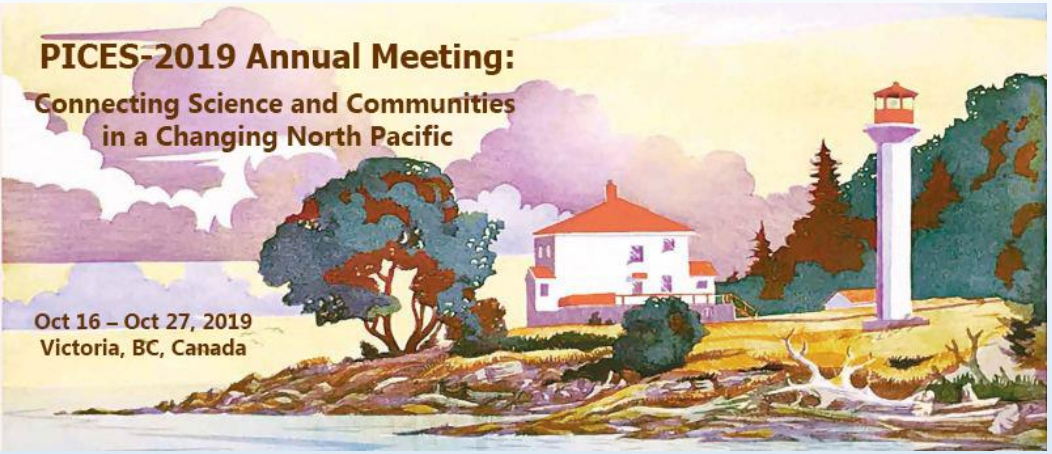

S9: MONITOR Topic Session
Coastal Ocean Observing Systems, Essential Biological Variables and Community-based Monitoring

Development of Information Service for Set Net fisheries using Satellite and numerical data

Sei-Ichi **Saitoh**[1], Takashi Hosokawa[2], and Fumihiro Takahashi[3]

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[3]Green & Life Innovation, Inc., Hakodate, Japan.

Hokkaido University Arctic Research Center

日東製網 NITTO SEIMO CO., LTD.

G&LI Green & Life Innovation, Inc.

Acknowledgment

This work was supported by Space data application model demonstration projects 2018, Cabinet Office, Government of Japan.

This work was cooperated with Nakamura Gyoba Set Net Fisheries Company.

