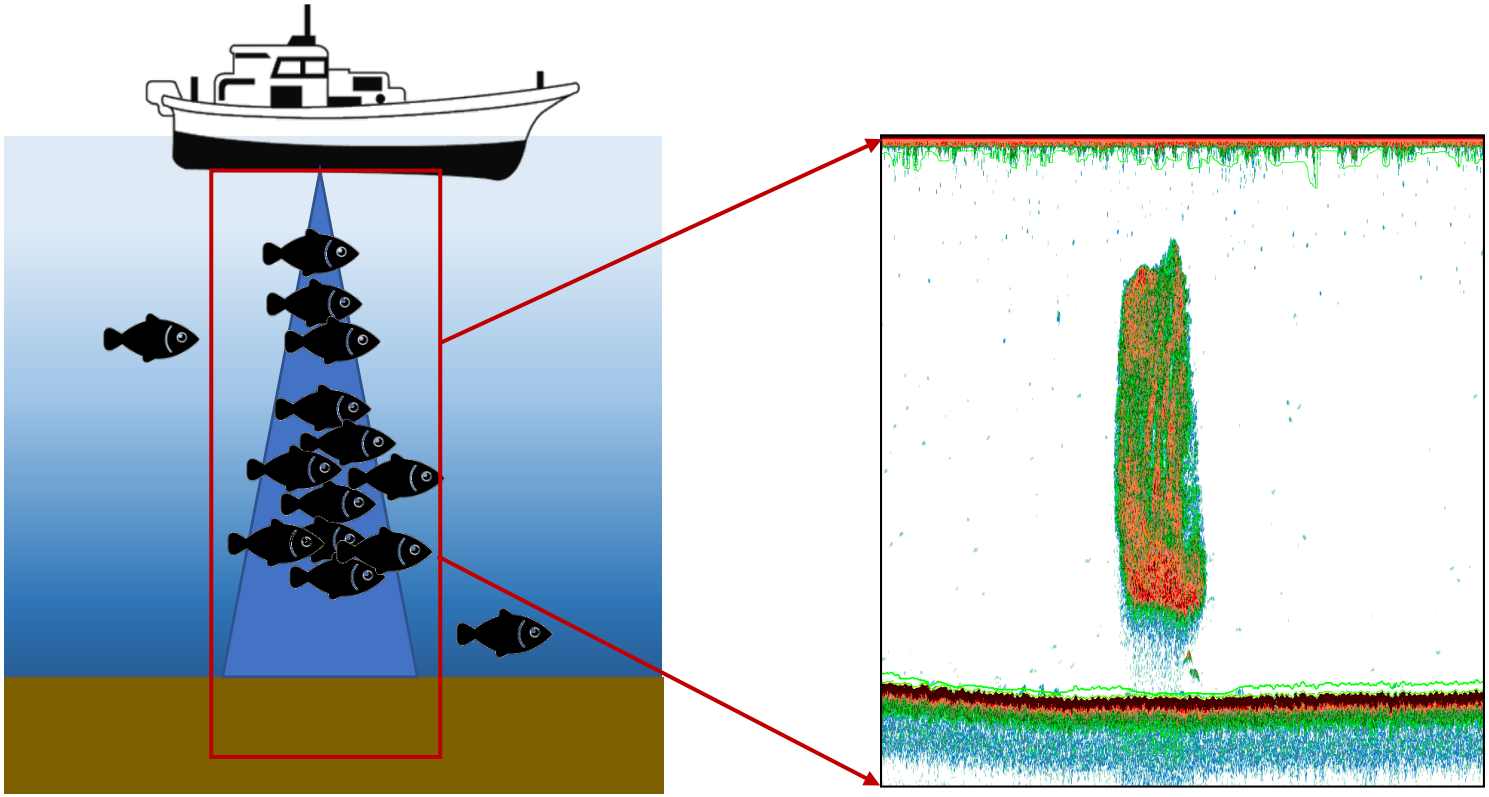
Assessment of fishery resources around Set-net using acoustic methods for sustainable fishery



Yanhui Zhu[1S*], Kenji Minami[2], Yuka Iwahara[3],
Kentaro Oda[3], Koichi Hidaka[3], Osamu Hoson[3],Kouji Morishita[3], Sentaro Tsuru[3],
Masahito Hirota[3], Hokuto Shirakawa[4], Kazushi Miyashita[4]

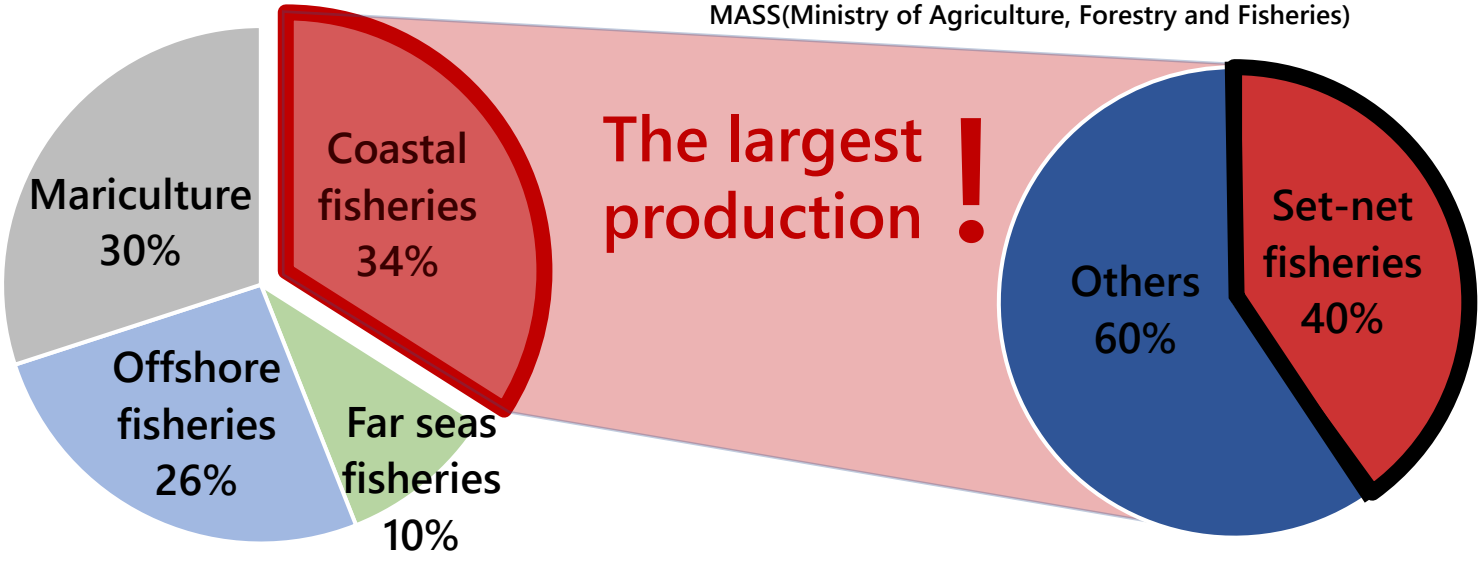
Introduction: Coastal fisheries in Japan

