Current State and Challenges of Data Collection in Japan

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Resource Survey

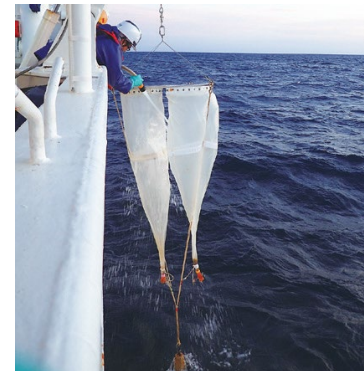## Resource survey activities

Information gathering /analysis
- Catch and operational information
- Measurement of catches at landing ports
- Data collection using ICT

Conduct survey on research vessel to understand:
- Oceanographic state (e.g., water temperature and salinity)
- Egg and juvenile surveys and catch surveys (the ecology and abundance of fish from eggs, juveniles to adults)
- Quantitative echo sounder (the amount of resources)
- Marked release surveys (migration and growth)

Identify and analyze samples and specimens
- Egg and juvenile
- Stomach contents
- Age determination (days, years) by otoliths and scales
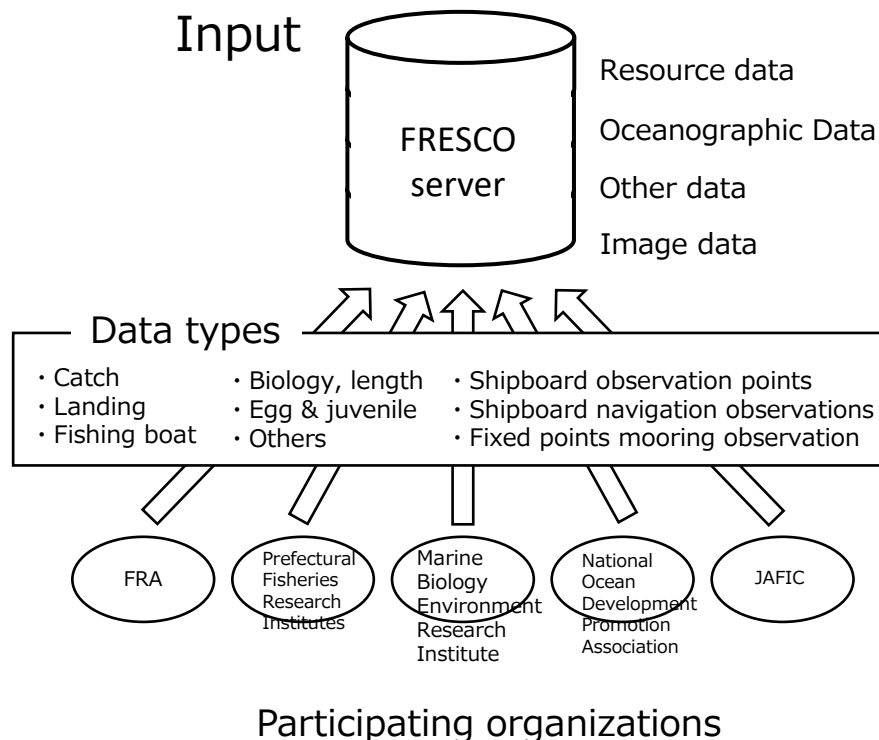
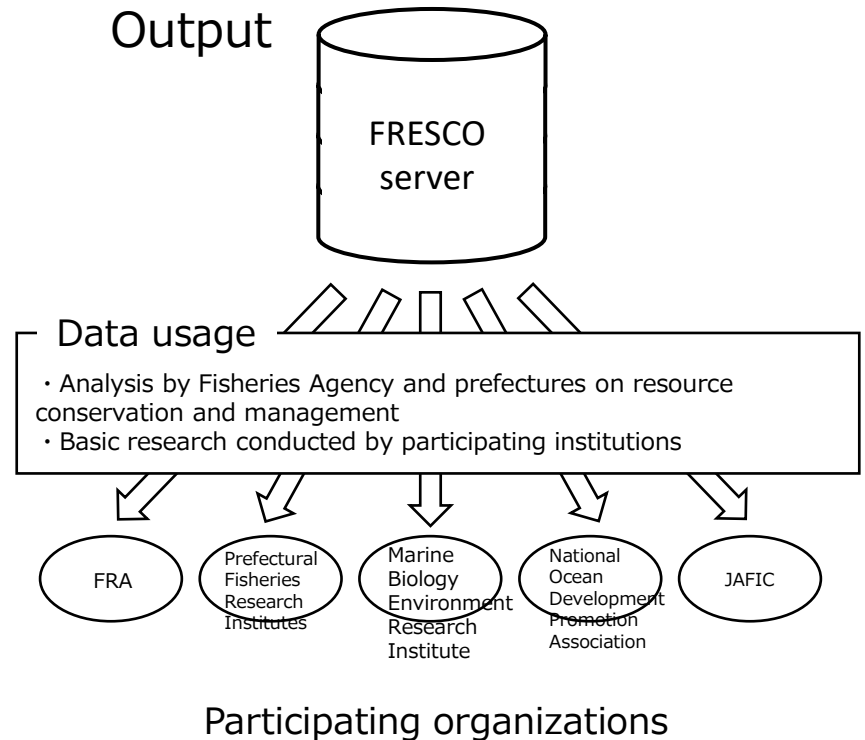# Survey data collection and management system FRESCO

