

# Fishery income fluctuation due to changing vessel speed from the harbor to the fishing ground, in the Japanese squid jigging fishery

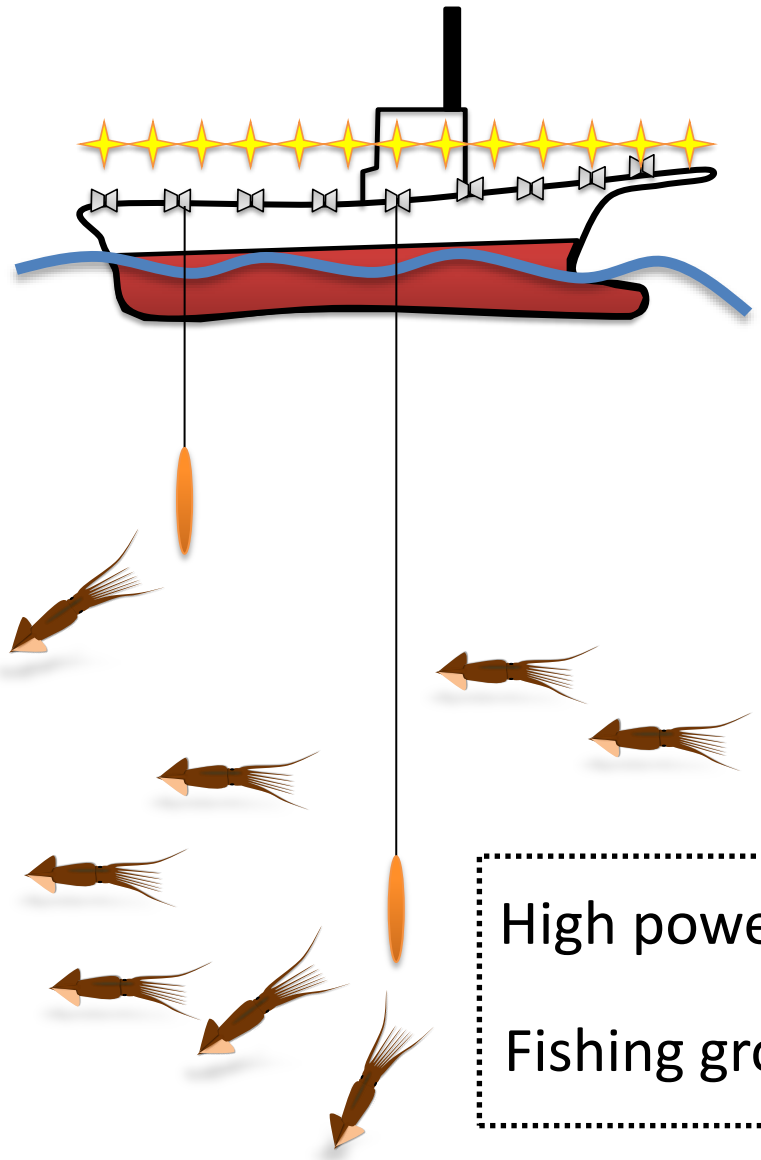
“Moving at high vessel speed” causes to

1. be able to operate their jigging operation for longer time
2. be able to operate their jigging operation at better fishing grounds
3. increase the catch of squid
4. increase the fuel cost at the moving process

Does it maximize fishery income?

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# Japanese coastal squid jigging fishery



Mainly catch Japanese common squid  
(*Todarodes pacificus*)