87% of Japanese fishermen serve in the **coastal fisheries**

MAFF(Ministry of Agriculture, Forestry and Fisheries)

Production value of respective fishery(¥)

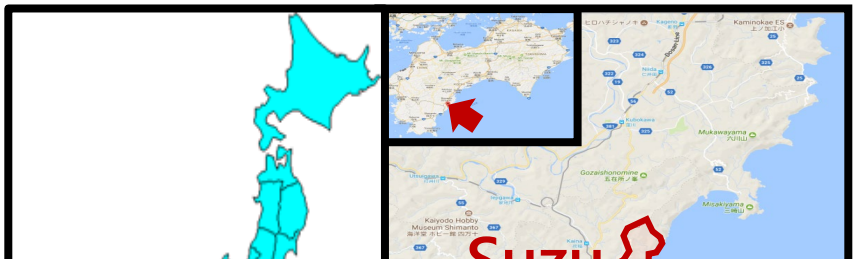
MASS(Ministry of Agriculture, Forestry and Fisheries)

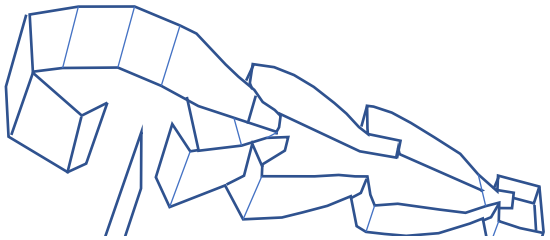


Set-net fisheries support coastal economy and people's life

Introduction: Set-net fishery

Suzu: The **only** main industry is **Set-net fishery**





Resource management

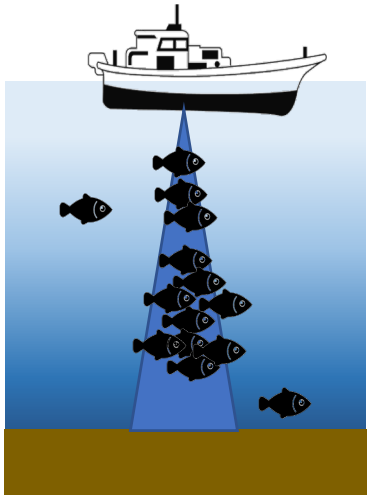
Set-net fishery requires more stable resources than others

Introduction: Resource management in Set-net fishery

Catch of Set-net

To understand the variation in the fish abundance

(Nemoto; 1997)



Echo sounder

!!