(Fishery Resource Conservation: Fishery Resource Survey Information System surrounding Japan)

- Established to collect and accumulate data based on the survey plan, etc. for the Fisheries Resource Survey and Assessment Promotion Project.
- JAFIC is in charge of database management.
- The purpose of the database is to exchange data within the JV organization and to prevent the data loss.

Input

FRESCO server

Resource data

Oceanographic Data

Other data

Image data

Data types

- ·Catch
- ·Landing
- ·Fishing boat
- ·Biology, length
- ·Egg & juvenile
- ·Others
- ·Shipboard observation points
- ·Shipboard navigation observations
- ·Fixed points mooring observation

FRA | Prefectural Fisheries Research Institutes | Marine Biology Environment Research Institute | National Ocean Development Promotion Association | JAFIC

Participating organizations

Output

FRESCO server

Data usage

- · Analysis by Fisheries Agency and prefectures on resource conservation and management
- · Basic research conducted by participating institutions

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Participating organizations

Resource Survey

Resource survey activities

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Conduct survey on research vessel to understand:
- Oceanographic state (e.g., water temperature and salinity)
- Egg and juvenile surveys and catch surveys (the ecology and abundance of fish eggs, juveniles to adult)
- Fish finder device (the amount of resources)
- Marked release surveys (migration and growth)
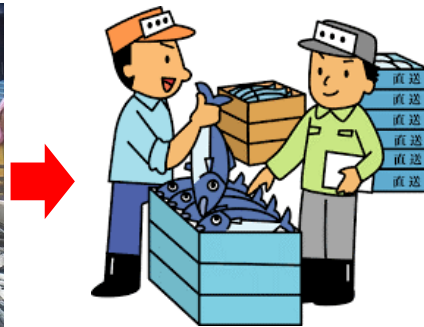
Identify and analyze sample specimens
- Egg and juvenile
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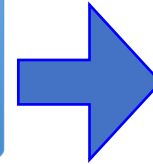- Age determination (days, years) by otoliths and scales

Collect fishery data

Collect fishery data

Database
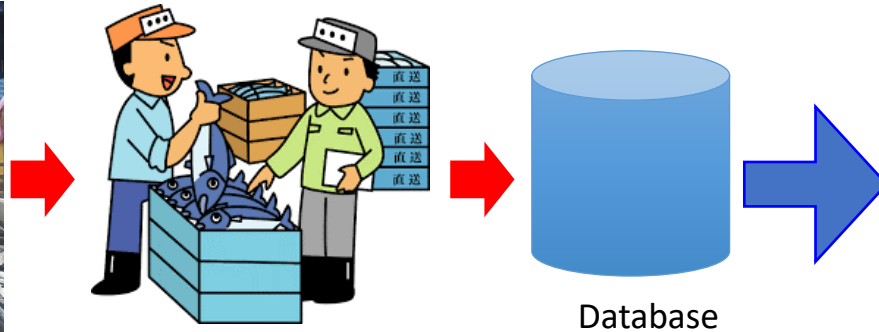
Improve accuracy and speed of resource assessment

1．Landing information from local markets and fishery cooperatives

Fishery type, species (stocks), catch, etc.

2．Biological information of the catch

Species, size, etc.

