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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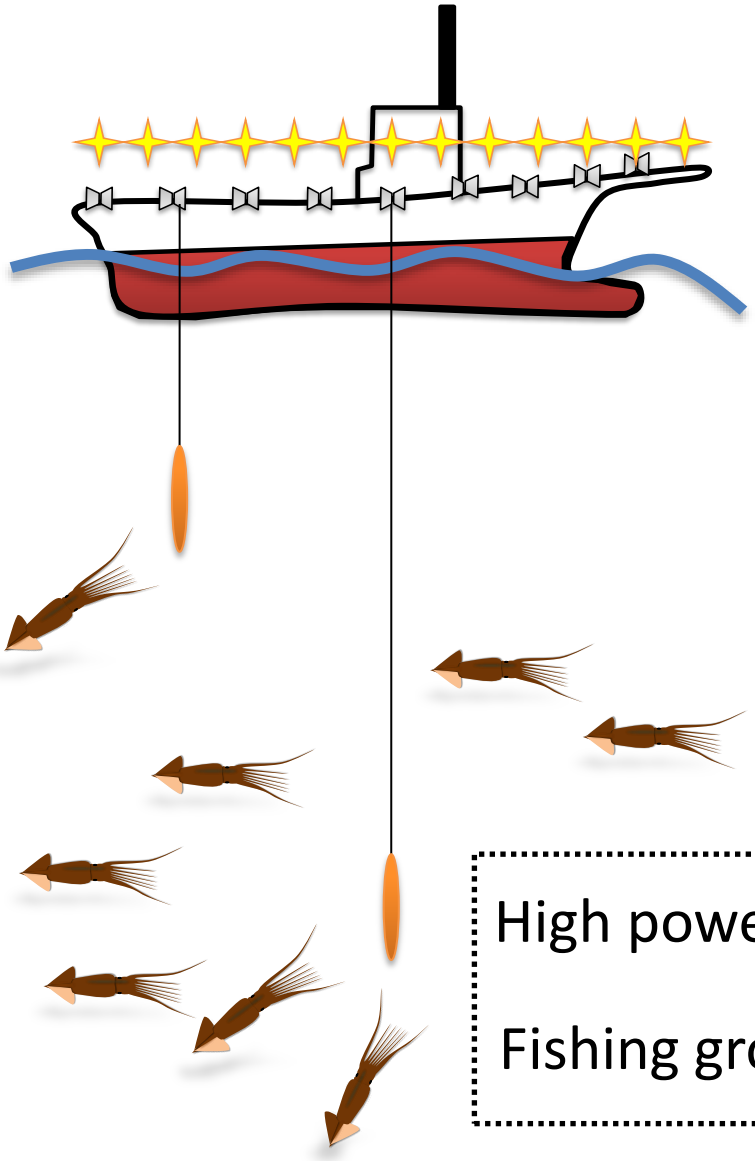
Japanese coastal squid jigging fishery



Mainly catch Japanese common squid (*Todarodes pacificus*)