Vessel size: 5 – 19 GT

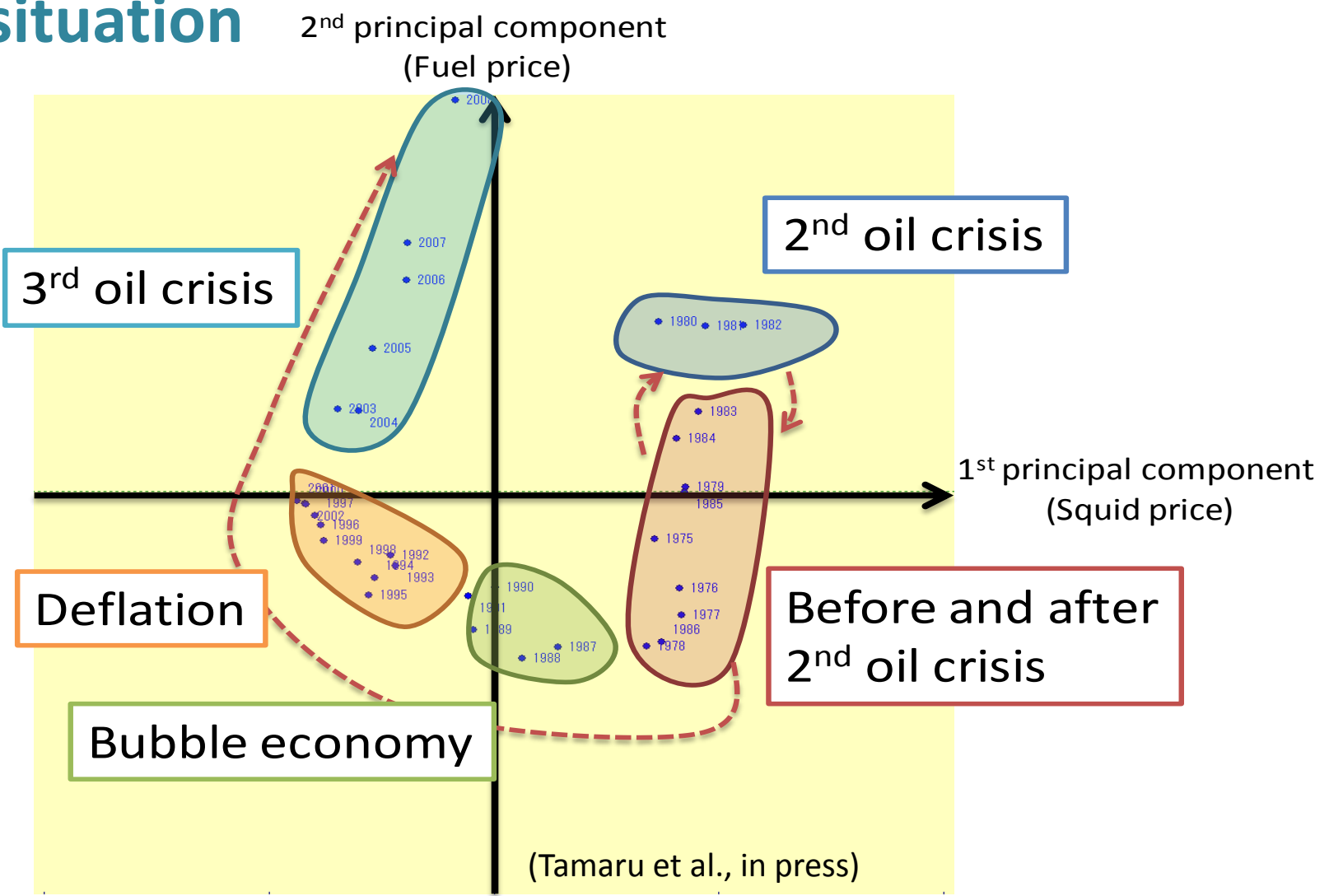
2 – 3 fishermen / ship

Automatic jigger machines

High powered fish lamps  
Fishing ground is so far from a harbor (20 – 40 km)

➔ High fuel consumption in comparison to other fishery

# Social situation



Many fishermen have been in financial trouble because of rising fuel price and falling fish prices (Baba, 2008)



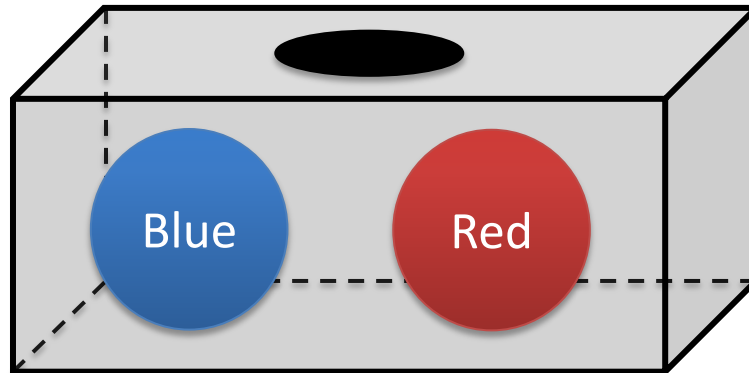
People make a risky choice when they are in bad situations (Kahneman and Lovallo, 1993)

# The Prospect Theory 1

Daniel Kahneman (Winner of the Nobel Prize in Economics)

- people make a choice which they only think that is optimal
- they make an risky choice when they are in bad situations

Question 1



A. Regardless of color, you get 10,000\$

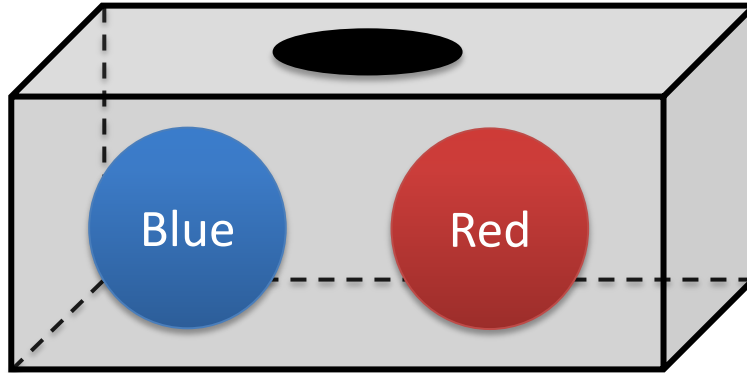
B. Only Blue, you get 20,000 \$

Expected value = 10,000\$

Almost of all people chosed "A"

# The Prospect Theory 2

## Question 2



If you are into someone for \$ 20,000...