内閣府
Cabinet Office

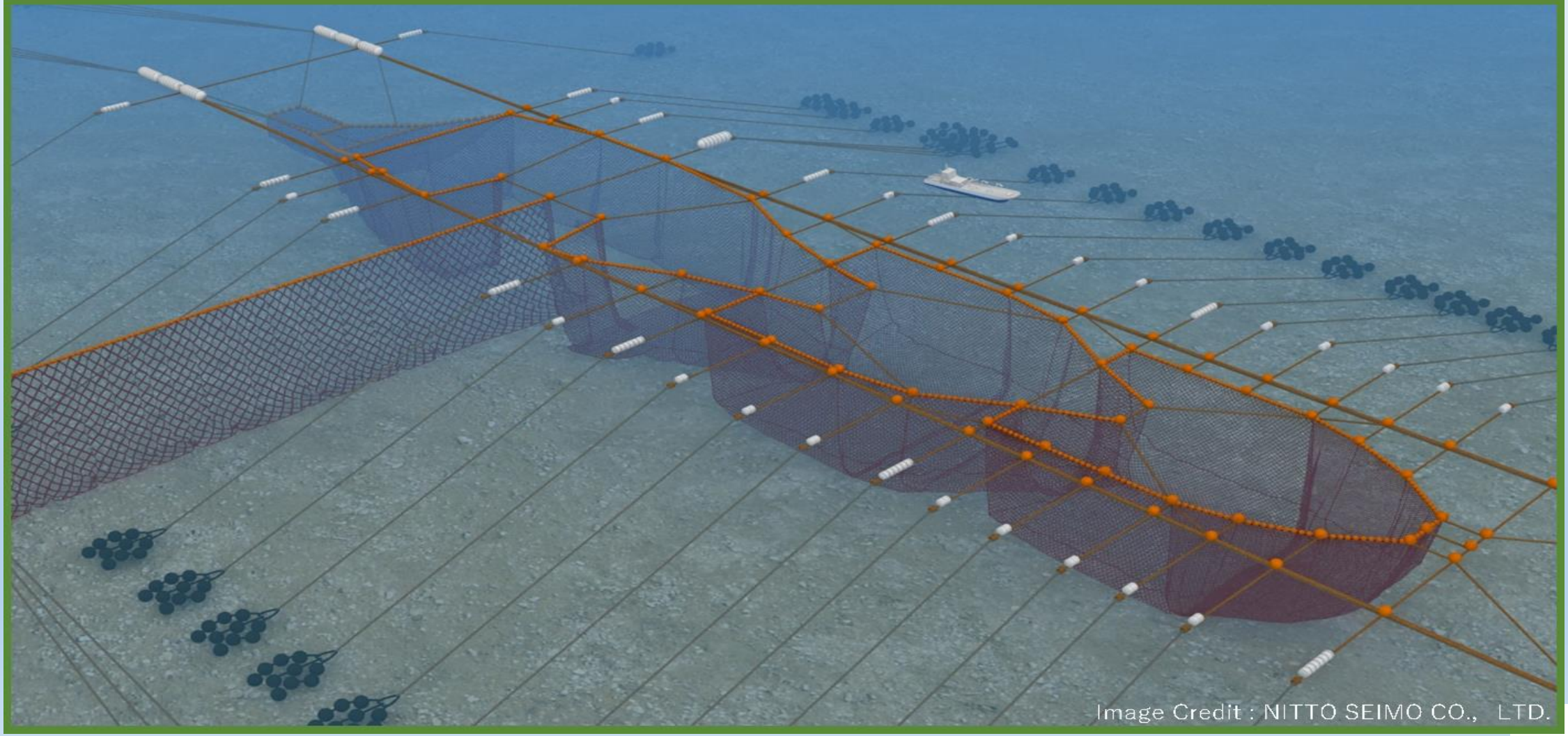
中村漁場

Contents

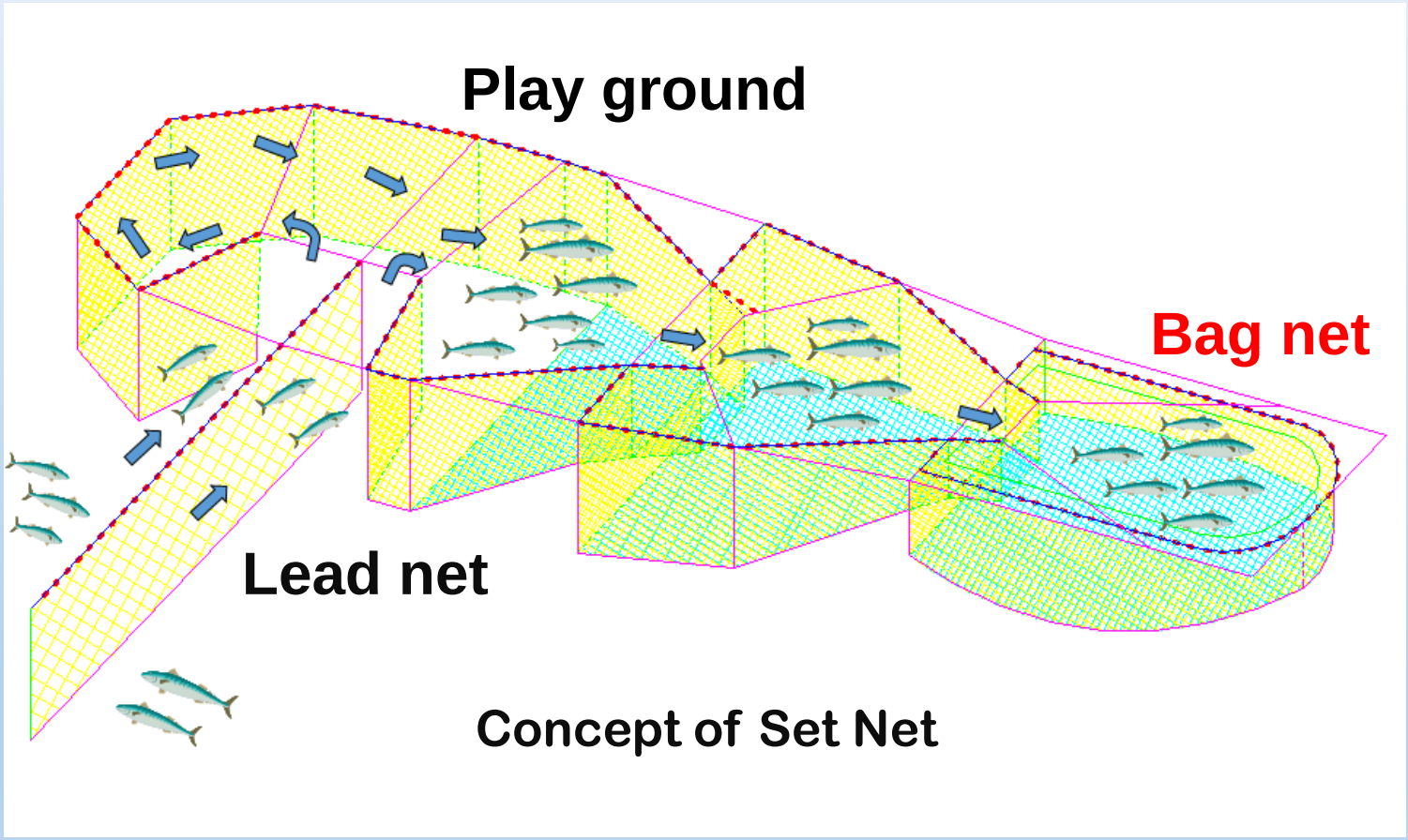
- Introduction: Set Net Fisheries
- Motivation
- Development of prediction model
- Experimental activities
- Effect of information service
- Future aspects
- Summary

