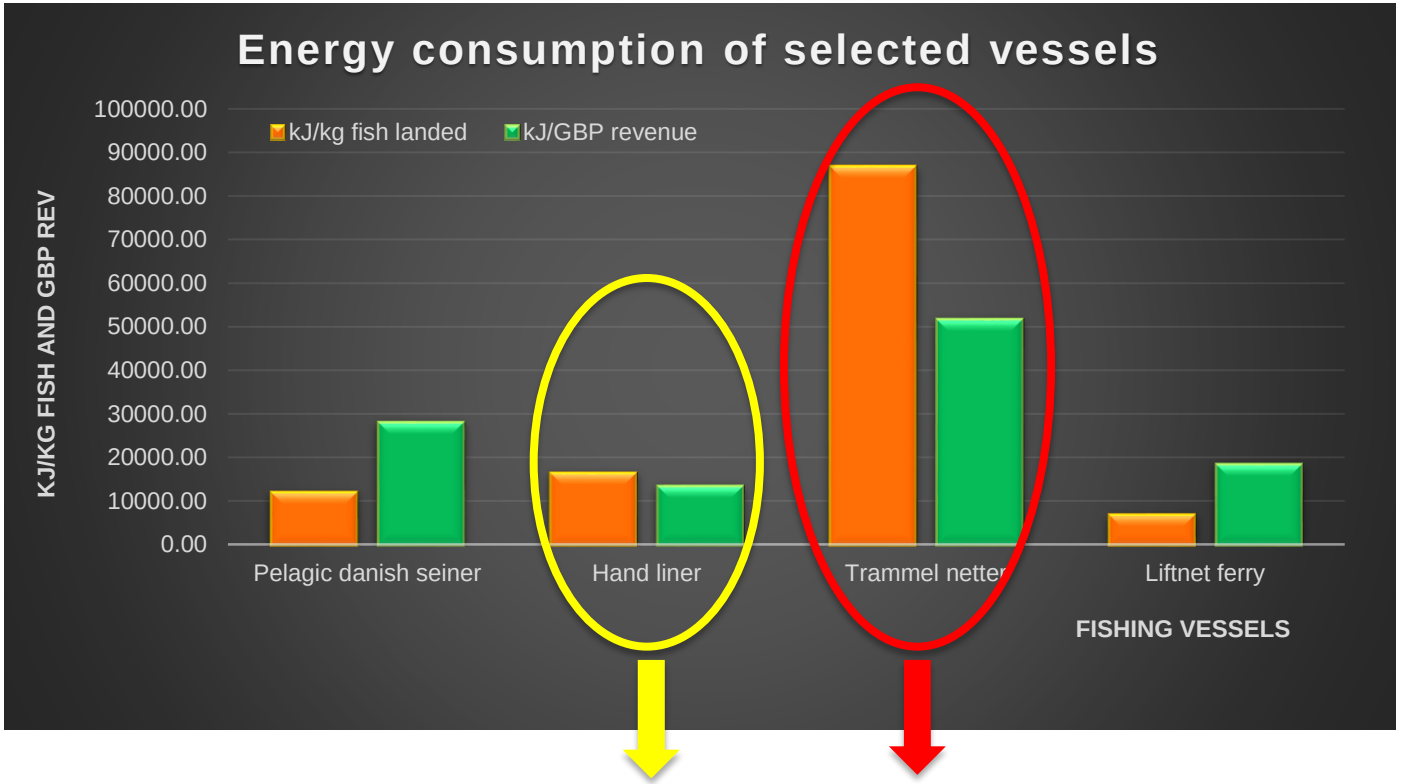


Fig 8 Species landed from studied vessels

Energy Consumption



Hand liner is the most efficient fishing due to consume the reasonable energy to catch valuable fish

Trammel netter is the most energy intensive fishing due to:

- Landed the lowest catch volume but most valuable price
- Mostly doing active fishing

Energy Consumption

Studied vessels	Fuel use (litre/kg)	Comparable result	
		Other studies	Fuel use (litre/kg)
Pelagic Danish seiner	0.27	Danish seiner	0.42[d]
			0.32[b]
			0.13[c]
Hand liner	0.48	Hook	0.18[c]
		Hand liner	0.06[a]
Trammel netter	2.56	Bottom trawler	3.65[d]
			1.65[a]
		Shrimp trawler	1.22[c]
Lift net ferry	0.18	NA	NA
Global fuel consumption 0.53 kg fuel/kg fish landed [e]			

Sources: a. Basurko et.al (2013); b. Parker et.al (2015); c. Schau et.al (2009); d. Thrane et.al (2004), e. Tyedmers et.al (2005)

Strategies formulation

SWOT ANALYSIS	**Strengths (S)** • Propel coastal economy • Supportive infrastructures • Good fish quality • Open to technology	**Weaknesses (W)** • High uncertainty • Limited fishing ground • Limited skills • Resist to change fishing habits
Opportunities (O) • Tourism • Open for research	**Strategies S-O** • Technical application and research on fuel use • Develop the variant of seafood product	**Strategies W-O** • Develop tourism in fishing • Job substitution
Threats (T) • Increasing fuel price • Decreasing fish production	**Strategies S-T** • Speed management • Fuel substitution	**Strategies W-T** • Increase the fish value • Job substitution

Strategies formulation

Potential improvement	Implementation	Status
Technical application and research on fuel use	• Periodic maintenance • Encourage more research in fishing efficiency	• Partly implemented • Researched in lift net: Battery to power light fishing
Develop tourism in fishing	• Boat hire	• Partly implemented
Develop the variant of seafood products	• Conducting fish processing workshop	• Implemented without successful follow up
Speed management	• Slow steaming	• Implemented in all vessels
Fuel substitution	• Fuel substitution to LPG	• Implemented in hand liner
Increase the fish value	• Government involves in deciding the fish selling price • Community agreement to increase selling price	• Difficult to be implemented • Difficult to be implemented
Job substitution	• Doing another job when low fishing season coming	• Implemented by some fishers

Conclusion

- Energy inputs: fuel, ice and lubricant oil
- The most energy intensive fishing is trammel netter
- Compared to other fuel consumption in similar yet advanced operation, the fuel consumption in studied vessels is relatively high.
- Potential improvement focus on increasing fuel efficiency which also consider economic priority and fishermen's fishing habit.

Thank You

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