Vessel size: 5 – 19 GT

2 – 3 fishermen / ship

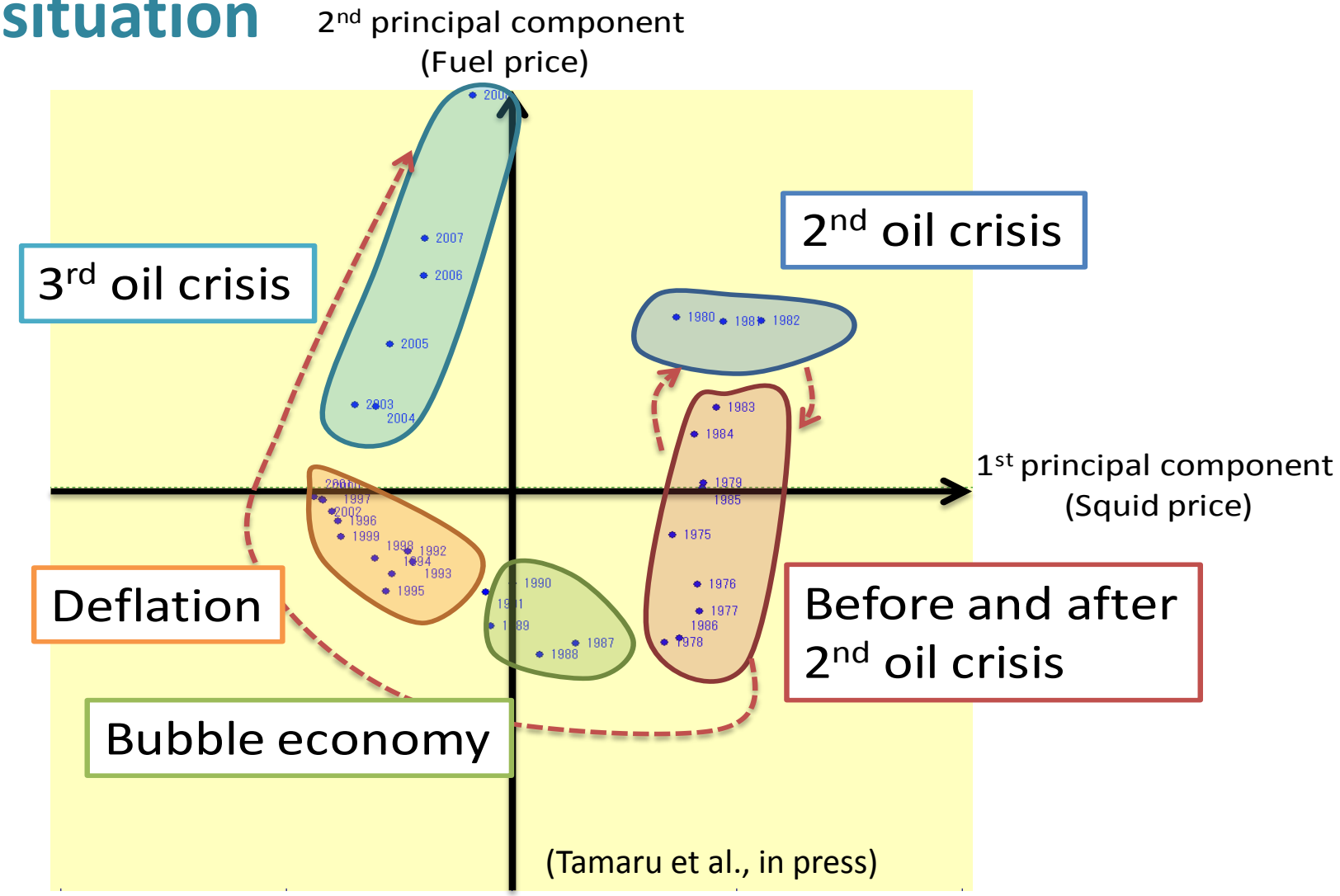
Automatic jigger machines

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

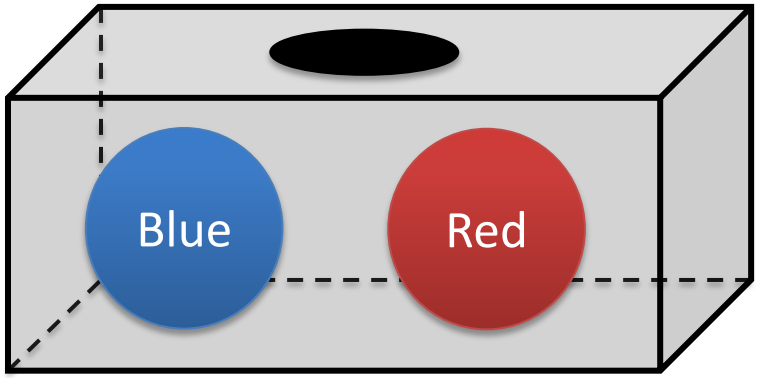
(Kahneman and Lovallo, 1993)