- A. Regardless of color, you get 10,000\$
- B. Only Blue, you get 20,000 \$

Almost of all who chosed "A" in the question 1, chosed "B"



People don't make a choice as only high expected value

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Many Japanese coastal squid jigging fishermen might make a risky choice at their own fisheries management

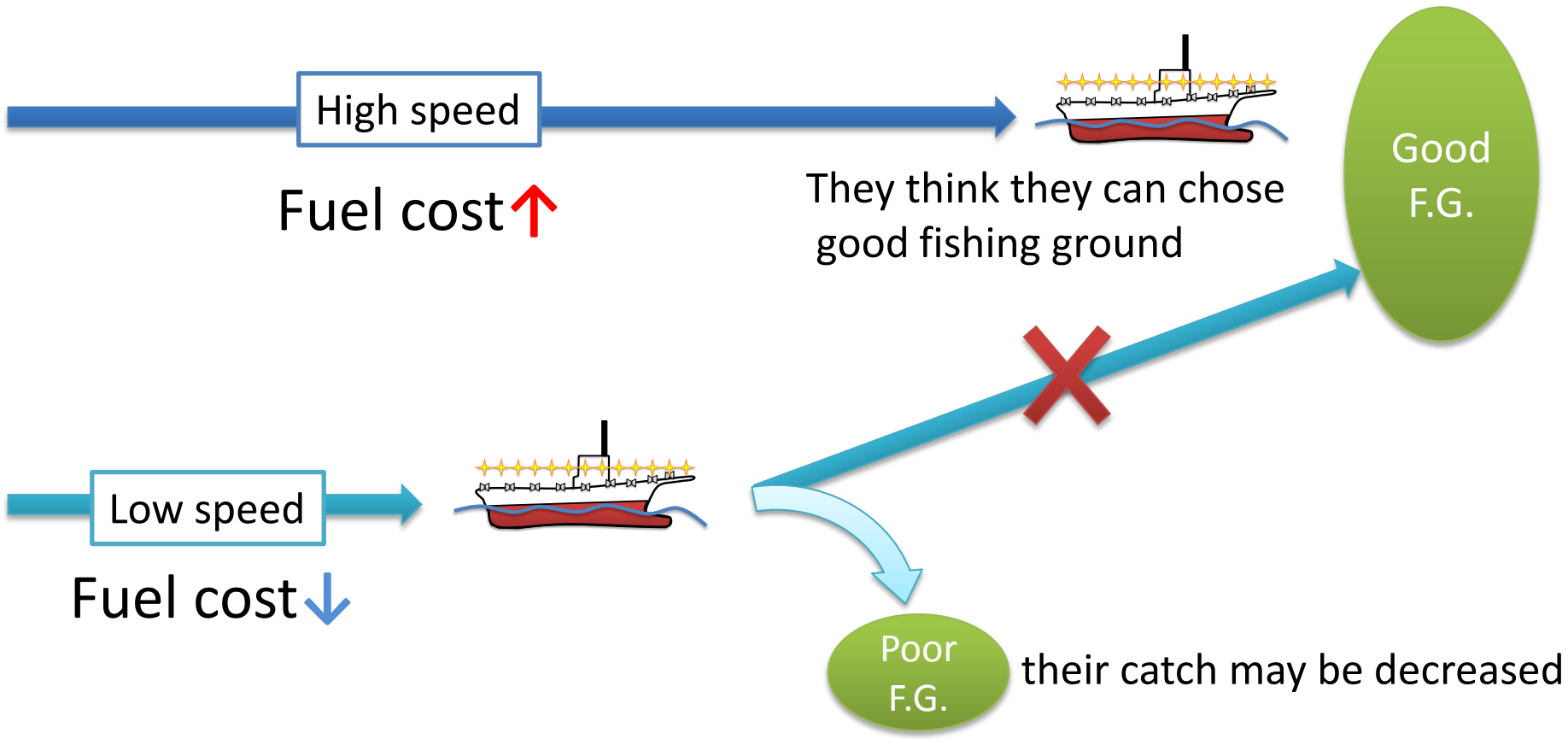
e.g.

1. Moving to far fishing ground

2. Using high power fishing lamps

3. Moving at high speed

# Introduction – Vessel speed at moving processes



# Why use simulation model?

Fishing condition change from hour to hour

Social situation also changes



Surveying real income in all social situations and operating conditions is not feasible



We used the Fishery Income Simulation Model (Tamaru et al., in press)

## **Purposes of this study** -----

To clarify fishery income fluctuation due to changing vessel speed from the harbor to the fishing ground, in the Japanese coastal squid jigging fishery

