

# Energy Consumption of Small Scale Fishing Vessel Operations in Indonesia

## A Case Study in Palabuhanratu, Indonesia



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Presented in MARENER 2017, World Maritime University  
Malmo, Sweden 24 – 25 January 2017

# Introduction

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

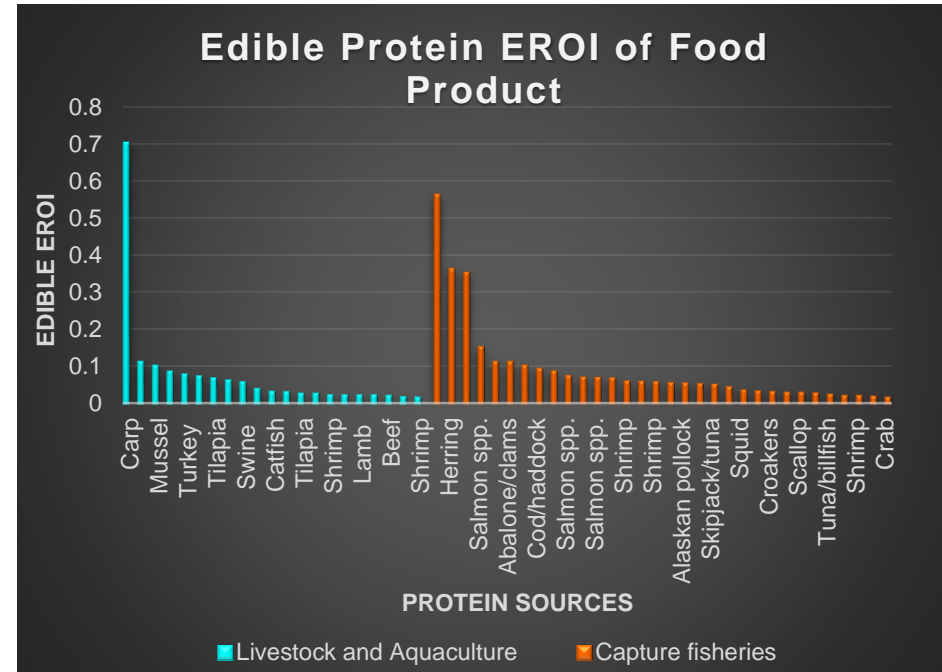


Fig. 1 Edible Protein EROI

- 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.

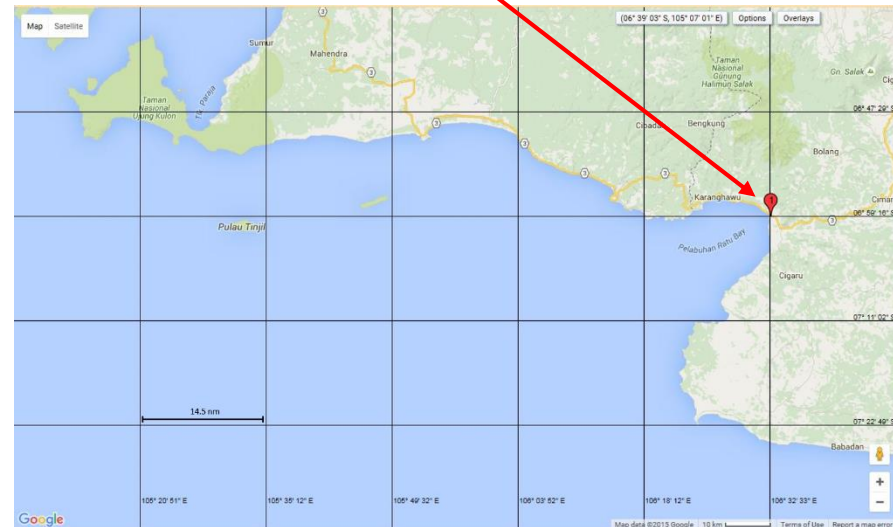
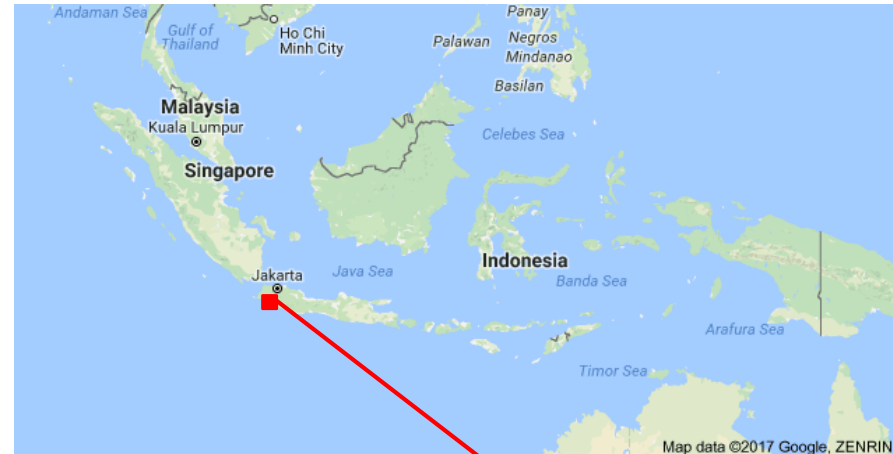