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$

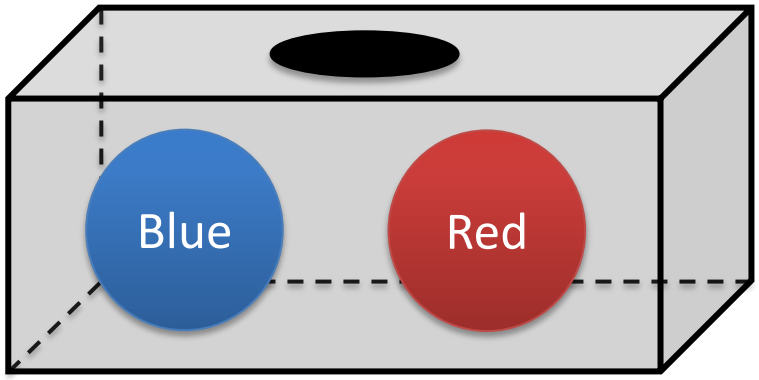
B. Only Blue, you get 20,000 $

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

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

e.g.

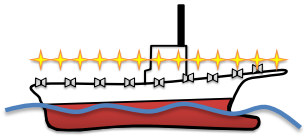
1. Moving to far fishing ground

2. Using high power fishing lamps

3. Moving at high speed

Introduction – Vessel speed at moving processes

High speed

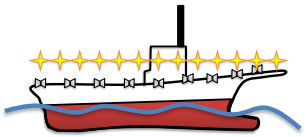


Fuel cost ↑

They think they can chose good fishing ground

Good F.G.

Low speed



Fuel cost ↓

Poor F.G.

their catch may be decreased

If they lose 1 knot at vessel speed, fuel consumption decrease about 15 %.

High speed

Low speed

Which is better for increasing their economic return?
Is economical speed same as ecological speed?

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

$E = P - O$

$O = F + M + W$

E: Income (JPY)

P: Price of catch (JPY)

O: Total cost (JPY)

F: Fuel cost (JPY)

M: Employment cost (JPY)

$F = f \cdot R$

f: Total fuel consumption (L)

R: Unit price of fuel (JPY/L)