Collect fishery data

Database

Improve accuracy and speed of resource assessment

１．Landing information from local markets and fishery cooperatives

Fishery type, species (stocks), catch, etc.

Current state of
Collecting Landing Information

National statistics on agriculture, forestry, and fisheries is reducing the number of target species and data by municipality is abolished

- ✓ National catch data, the basis for conducting stock assessments, is not available for many species.
- ✓ Detailed official statistics for local areas are not available.

→ Need alternative to the Agriculture, Forestry and Fisheries Statistics to track landings on a nationwide basis

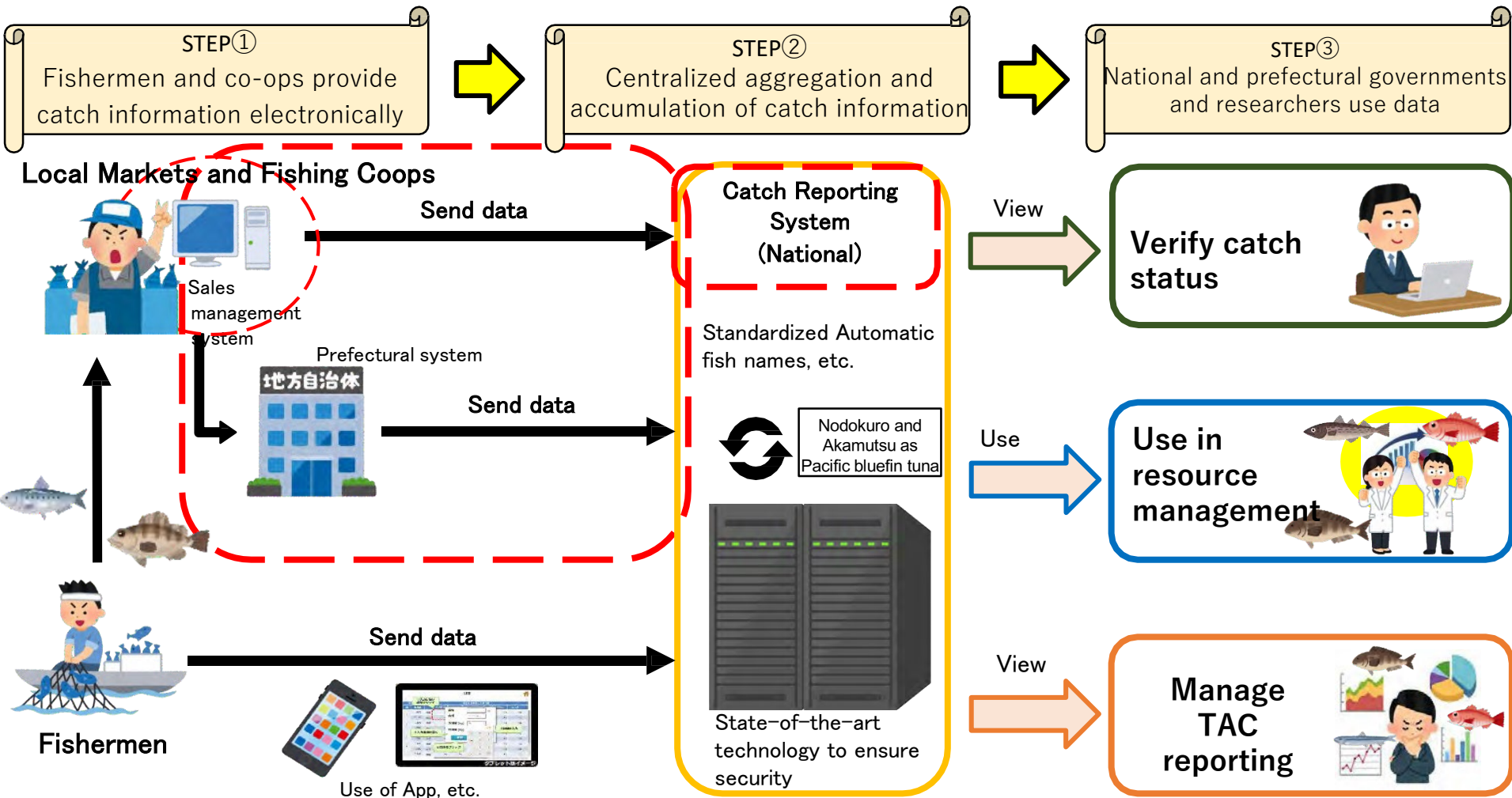Not all prefectures have a landings data aggregation system

- ✓ Some institutions collect comprehensive landing data automatically (or semi-automatically). Others collect, compile, and report data from fishing cooperatives, etc. by e-mail, fax, or mail

→ Need to develop collection methods to match the actual state of each institution and reduce workload.