Fig2. Case study location

# Method

## 1) Main data sources:

- Indonesian fisheries statistical reports
- Statistical reports from location of study
- Survey

## 2) Comparative studies

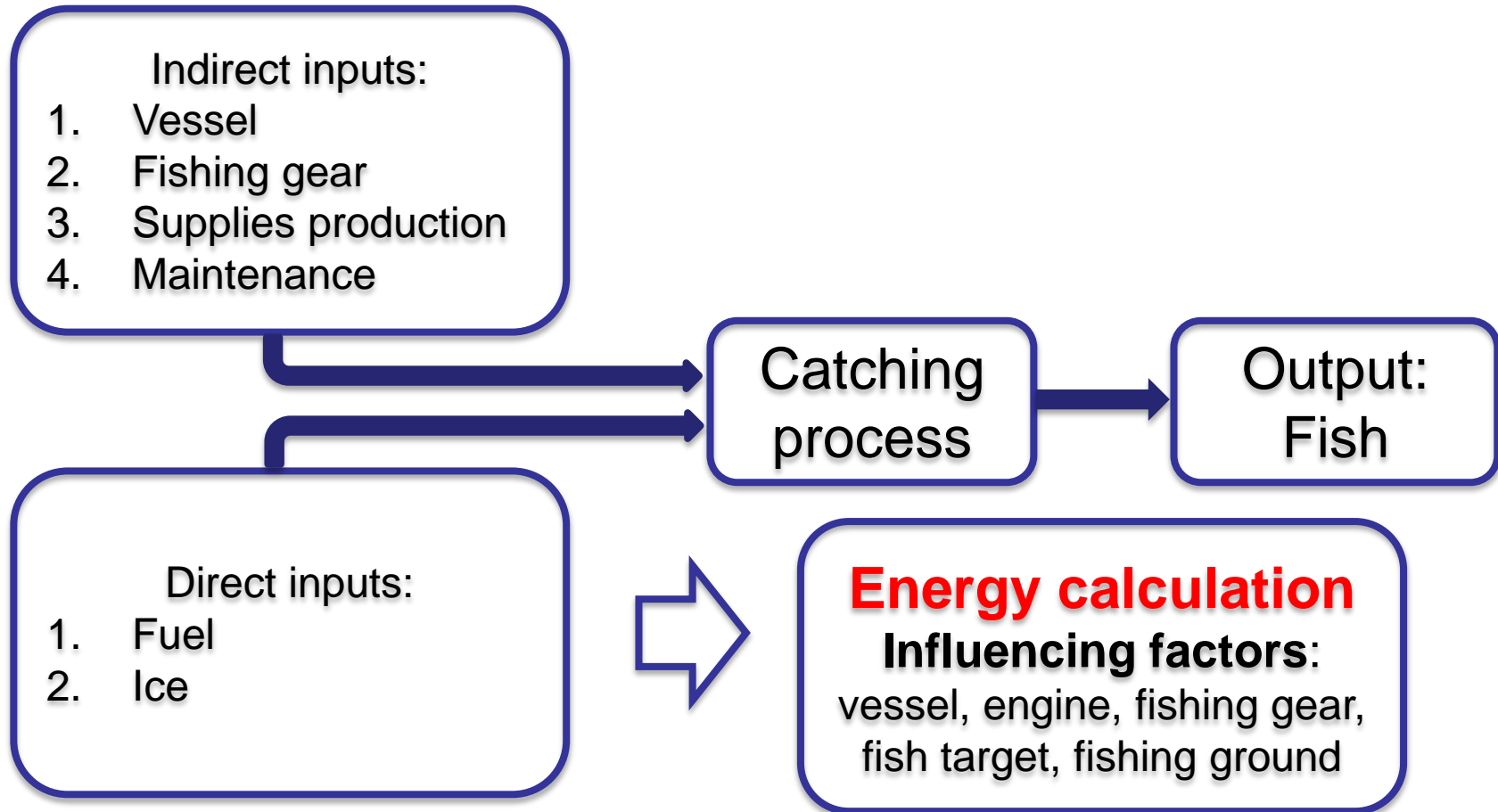
- Pelagic Danish seiner
- Hand liner
- Trammel netter
- Lift net ferry