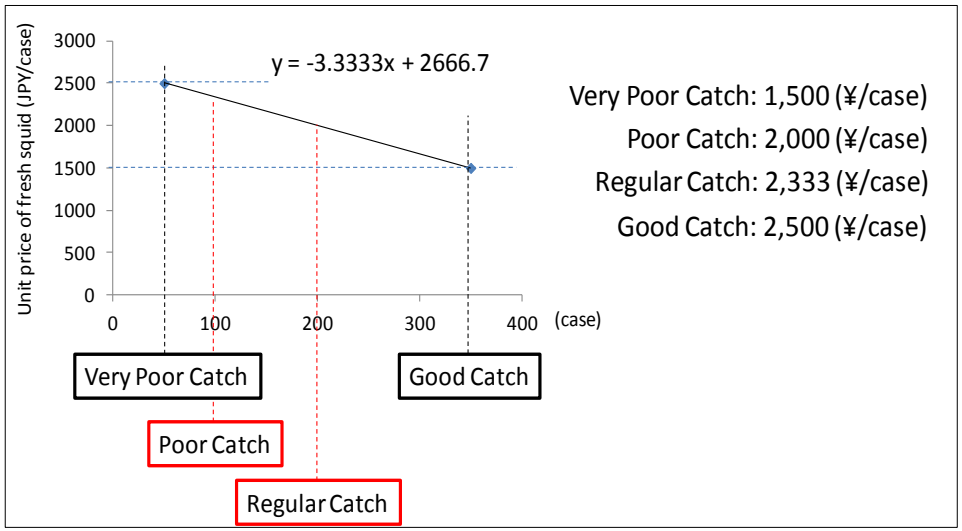
$P = C \cdot r$

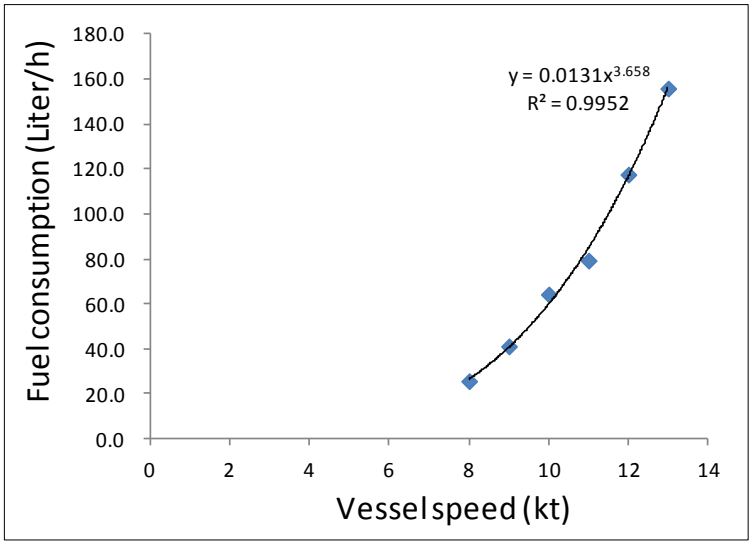
$f = m_m \cdot d + h_o \cdot m_o$

C: Amount of catch (case)

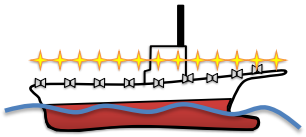
r: Unit price of squid (JPY/case)

m_m: Mileage of vessel (km/L)





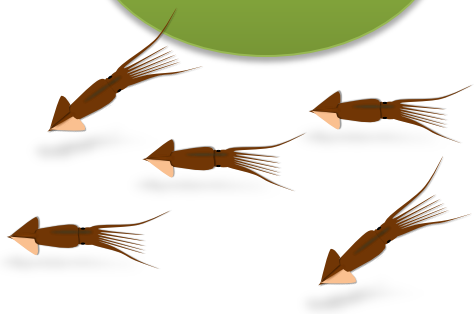
Setting condition



19GT

Harbor

Fishing Ground



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

Fuel
80 JPY/L
(now)

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
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 3rd oil crisis (80 JPY/L) ·····moved at 12 – 13 kt