Environment changes

①fish abundance

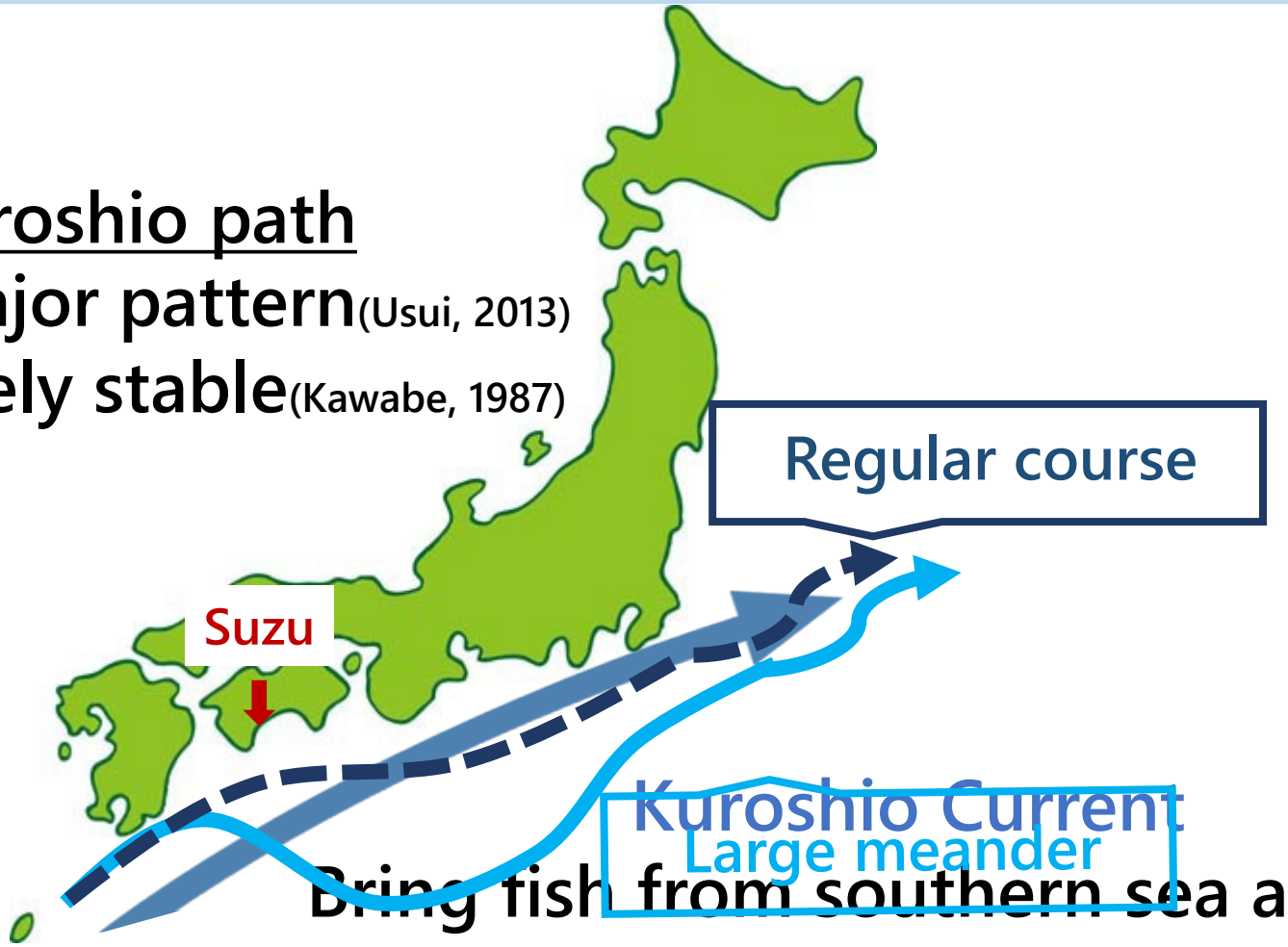
②fish distribution

Catch of Set-net & Acoustic data for more accurate resource management

Introduction: Environmental factor _ Kuroshio Current

Kuroshio path

- Two major pattern(Usui, 2013)
- Relatively stable(Kawabe, 1987)



Bring fish from southern sea areas to waters around Japan

Changes of Kuroshio path has an important effect on fish ecology

Purpose

For resources management in Set-net fishery

Fish distribution (acoustic survey)

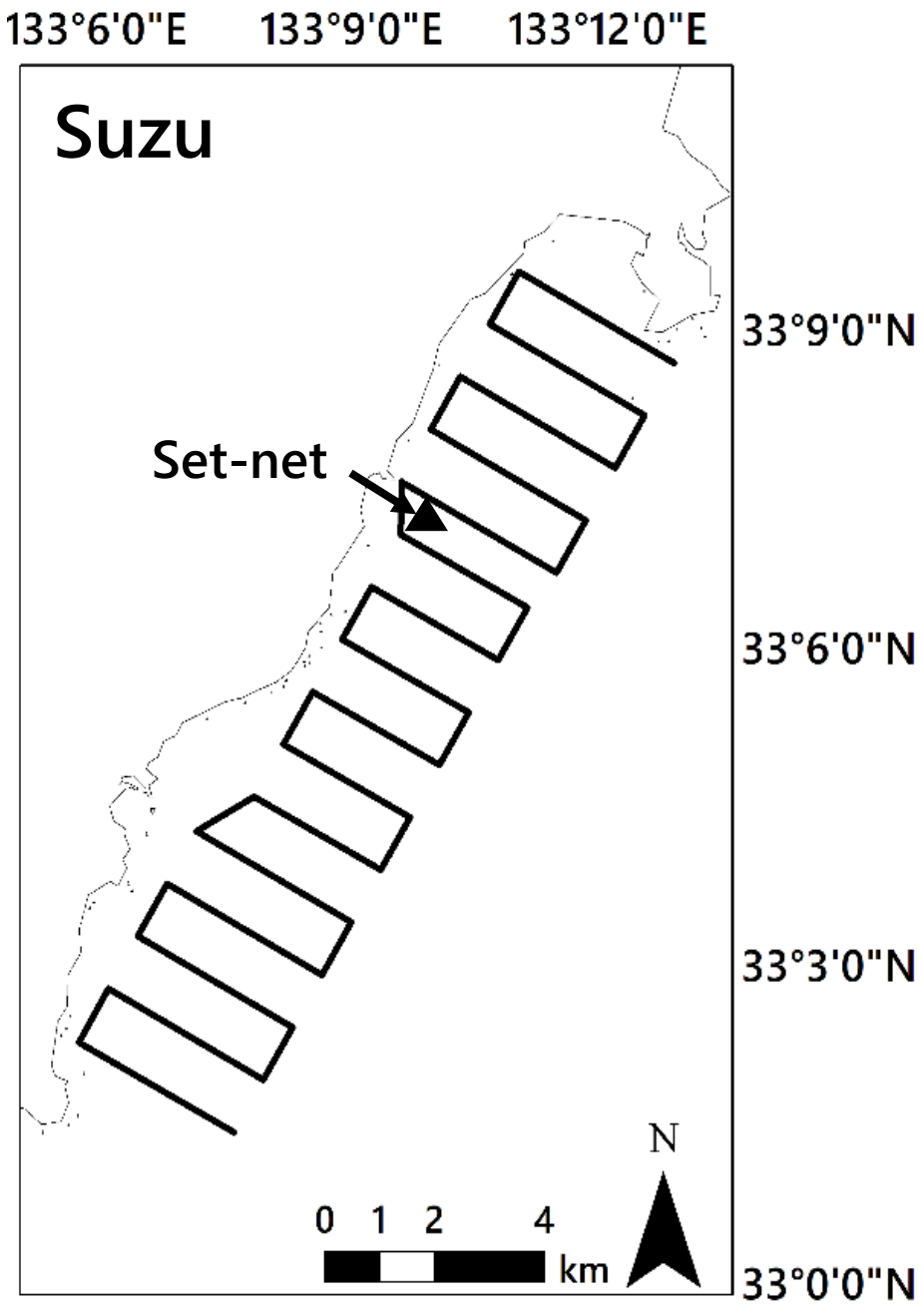
To clarify the reason for changes in fish distribution and fish abundance by various Kuroshio path