Set Net

大型定置網展開設置モデル図



Set Net Fisheries

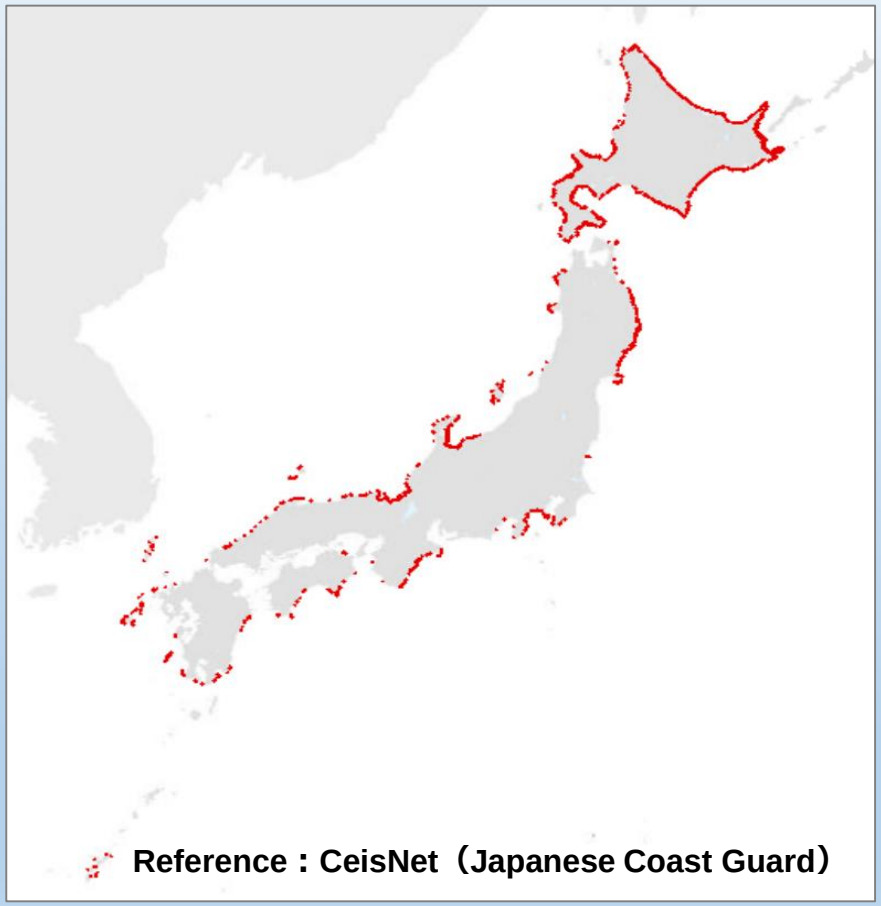


Concept of Set Net

Operation scenery of the Set net

Harvesting scenery of the Set net

・**Set net fisheries management entities :Hokkaido 34%**
・**Fisheries landing of Hokkaido : Set net fisheries 18%**