   ⇓

   At the 3rd oil crisis (120 JPY/L) ·····decreased to 10 kt

   ⇓

   After the 3rd oil crisis (80 JPY/L) ····· keep moving at 10 kt

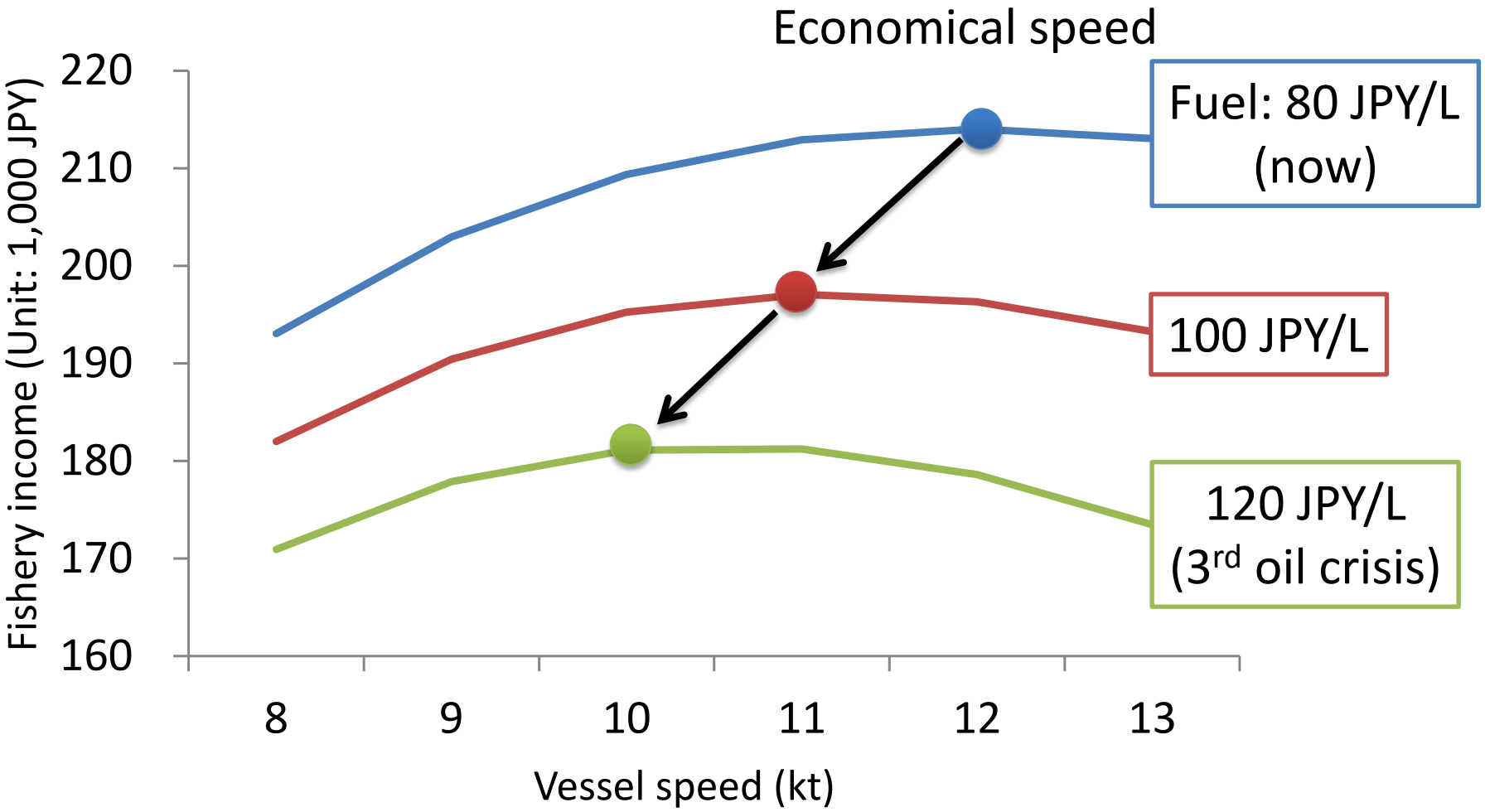
2. Fishermen can't predict expected catch of squid before they depart from a harbor.

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

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 ?

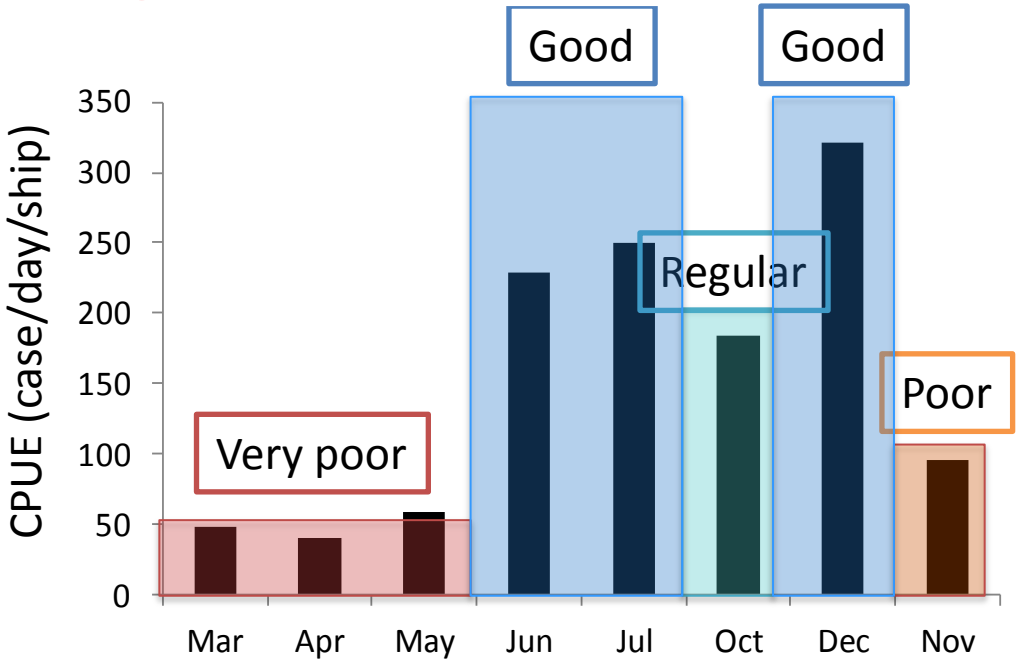
1. Do fishermen select economical vessel speed?