Catch of Set-net

Relationship between fish distribution & fish abundance and composition

Kuroshio Current

Methods: Study area and period



Fishing season in Suzu
Autumn→Winter→Spring

Survey period

- First year
  - Autumn (2016/11)
  - Winter (2017/2)
  - Spring (2017/5)
- Second year
  - Autumn (2017/11)
  - Winter (2018/2)
  - Spring (2018/5)

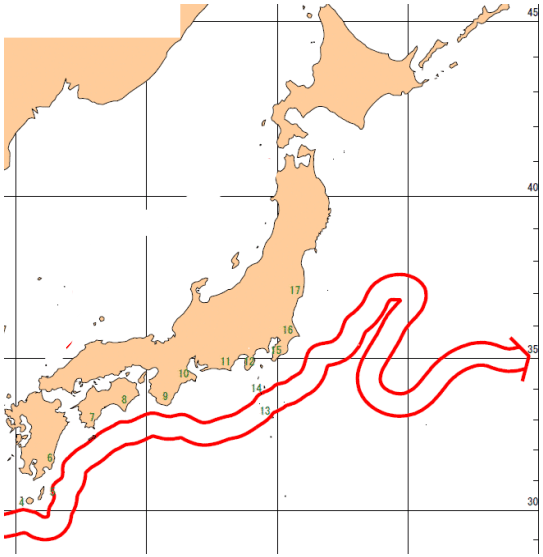
Methods: Study area and period

Application Laboratory JAMSTEC

Kuroshio Current curves from 2017/8

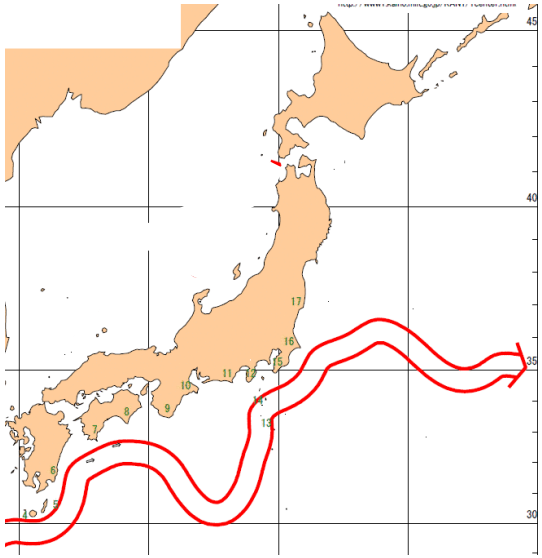
for the first time in 12 years

Regular course



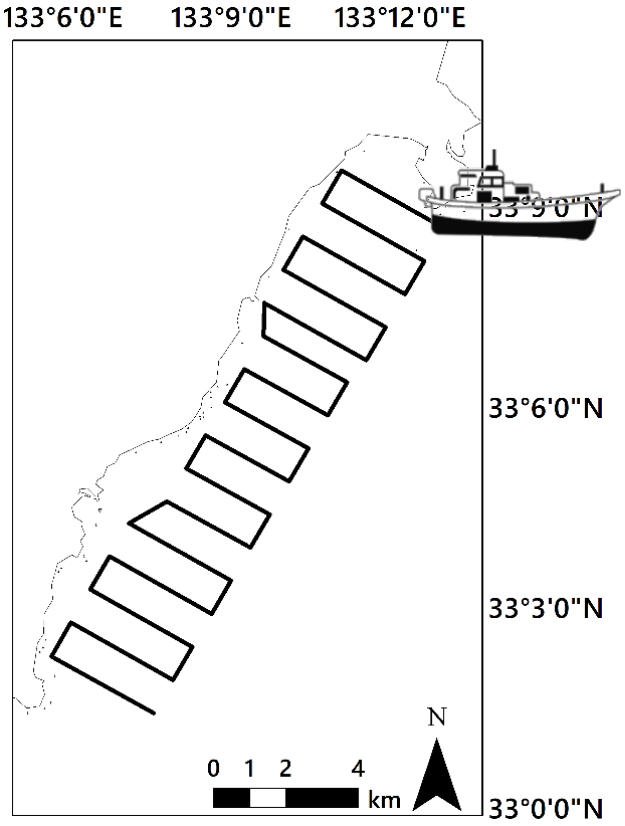
Autumn (2016/11)
Winter (2017/2)
Spring (2017/5)

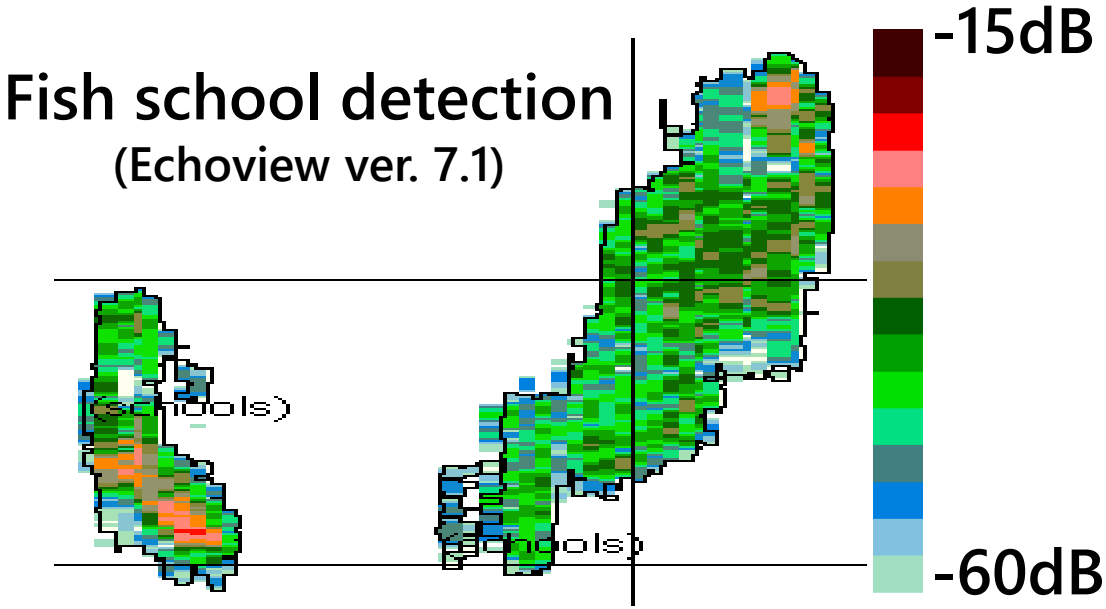
Large meander



Autumn (2017/11)
Winter (2018/2)
Spring (2018/5)