To clarify economical vessel speed, when fuel price changes

# Fishery Income Simulation Model

$$E = P - O$$

E: Income (JPY)  
 P: Price of catch (JPY)  
 O: Total cost (JPY)

$$P = C \cdot r$$

C: Amount of catch (case)  
 r: Unit price of squid (JPY/case)

$$O = F + M + W$$

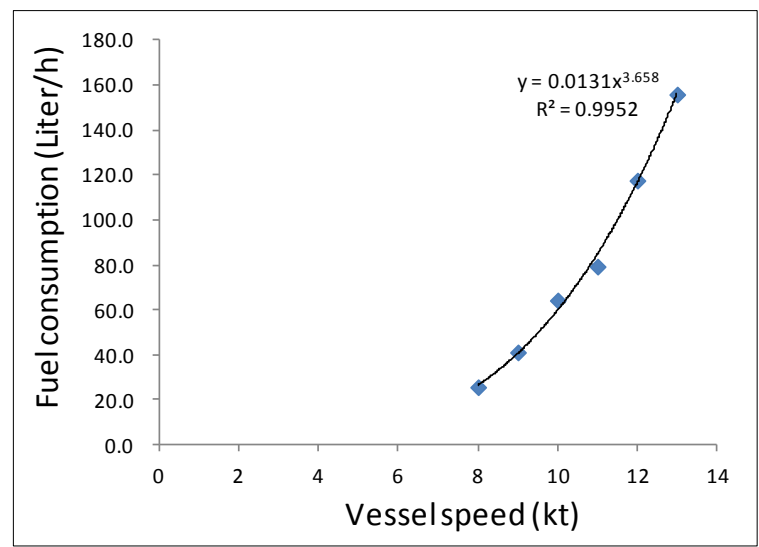
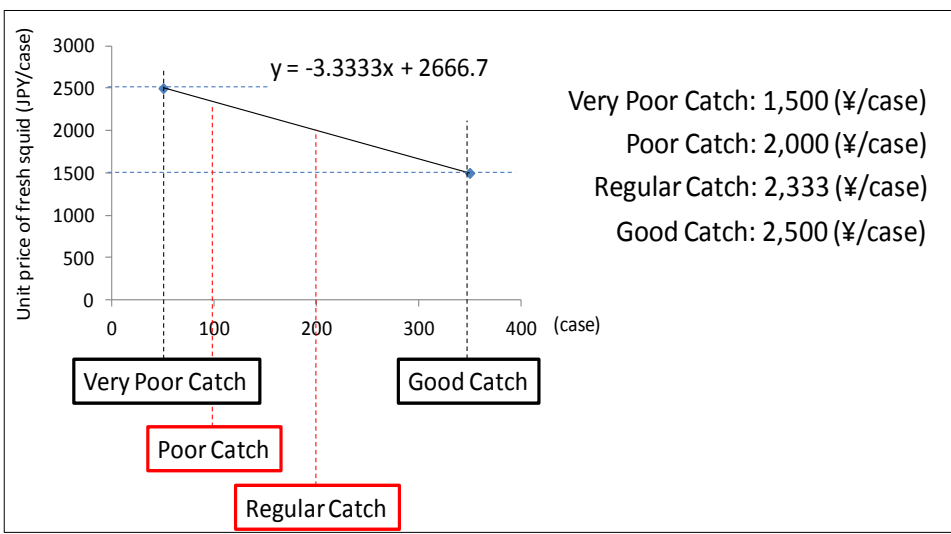
F: Fuel cost (JPY)  
 M: Employment cost (JPY)

$$F = f \cdot R$$

f: Total fuel consumption (L)  
 R: Unit price of fuel (JPY/L)