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

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

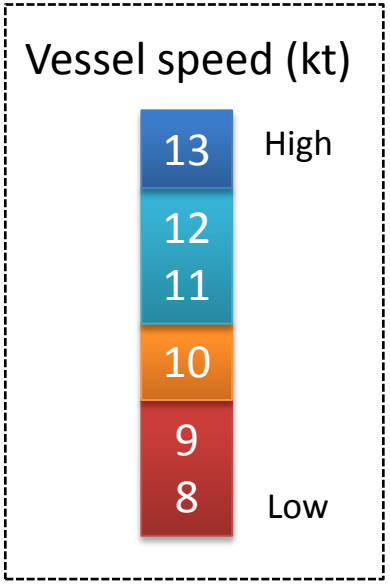
2. Estimating economical speed is meaninglessness?



80 JPY/L
now

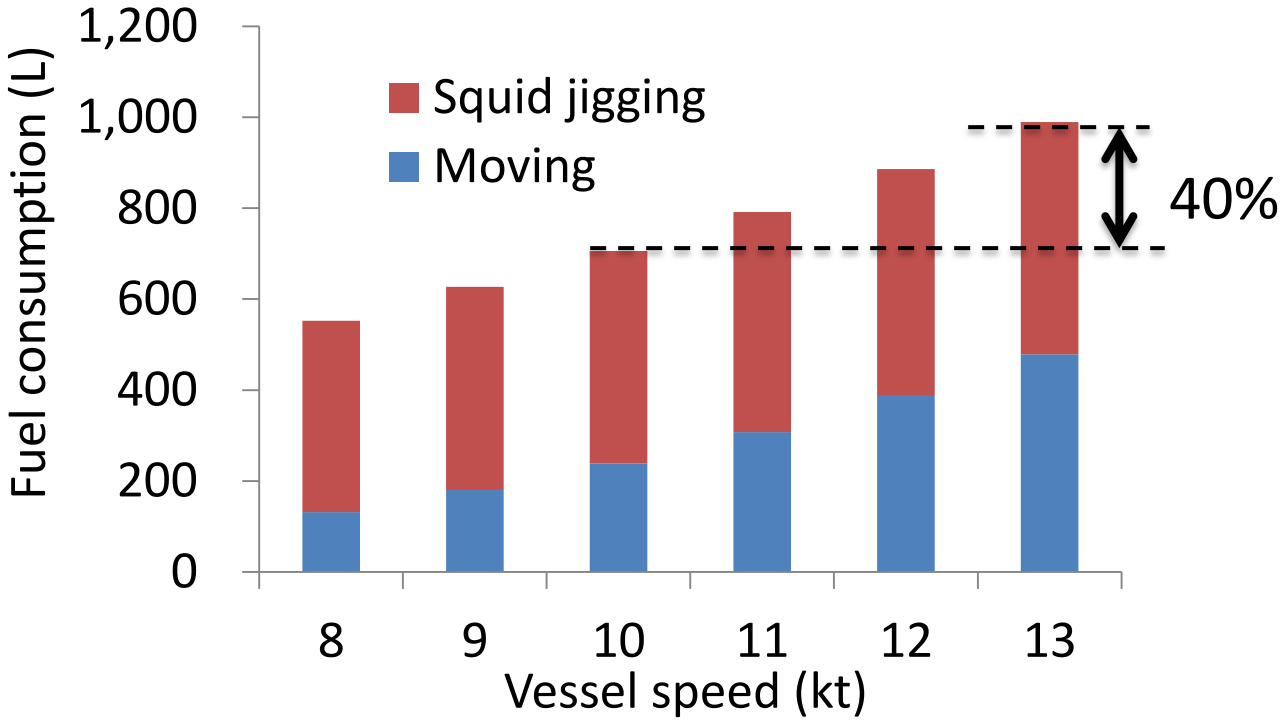
100 JPY/L

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_2 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_2 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
Average	193	203	209	213	214	213

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