Landings data collection
Fishing cooperatives, prefectures, etc.
Data centralization

STEP① Fishermen and co-ops provide catch information electronically

STEP② Centralized aggregation and accumulation of catch information

STEP③ National and prefectural governments and researchers use data

Local Markets and Fishing Coops

Sales management system

Send data

Prefectural system 地方自治体

Send data

Catch Reporting System （National）

Standardized Automatic fish names, etc.

Nodokuro and Akamutsu as Pacific bluefin tuna

State-of-the-art technology to ensure security

Fishermen

Send data

Use of App, etc.

View → **Verify catch status**

Use → **Use in resource management**

View → **Manage TAC reporting**

Smart Agriculture, Forestry and Fisheries WG, Growth Strategy Council
2/9/2021

Issues and challenges to systemize data collection

◆<u>If sales system is not available</u>

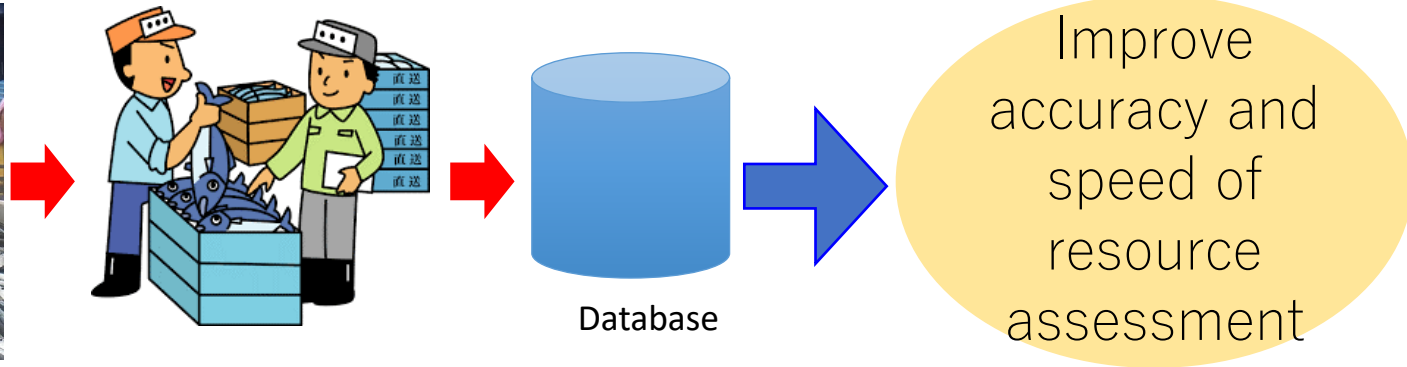How will the fishermen's coop, etc. report this information?

◆<u>If catch weight data is not available</u>

With just price data how to calculate quantity?

◆<u>When landings do not pass through the market</u>

Possible to ascertain the landings quantity outside of the market?

Collect fishery data

Database

Improve accuracy and speed of resource assessment

2．Biological information of the catch

Species, size, etc.

Fishery sites

Squid Jigging Boat (Hachinohe)

Fixed net fishing boat (Odawara)

Purse seine landling (Matsuura)

Gochi-ami fishery sorting and measuring (Joetsu)
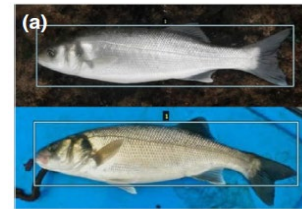
Image Analysis Technology Development

① Image recording

✓ After sorting, camera captures images on the conveyor
✓ Search for optimum conditions, installation, etc.
✓ Images taken at different times of the year
→ Variety of fish species→ Increase training data for deep learning
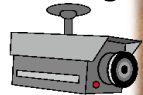
② Image analysis

a) Creation of training data by automated image cropping

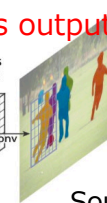Automatically pick out fish bodies in images ⇒ Training data