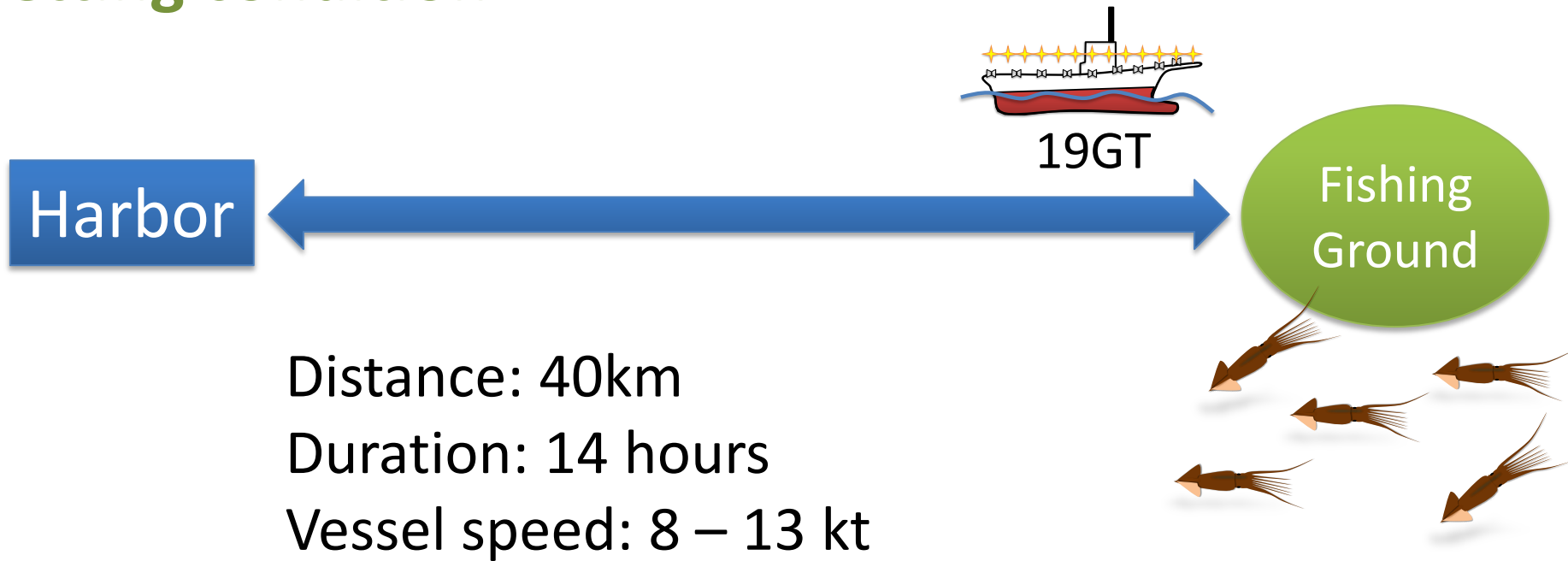
$$f = m_m \cdot d + h_o \cdot m_o$$

$m_m$ : Mileage of vessel (km/L)





# Setting condition



Distance: 40km

Duration: 14 hours

Vessel speed: 8 – 13 kt

Catch condition: Very poor (50 cases)

Poor (100 cases)

Regular (200 cases)

Good (350 cases)

We estimated fishery income in each catch condition.

## Economical vessel speed in each catch condition

|                           | Catch condition | vessel speed (kt) |     |     |     |     |     |
|---------------------------|-----------------|-------------------|-----|-----|-----|-----|-----|
|                           |                 | 8                 | 9   | 10  | 11  | 12  | 13  |
| Fuel<br>80 JPY/L<br>(now) | Very poor       | 39                | 40  | 39  | 36  | 32  | 26  |
|                           | Poor            | 128               | 134 | 137 | 138 | 137 | 134 |
|                           | Regular         | 260               | 274 | 284 | 290 | 293 | 294 |
|                           | Good            | 345               | 365 | 379 | 388 | 394 | 398 |
|                           | Average         | 193               | 203 | 209 | 213 | 214 | 213 |

(Unit: 1,000 JPY)

### Bad catch condition

Moving at lower vessel speed cause to increase fishery income.

### Good catch condition

Moving at higher vessel speed cause to increase fishery income.