## 3) Energy consumption

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



# Energy inputs on fishing





**Outboard 40 HP, 10–15 people, 73 units**

**Fig 3. Pelagic Danish Seiner**



**Outboard 10-15 HP, 1-2 people, 244 units**

**Fig 4. Hand liner**



**Inboard 22 HP, 3-4 people, 31 units**

**Fig 5. Trammel netter**



**Inboard 100 HP, 1-2 people, 25 units**

**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

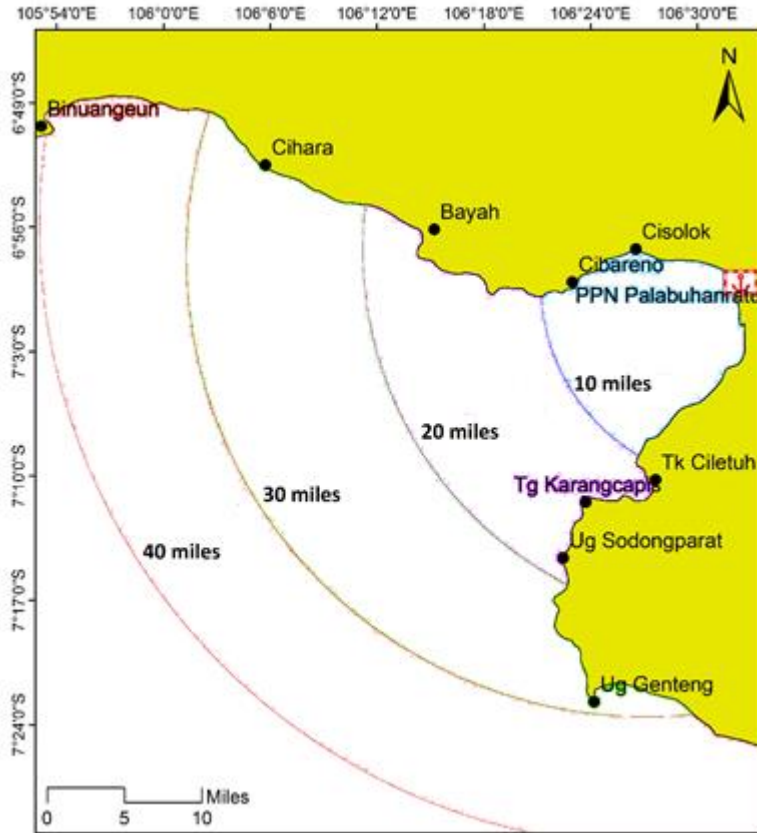


Fig 7 Fishing grounds

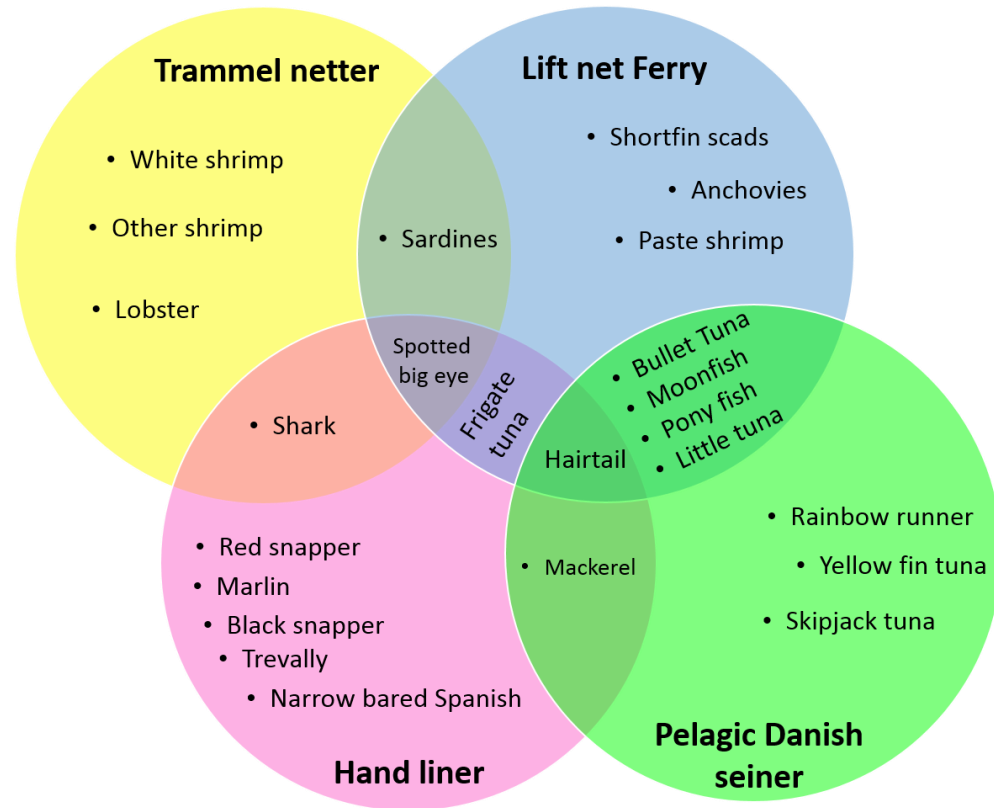
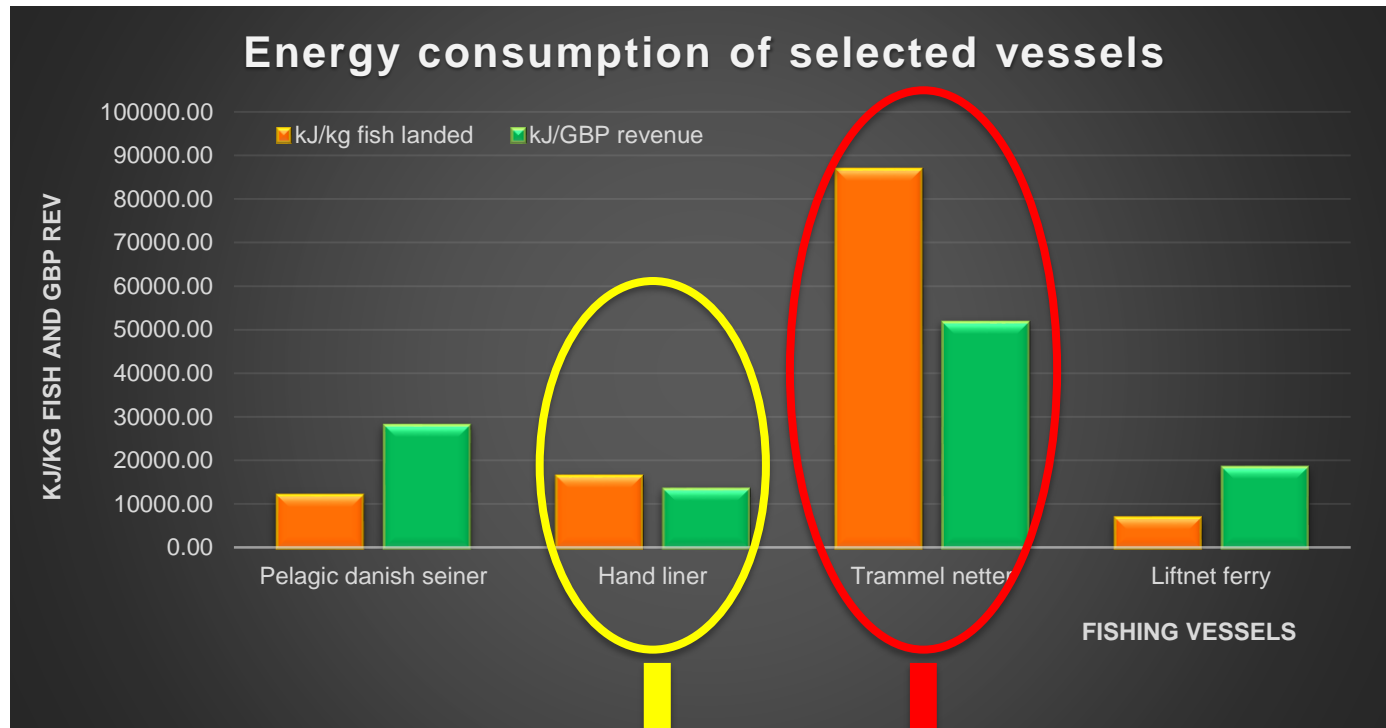