Source :
Monkman et al. (2019), Fig 1a

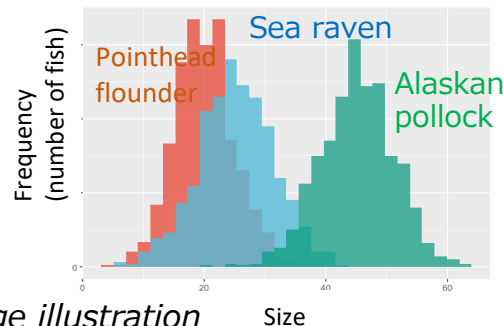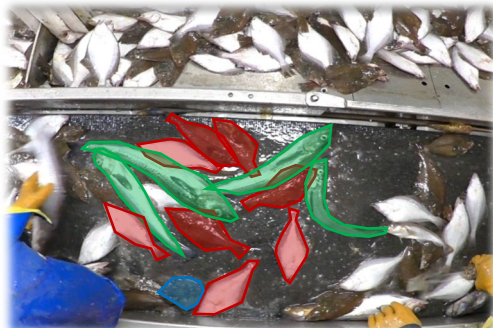b) AI construction by deep learning

Input image   Species output   Calculate object area in the image⇒ Convert to body length

Source : He et al. (2017), Fig 1

③ Recognized by AI (fish species, length)

Pointhead flounder

Sea raven

Alaskan pollock

Frequency (number of fish)

Size

※*Image illustration*

■ In the future, the application can be used in other markets equipped such as sorting tables

■ Imaging/analysis system must be inexpensive and compact for nationwide use (separate hardware development needed).

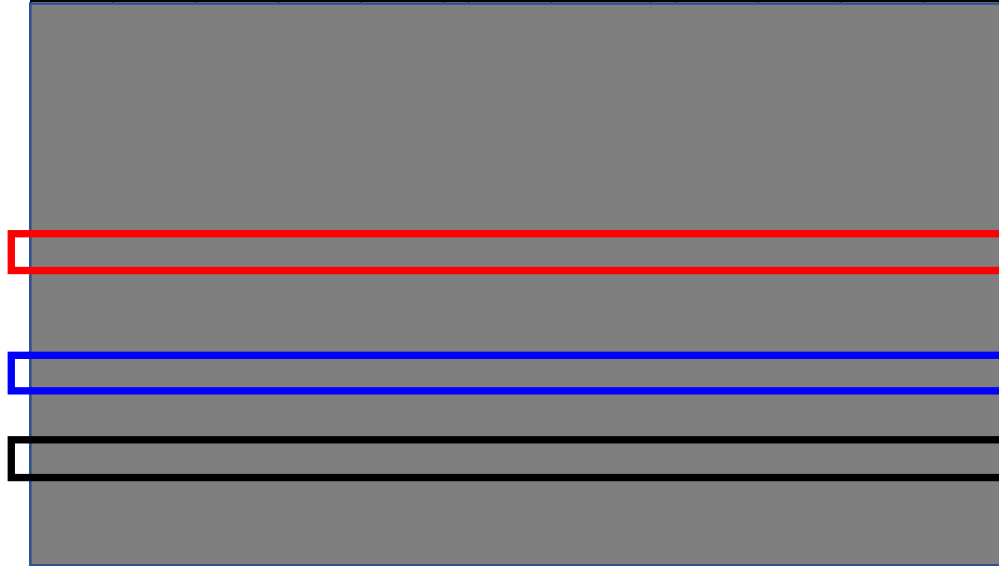■ On site labor reduction through computerization