# Discussion

1. Do fishermen select economical speed in each fuel price level?

Before the 3<sup>rd</sup> oil crisis (80 JPY/L) .....moved at 12 – 13 kt



At the 3<sup>rd</sup> oil crisis (120 JPY/L) .....decreased to 10 kt



After the 3<sup>rd</sup> oil crisis (80 JPY/L) ..... keep moving at 10 kt

2. Fishermen can't predict expected catch of squid before they depart from a harbor.

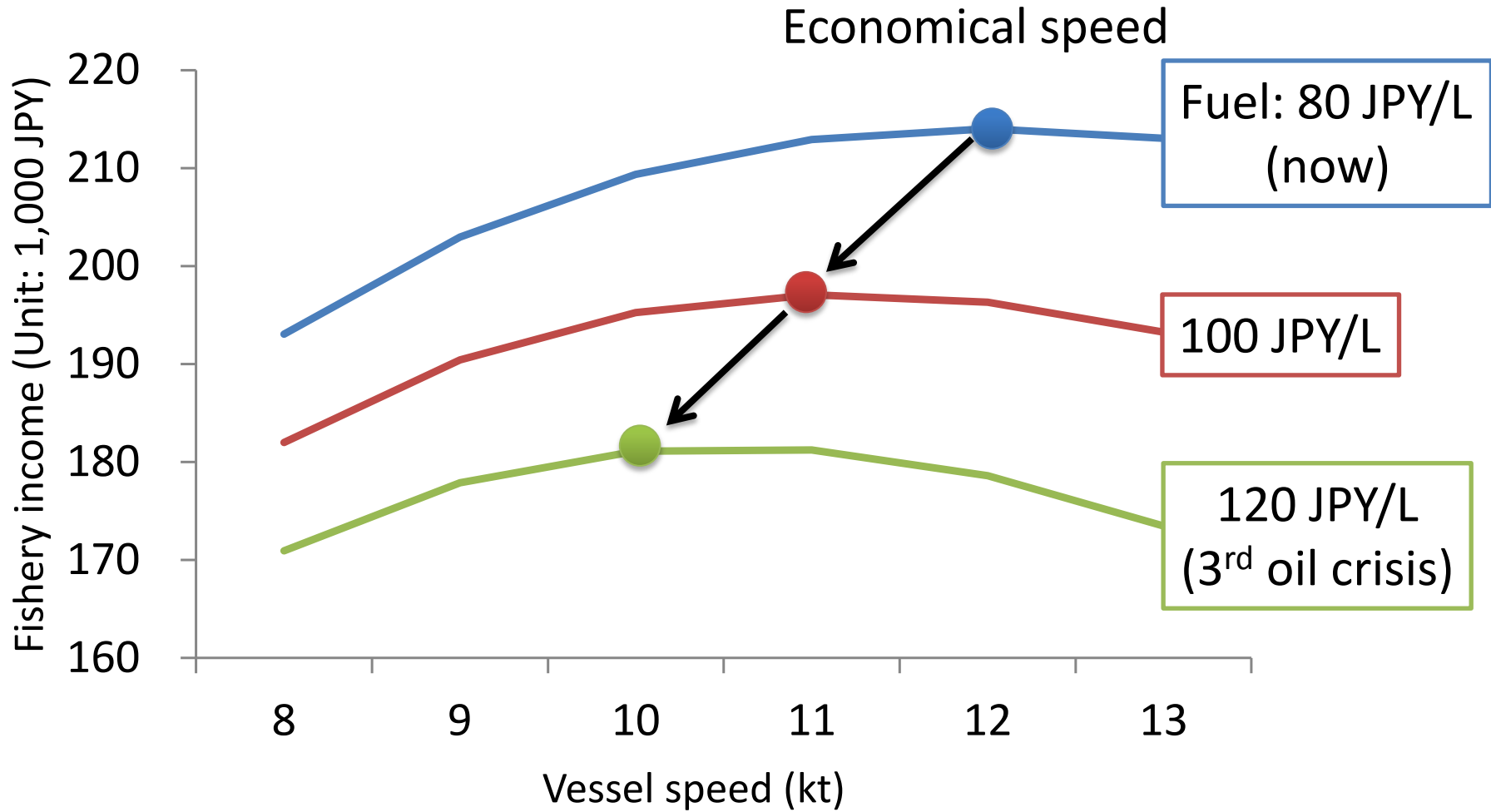


Does estimating the economical vessel speed in each catch condition have meaningfulness?

3. Economical vessel speed is the same as ecological vessel speed?

4. What should we do for constructing efficient system of coastal squid jigging fishery ?

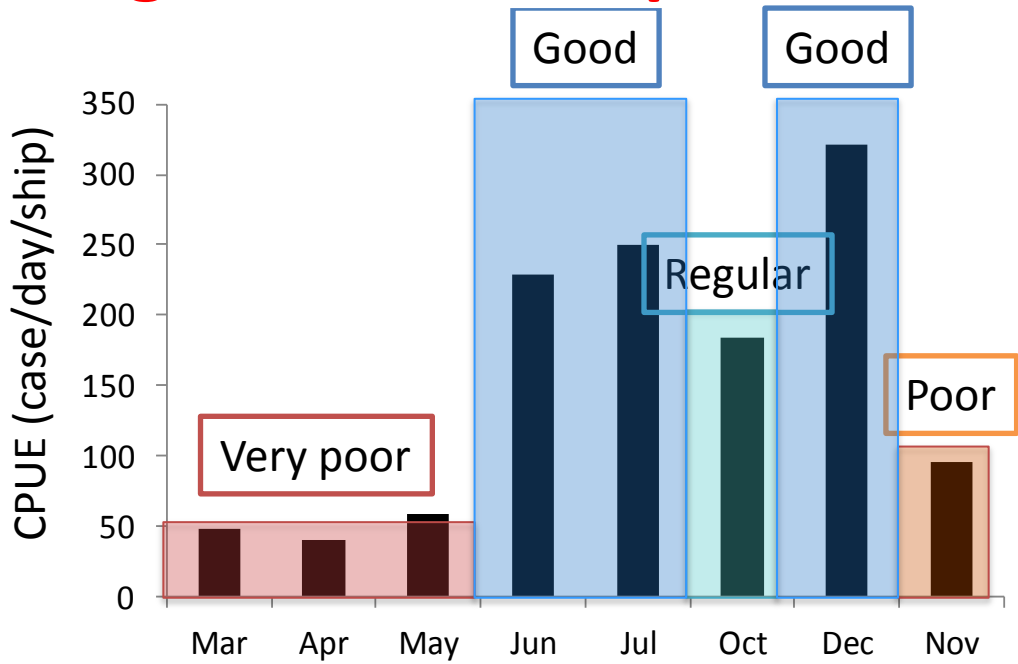
# 1. Do fishermen select economical vessel speed?