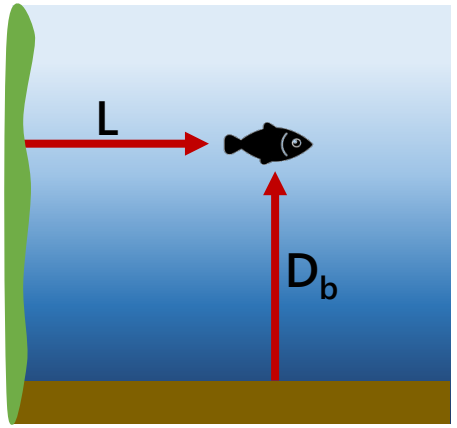
Methods: Measurement of fish distribution





Fish distribution(GAM)

- Sa & Distance from shore
- Sv & Distance from bottom



Methods: Analysis of fish abundance and composition

Catch of Set-net

① **Survey period**

Comparison with the acoustic data

⇩

To clarify the relationship between
fish distribution and fish composition

② **One year**

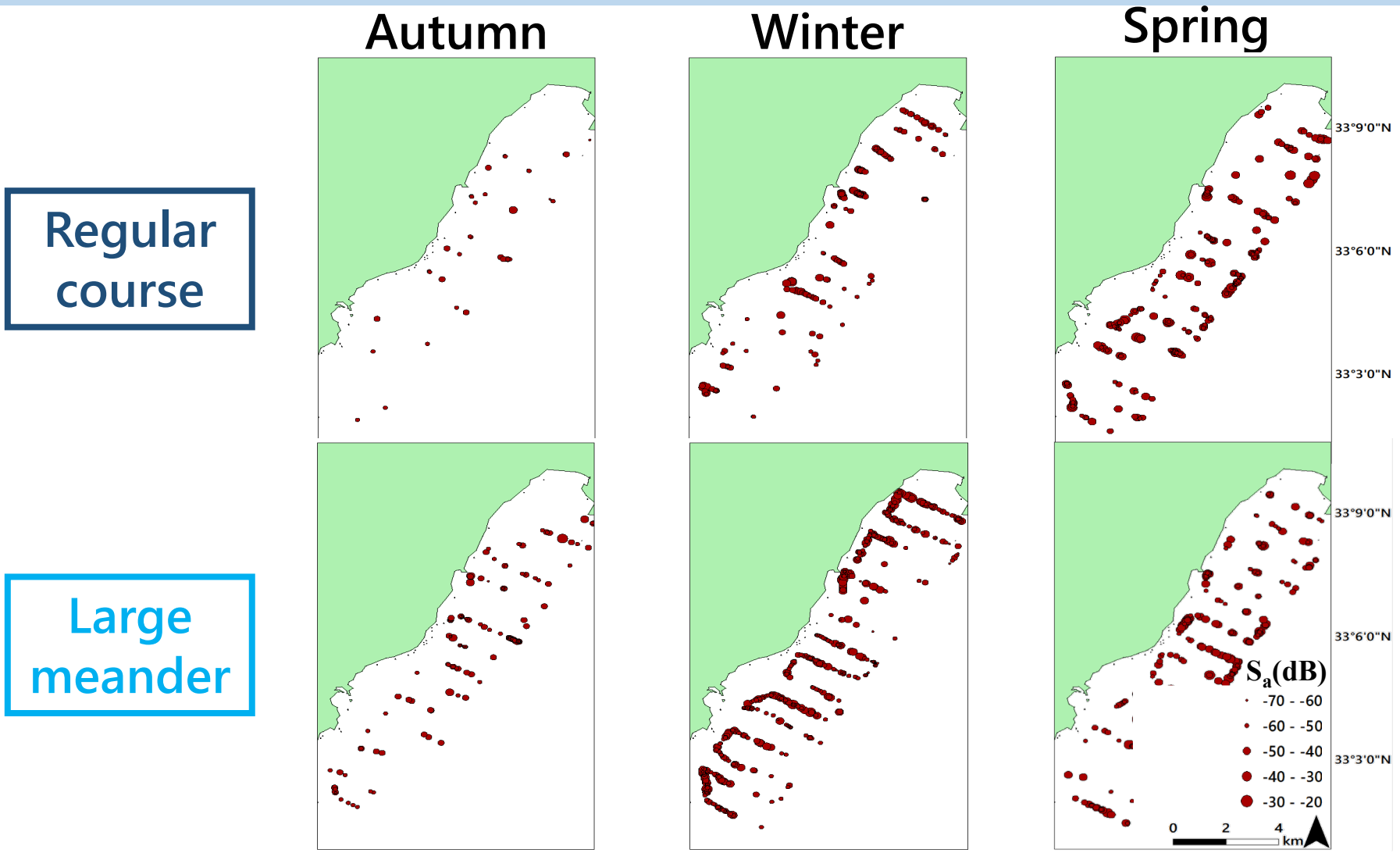
Understand the annual variation in the fish abundance

Environmental survey

・Temperature around Set-net
(Conductivity Temperature Depth profiler)