Fishing port with sorting machine

Automatic sorting machine

Image capture frame

Conveyor belt

Fish on conveyor belt
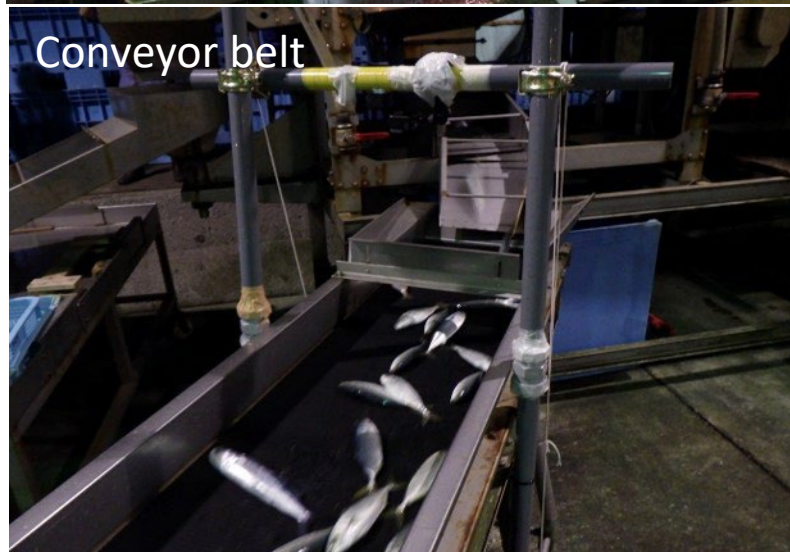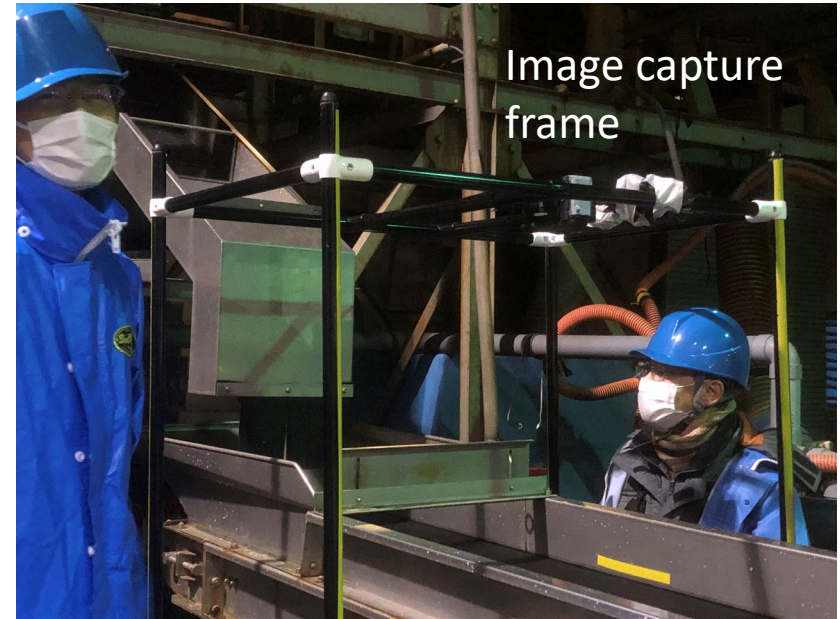
Seeking appropriate image recording conditions

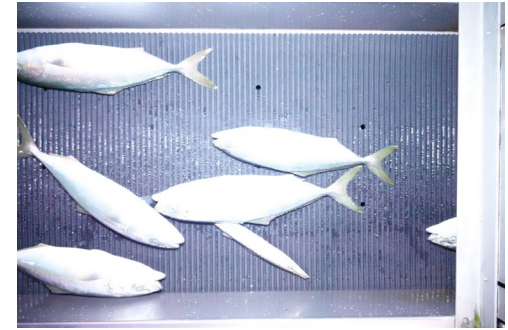| LED | | カメラ | | | | | | | | | | |
|-----|-----|-------|-------|-------|---|------|------|----|-----|------|------|
| 光量 | 色温度 | ISO感度 | 絞り値 | 露出時間 | | 開始時間 | 画像No | | ぶれ | 暗い | 白飛び | ピント |

White out

Blurry

Good

From imaging experiment plan

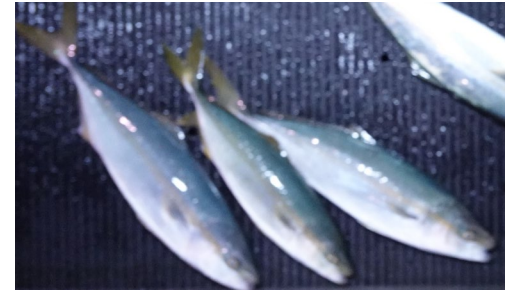Environment specific to the landing site

→Light conditions varies by time of the day（semi-enclosed outdoor environment）
→Conveyor belt speed varies each time