Decreasing their vessel speed to 10 kt at the 3<sup>rd</sup> oil crisis is the economical choice

Keeping their vessel speed at 10 kt now is not economical choice

# 2. Estimating economical speed is meaningless?



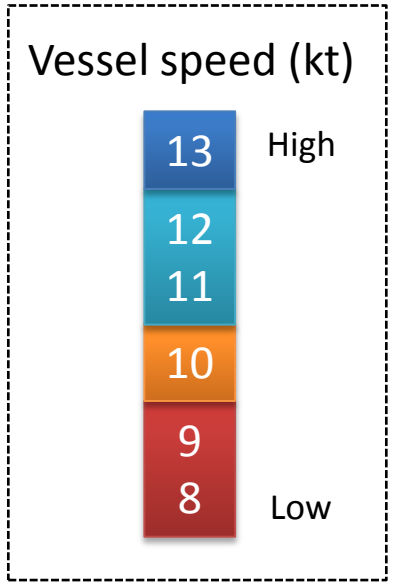
80 JPY/L  
now



100 JPY/L

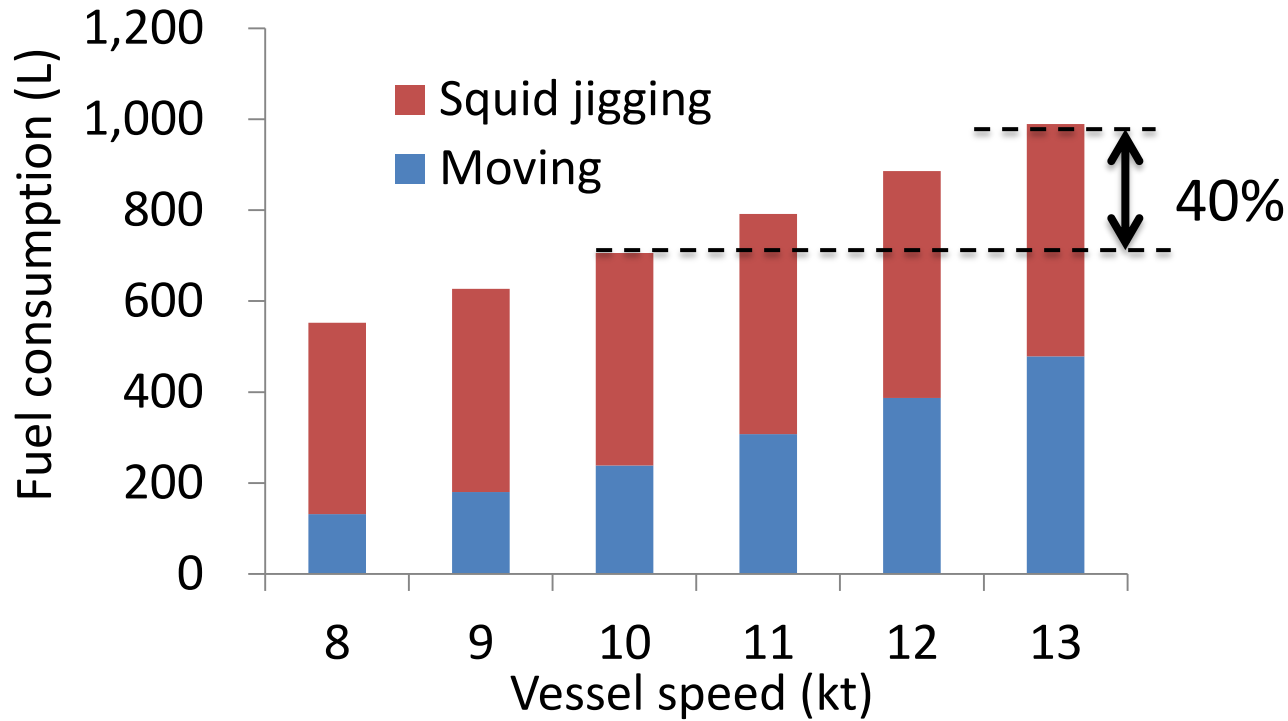


120 JPY/L



By selecting vessel speed in each season, fishermen will increase their fishery income.

### 3. Vessel speed and fuel consumption



If fishermen increase vessel speed from 10 kt to 13 kt, fuel consumption and emission of exhausted CO<sub>2</sub> increase 40%

From the view of sustainable fishery, increasing speed is not better way

By extending the duration of the operation, fishermen might increase their fishery income, and might decrease fuel consumption and emission of exhausted CO<sub>2</sub> gas.