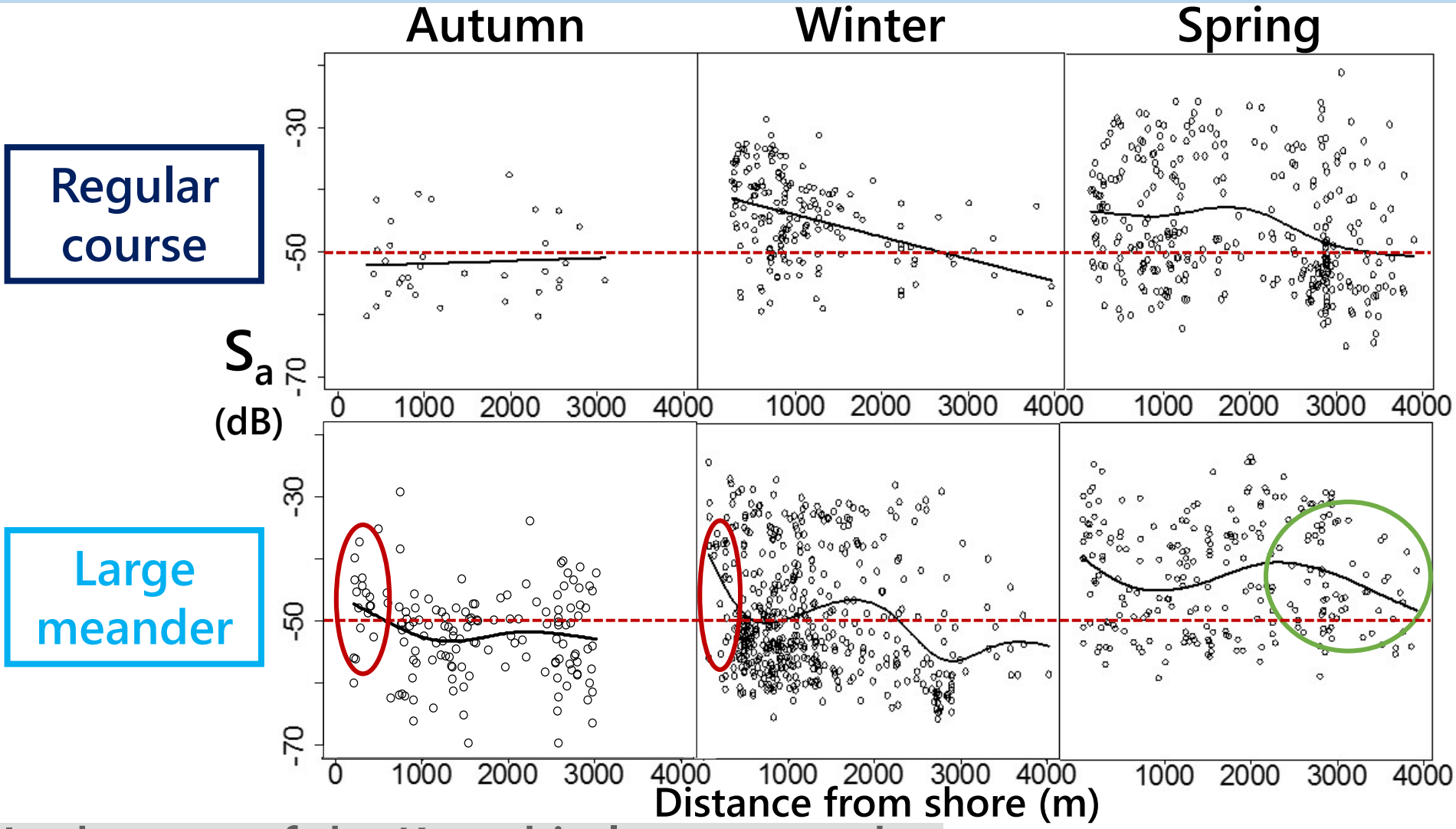
CTD

Results: Fish distribution



With the change of Kuroshio flow path the fish abundance and fish distribution changed

Results: Horizontal structure(S_a & Distance from shore)