Fig 8 Species landed from studied vessels

# 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 <sup>d</sup>
			0.32 <sup>b</sup>
			0.13 <sup>c</sup>
Hand liner	0.48	Hook	0.18 <sup>c</sup>
		Hand liner	0.06 <sup>a</sup>
Trammel netter	2.56	Bottom trawler	3.65 <sup>d</sup>
			1.65 <sup>a</sup>
		Shrimp trawler	1.22 <sup>c</sup>
Lift net ferry	0.18	NA	NA
<b>Global fuel consumption 0.53 kg fuel/kg fish landed <sup>e</sup></b>			

Sources: a. Basurko et al (2013); b. Parker et al (2015); c. Schau et al (2009); d. Thrane et al (2004), e. Tvedmers 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	<ul style="list-style-type: none"> <li>• Periodic maintenance</li> <li>• Encourage more research in fishing efficiency</li> </ul>	<ul style="list-style-type: none"> <li>• Partly implemented</li> <li>• Researched in lift net: Battery to power light fishing</li> </ul>
Develop tourism in fishing	<ul style="list-style-type: none"> <li>• Boat hire</li> </ul>	<ul style="list-style-type: none"> <li>• Partly implemented</li> </ul>
Develop the variant of seafood products	<ul style="list-style-type: none"> <li>• Conducting fish processing workshop</li> </ul>	<ul style="list-style-type: none"> <li>• Implemented without successful follow up</li> </ul>
Speed management	<ul style="list-style-type: none"> <li>• Slow steaming</li> </ul>	<ul style="list-style-type: none"> <li>• Implemented in all vessels</li> </ul>
Fuel substitution	<ul style="list-style-type: none"> <li>• Fuel substitution to LPG</li> </ul>	<ul style="list-style-type: none"> <li>• Implemented in hand liner</li> </ul>
Increase the fish value	<ul style="list-style-type: none"> <li>• Government involves in deciding the fish selling price</li> <li>• Community agreement to increase selling price</li> </ul>	<ul style="list-style-type: none"> <li>• Difficult to be implemented</li> <li>• Difficult to be implemented</li> </ul>
Job substitution	<ul style="list-style-type: none"> <li>• Doing another job when low fishing season coming</li> </ul>	<ul style="list-style-type: none"> <li>• Implemented by some fishers</li> </ul>

# Conclusion

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- 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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Acknowledgment:

1. DIKTI, Ministry of Research Technology and Higher Education – Indonesia
2. LPDP, Ministry of Finance – Indonesia