### 3. Moving at 10kt and extend duration 1 hour

| 80 JPY/Liter | Catch condition | vessel speed (kt) |     |     |     |     |     |
|--------------|-----------------|-------------------|-----|-----|-----|-----|-----|
|              |                 | 8                 | 9   | 10  | 11  | 12  | 13  |
|              | Very poor       | 39                | 40  | 39  | 36  | 32  | 26  |
|              | Poor            | 128               | 134 | 137 | 138 | 137 | 134 |
|              | Regular         | 260               | 274 | 284 | 290 | 293 | 294 |
|              | Good            | 345               | 365 | 379 | 388 | 394 | 398 |
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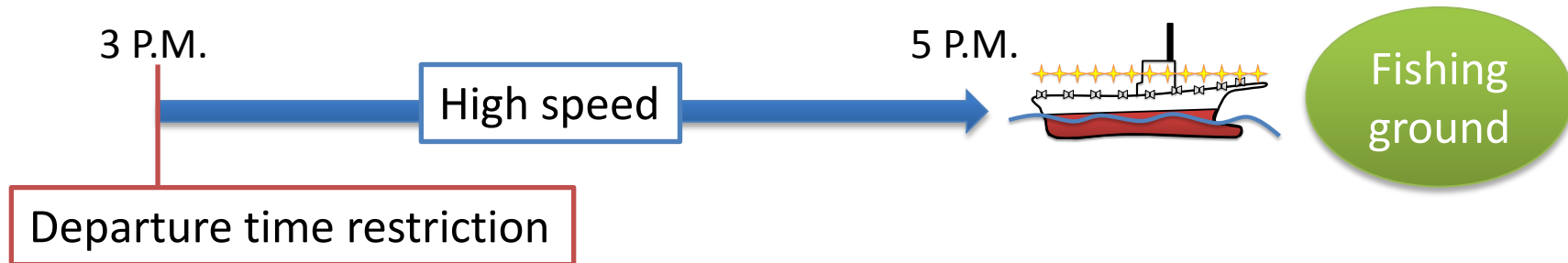
| 100 JPY/Liter | Catch condition | vessel speed (kt) |     |     |     |     |     |
|---------------|-----------------|-------------------|-----|-----|-----|-----|-----|
|               |                 | 8                 | 9   | 10  | 11  | 12  | 13  |
|               | Very poor       | 28                | 27  | 24  | 20  | 14  | 7   |
|               | Poor            | 117               | 121 | 123 | 122 | 119 | 114 |
|               | Regular         | 249               | 261 | 269 | 274 | 275 | 274 |
|               | Good            | 334               | 352 | 364 | 372 | 377 | 378 |
|               | Average         | 182               | 190 | 195 | 197 | 196 | 193 |

| 120 JPY/Liter | Catch condition | vessel speed (kt) |     |     |     |     |     |
|---------------|-----------------|-------------------|-----|-----|-----|-----|-----|
|               |                 | 8                 | 9   | 10  | 11  | 12  | 13  |
|               | Very poor       | 17                | 15  | 10  | 4   | -4  | -13 |
|               | Poor            | 106               | 109 | 109 | 106 | 101 | 94  |
|               | Regular         | 238               | 249 | 255 | 258 | 258 | 254 |
|               | Good            | 323               | 340 | 350 | 357 | 359 | 358 |
|               | Average         | 171               | 178 | 181 | 181 | 179 | 173 |

At almost of all situations, by extending duration of operation 1 hour for moving at 10 kt, fishermen will increase their fishery income.

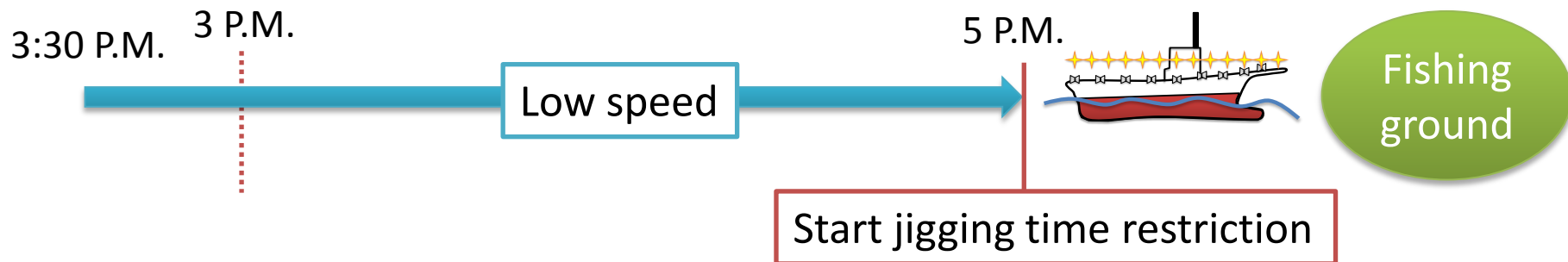
## 4. What should we do?

Now, few fishing port have departure time restriction



Fishermen tend to move at high vessel speed

We should to change from departure time restriction to start jigging operation time restriction



Fishermen will increase their fishery income and will decrease fuel consumption and emission of exhausted CO<sub>2</sub> gas.



# Summary

To decreasing their vessel speed from 13 kt to 10 kt in the 3<sup>rd</sup> oil crisis

➔ Economical choice

To keep moving at 10 kt now

➔ Not economical choice

High season for squid jigging fishery (Jun. Jul. Oct. Dec.)

➔ Moving at 12 kt is an economical choice

Low season

➔ Moving at about 10 kt is an economical choice

At almost of all situations, by extending duration of operation for moving at 10 kt, fishermen will increase their fishery income and will decrease fuel consumption and emission of exhausted CO<sub>2</sub> gas.

Departure time restriction ➔ Start jigging operation time restriction

Thank you for  
your attention



*Todarodes pacificus*