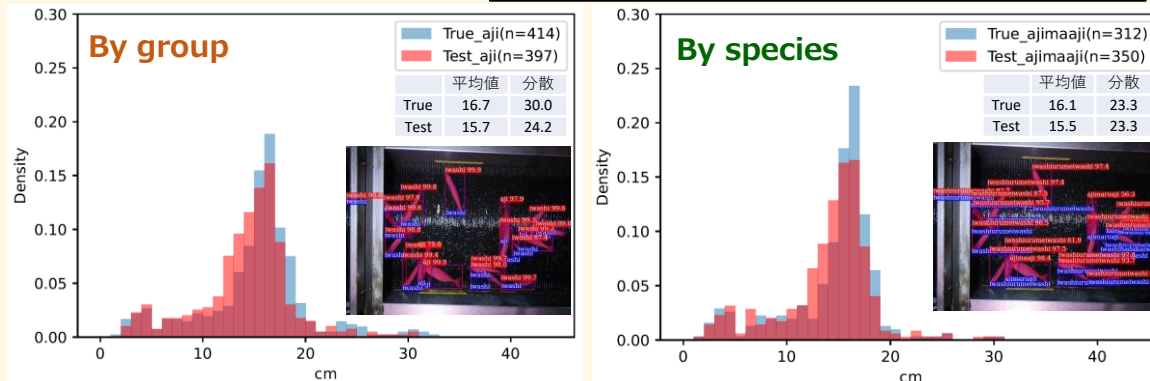# Species recognition and measurement
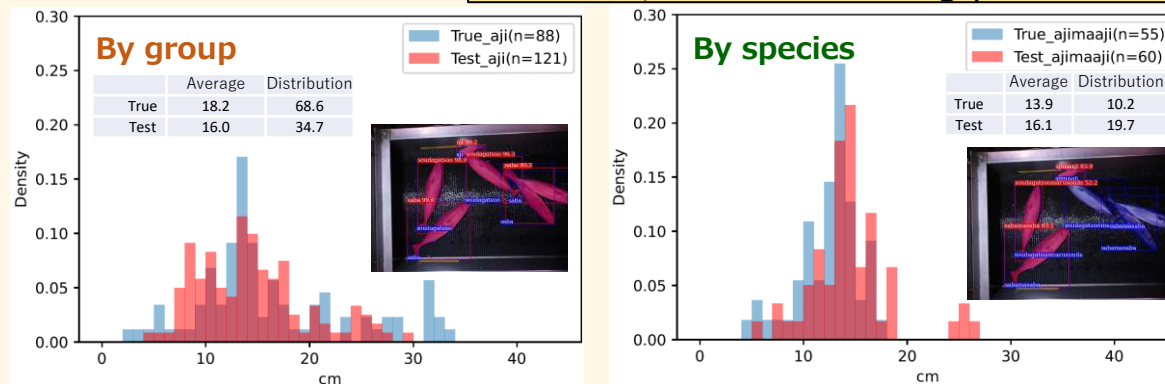

A. During the period, using sorting machine, Odawara fishing port

By group — True_aji(n=414), Test_aji(n=397)

	平均値	分散
True	16.7	30.0
Test	15.7	24.2

By species — True_ajimaaji(n=312), Test_ajimaaji(n=350)

	平均値	分散
True	16.1	23.3
Test	15.5	23.3

·Bias is -6%(G), -4%(by species). The size is generally captured. Possible to use.
· Species classification model detected 38 false positives, but **should dismiss to be on the safe side**.

B. Outside the period, using sorting machine, Odawara fishing port

By group — True_aji(n=88), Test_aji(n=121)

	Average	Distribution
True	18.2	68.6
Test	16.0	34.7

By species — True_ajimaaji(n=55), Test_ajimaaji(n=60)

	Average	Distribution
True	13.9	10.2
Test	16.1	19.7

· Bias is -12%(G), -16%(By species). **Performance was lower in the same fishing port compared to A.**
· The group classification model detected 33 fish and the fish species model detected 5 fish (26/33 were mackerel G).
· Mackerel is 1185, so false positives for mackerel as jack mackerel are more significant for jack mackerel.

Shibata et al. (2022)

Challenges of image analysis in ports

1. **Image recording condition**

- Camera placement
- Power availability
- Lighting condition

2. **Image analysis**

- Knowledge of artificial intelligence (AI) analysis
- Creating training data
- Identifying 200 species of fish
- Measuring fish size when overlapped or not straight

3. **Nationwide rollout**

- Inexpensive, simple, and reliable system

Thank you

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