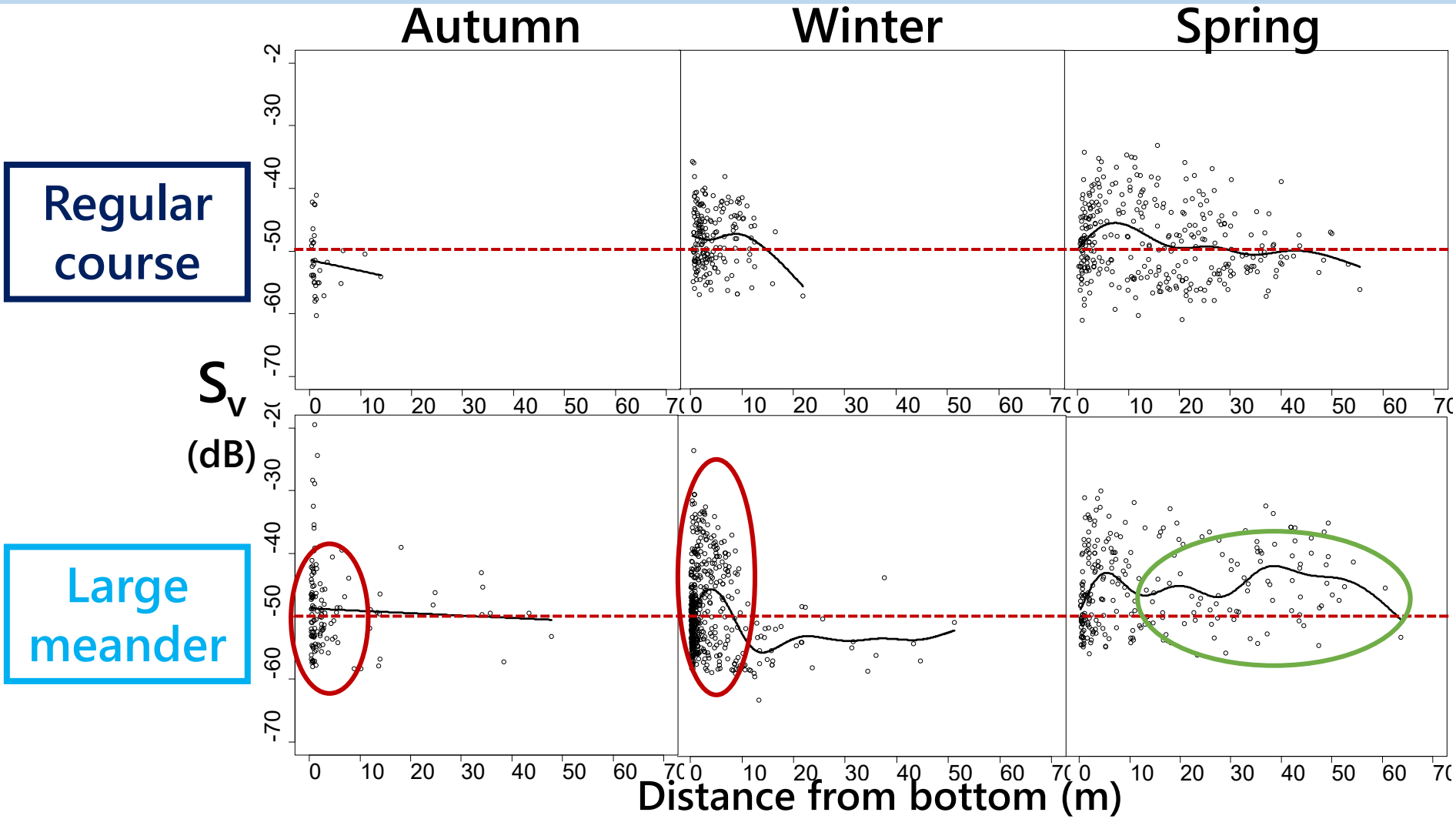


In the year of the Kuroshio large meander

Autumn & Winter: Increased fish density on the shore

Spring: Increased fish density on the offshore

Results: Vertical structure(S_v & Depth from bottom)



In the year of the Kuroshio large meander

Autumn & Winter: Increased fish density near the bottom

Spring: Increased fish density near the surface

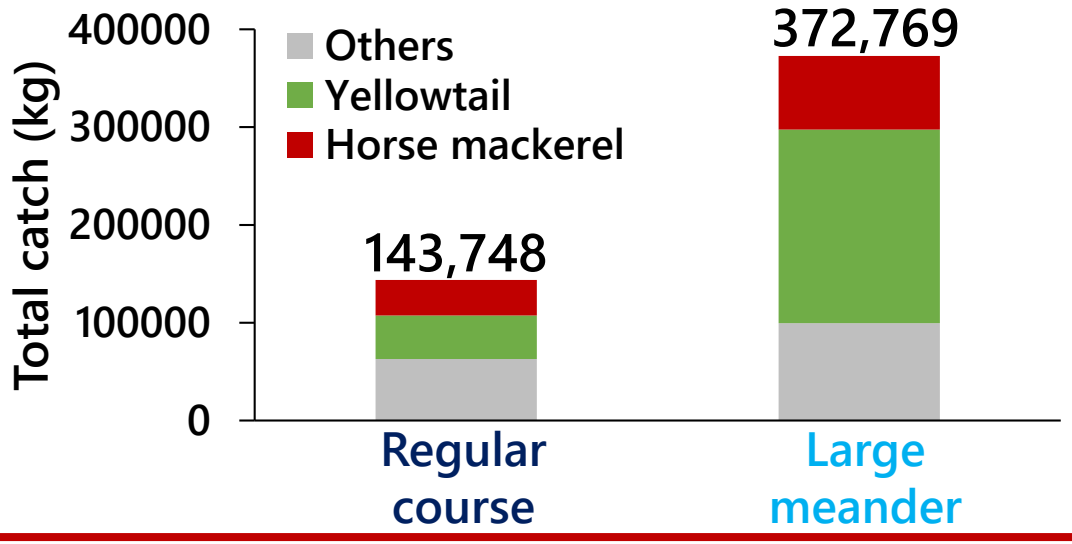
Results: Change of dominant fish species (Catch data)

- **Dominant fish species (survey period)**

	Autumn	Winter	Spring
Regular course	Horse mackerel (54%)	Yellowtail (60%)	Sardine (58%)
Large meander	Horse mackerel (69%)	Horse mackerel (44%)	Yellowtail (58%)

With the change of Kuroshio flow path each season's dominant fish species changed

- **Total catch(1 year)**



Increased catch in the year of Kuroshio large meander

Results: Water temperature of survey area

	Autumn	Winter	Spring
Regular course	21.6 ~ 22.6°C	16.2 ~ 17.5°C	17.6 ~ 20.6°C
Large meander	19.2 ~ 20.1°C	13.1 ~ 14.6°C	16.2 ~ 19.4°C
			(Min. ~ Max.)
Average ΔT	-2.5°C	-3°C	-1.5°C

Why? The water temperature has dropped due to the influence of the Kuroshio Current Why?

Discussion: Drop in water temperature

How about
the fish species??

(NORIHISA; 2013)

Kuroshio countercurrent
(High water Temp.)