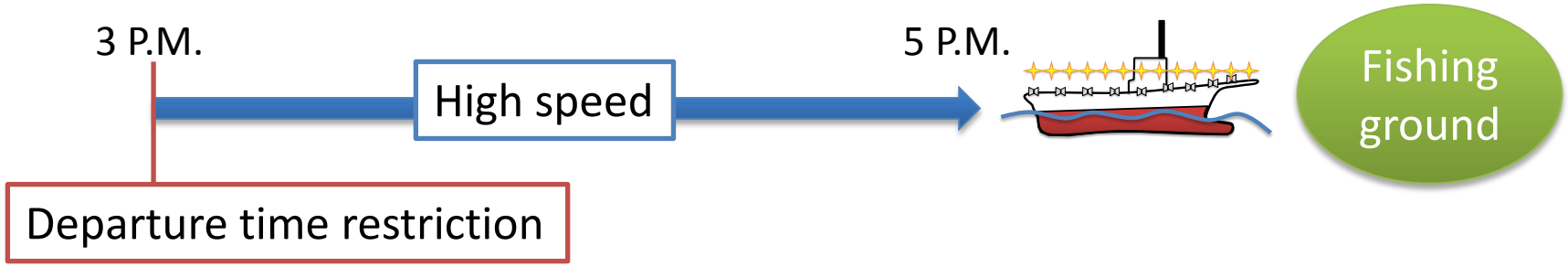
120 JPY/Liter

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.

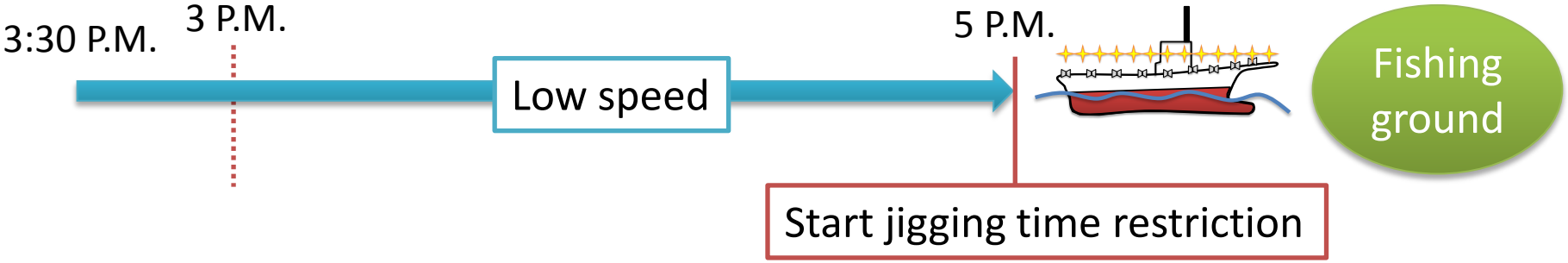
4. What should we do?

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_2 gas.

Summary

To decreasing their vessel speed from 13 kt to 10 kt in the 3rd 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_2 gas.

Departure time restriction ➡ Start jigging operation time restriction

Thank you for your attention

Todarodes pacificus