

# Life Cycle Assessment on Fish Products



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## Introduction

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- Global world trade → some quality standards (ISO 9000 series, ISO 14000 series, etc)
- ISO 14000 series are designed as an environmental management system for the industries.
- In 1997 some EU members have already applied the **ISO 14040: Environmental Management – Life Cycle Assessment**



## Introduction

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- **Life Cycle Assessment (LCA)** is a technique for assessing the environmental aspects and potential impacts associated with a product.
- **The use of the LCA:**
  - information source, planning and political tools
  - comparing some products in the same goal
  - optimizing the production
  - choosing the proper parameters for product policies
- **The implementation of LCA** can be restricted in industrial, regional, national and international environment.



## Introduction

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- Gunung Kidul Region has locations for the research, which have high potency of sea products (fish, lobster, sea grass, etc.)
- Sea fish production in 1998 726.0 tons; 1999 798.0 tons, but consumption rate was only 3.70 kg/person/year.
- The research was conducted in Baron, Drini and Ngrenehan coasts and fresh, grilled and fried fish served as samples



## Indonesia, Java, Yogyakarta

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# Indonesia, Java, Yogyakarta





## Method

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- Observing the daily activities of fishermen and seafood producers, which were guided by questionnaire and depth interview
- Microbiological tests for pathogenic microorganisms (*Escherichia coli*, *Staphylococcus sp* and *Salmonella sp*)



## System Boundary for LCA

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- Preparation before catching fish
- Catching fish in ocean
- Back to coast and uploading fish
- Marketing
- Fish processing near the coast

## The equipments



- Boats
- Engine
- Fuel
- Nets

## The activities



- The fishermen start to catch the fish in the sea

## Uploading the catch of the day



- Back to the coast and uploading the catch of the day

## Conditions in Baron, Ngrenehan, Drini

Coast	Distance from Yogyakarta (km)	Number of boats with engine	Number of fishermen (person)	Supporting facilities
Baron	60	70 – 80	100 – 150	Fish auction place, ice fabric, fuel station
Drini	67	30 – 40	70	Fish auction place, ice fabric, fuel station
Ngrenehan	75	40 - 50	100	Fish auction place, ice fabric, fuel station

## Conditions of providing fresh fish

Coast	Time (hour)	Fishermen (person)	Distance (km)	Fuel (litre)	Normal caught fish (kg)	Current caught fish (kg)
Baron	7 - 8	2	1 - 5	20	100 - 150	30 - 40
Baron	8	3	5	25	100 - 200	45
Drini	8	3	5 - 10	25	100 - 150	45
Drini	6 - 7	3	1 - 8	25	100 - 150	40
Ngrenehan	8	3	2 - 7	25	100 - 150	30 - 40
Ngrenehan	7 - 8	3	1 - 5	20	100 - 150	35



## Data and results for 1 kg fresh fish (example)

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- Catch of the day: 30 kg fish
- Fishermen: 3
- Burned gasoline: 20 kg per day
- Human energy (food): 1,500 kJ/kg fish
- Fuel energy: 6.7 kWh/kg fish
- CO<sub>2</sub>: 1.87 kg/kg fish
- SO<sub>2</sub>: 0.87 g/kg fish
- NO<sub>x</sub>: 1.7 g/kg fish



## Extrapolation to normal catch of the day (example)

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- Normal catch: 90 kg fish
- Fishermen: 3
- Burned gasoline: 20 kg per day
- Human energy (food): 500 kJ/kg fish
- Fuel energy: 2.2 kWh/kg fish
- CO<sub>2</sub>: 0.6 kg/kg fish
- SO<sub>2</sub>: 0.3 g/kg fish
- NO<sub>x</sub>: 0.6 g/kg fish



## Additional results for 1 kg fried fish (example)

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- Human energy (food): 260 kJ/kg fish
- Coal energy: 1.5 kWh/kg fish
- CO<sub>2</sub>: 0.6 kg/kg fish
- SO<sub>2</sub>: 0.6 g/kg fish
- NO<sub>x</sub>: 0.3 g/kg fish

## Result of microbiological tests

Kind of test	Baron Fresh Fish	Baron Fried Fish	Ngrenehan Fresh Fish	Ngrenehan Grilled Fish	Drini Fresh Fish
Total Plate Count	$3 \times 10^7$	$5.2 \times 10^6$	$8.9 \times 10^6$	$1.56 \times 10^5$	$< 10^5$
<i>Escherichia coli</i>	Positive	Negative	Negative	Negative	Negative
<i>Staphylococcus</i> sp	Negative	Negative	Negative	Negative	Negative
<i>Salmonella</i> sp	Negative	Negative	Negative	Negative	Negative



## Conclusions

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- The microbiological quality of the fish is good and ready to eat, in case of **frying** the fish!
- The ecological quality - in terms of energy and emissions - can be improved by **increasing** the catch of the day!
- And: The amount of catch of the day depends upon the **ecological quality of coast and sea water!**

**Thank you for your attention**