Cold water eddy

Cold water mass formed in the survey area
due to the Kuroshio large meander

Discussion: Optimum temperature of dominant fish

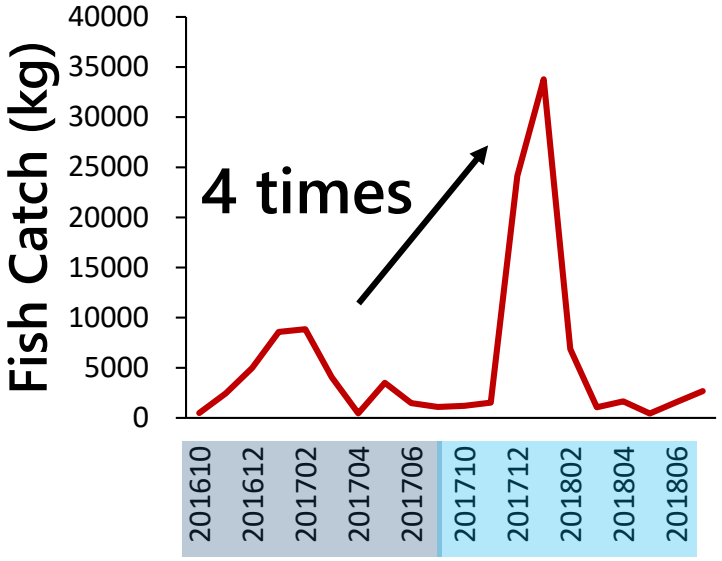
Horse Mackerel

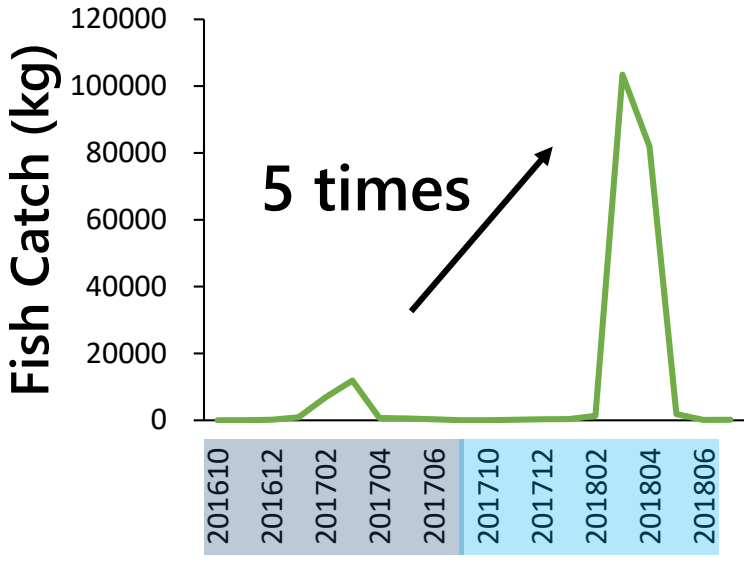
Optimum temperature
(14 – 20°C) NEMOTO; 2017

Yellowtail

Optimum temperature
(16 – 17°C) KAJI; 2008

What will happen to the fish distribution ??

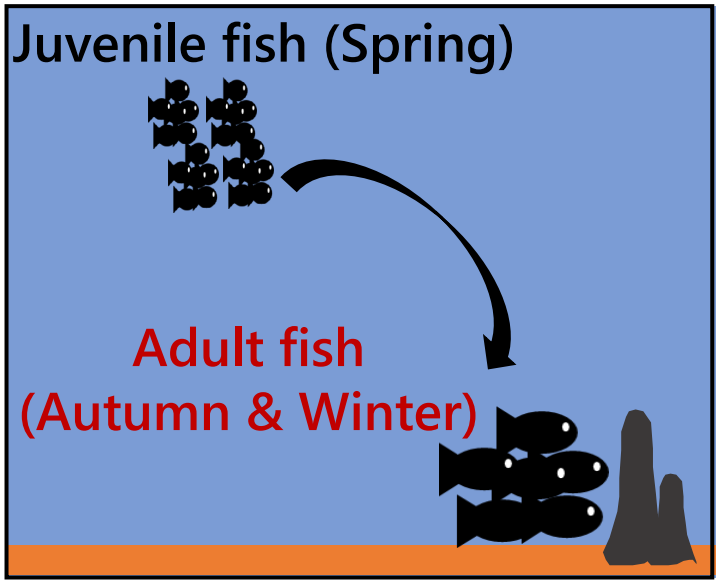




Increased fish abundance due to Kuroshio large meander

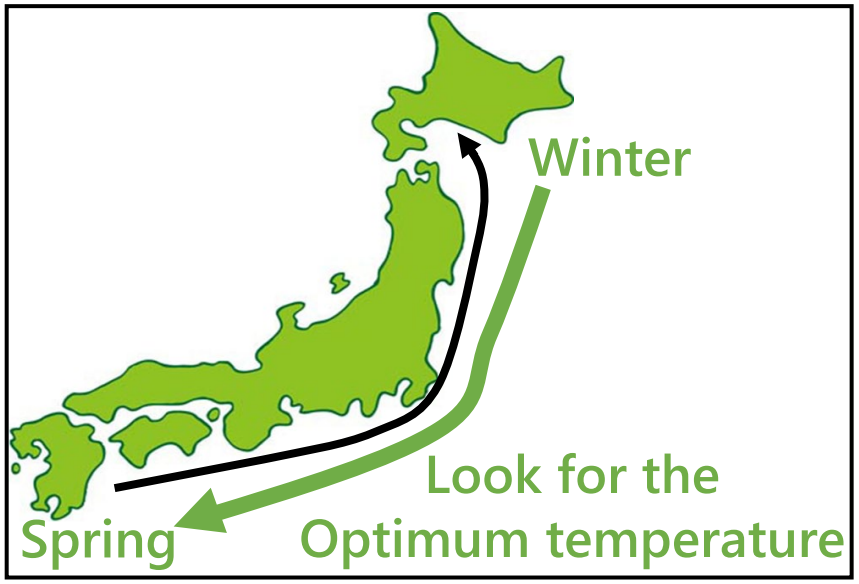
Discussion: Change of fish distribution

Horse Mackerel



Shore and bottom↑

Yellowtail



Offshore and surface↑

Results

Autumn & Winter: Increased fish density near the bottom

Spring: Increased fish density near the surface and offshore

The acoustic data properly reflects changes in the fish distribution and abundance .

Summary

Kuroshio large meander

⇩

Water temperature dropped

⇩

Increased fish abundance & changes in composition

⇩

Fish distribution changed

Fish distribution and abundance
is effected by the change of Kuroshio flow path

Future work: Smart Fishery

For more accurate and efficient resource management

Data Analysis (Acoustic+Catch) + Information and Communication Technology (ICT)

- The automation of data analysis
- Create a system that can be shared on the Internet

⇩

Efficient and Stable Fishery Management

THANK YOU
for your
ATTENTION!