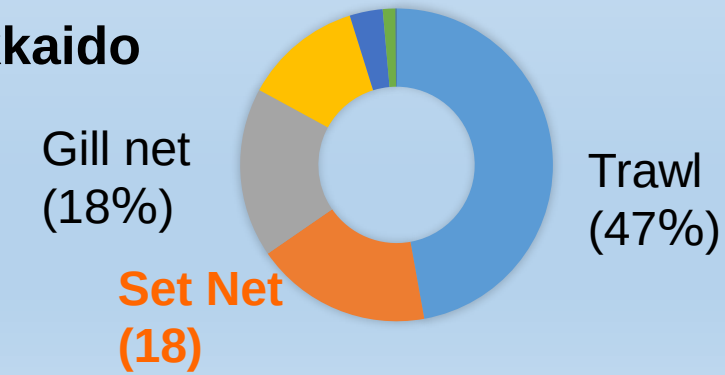
Distribution of set net fishing rights

Set net fisheries management entities

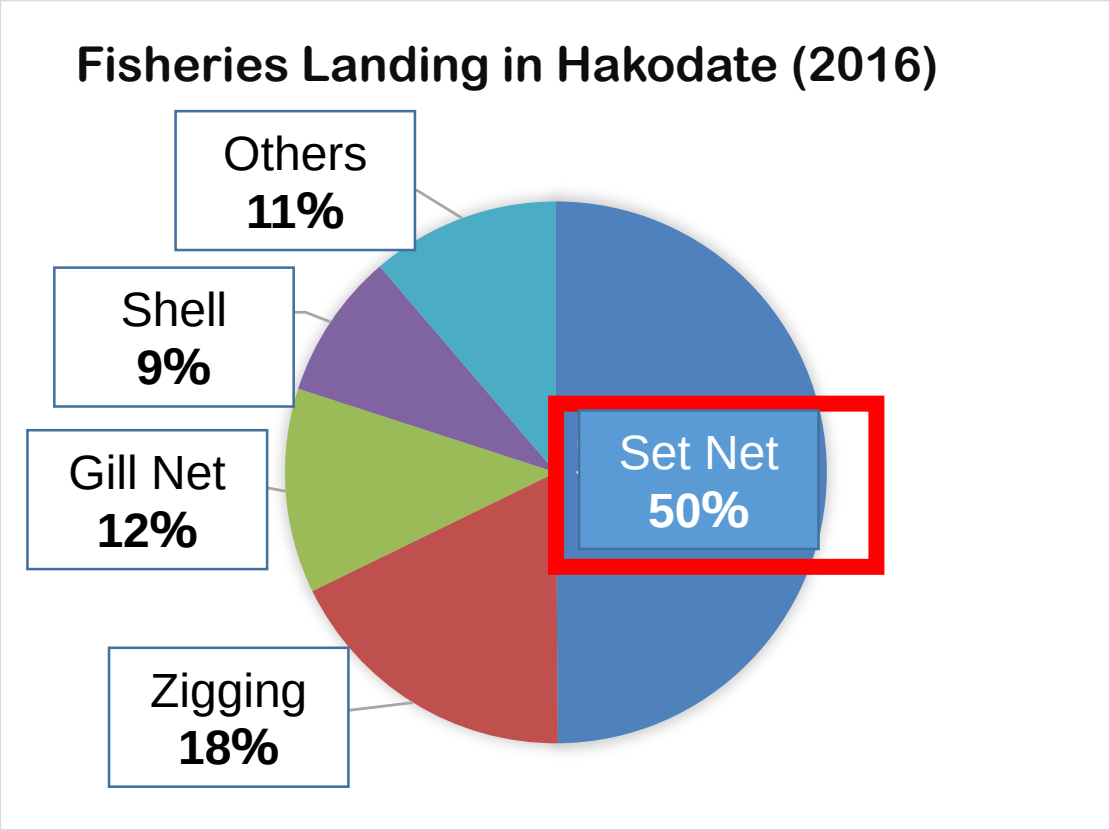
	Japan	Hokkaido
Large Set Net	431	34
Salmon Set Net	821	821
Small Set Net	2,867	552
Total	4,119	1,407

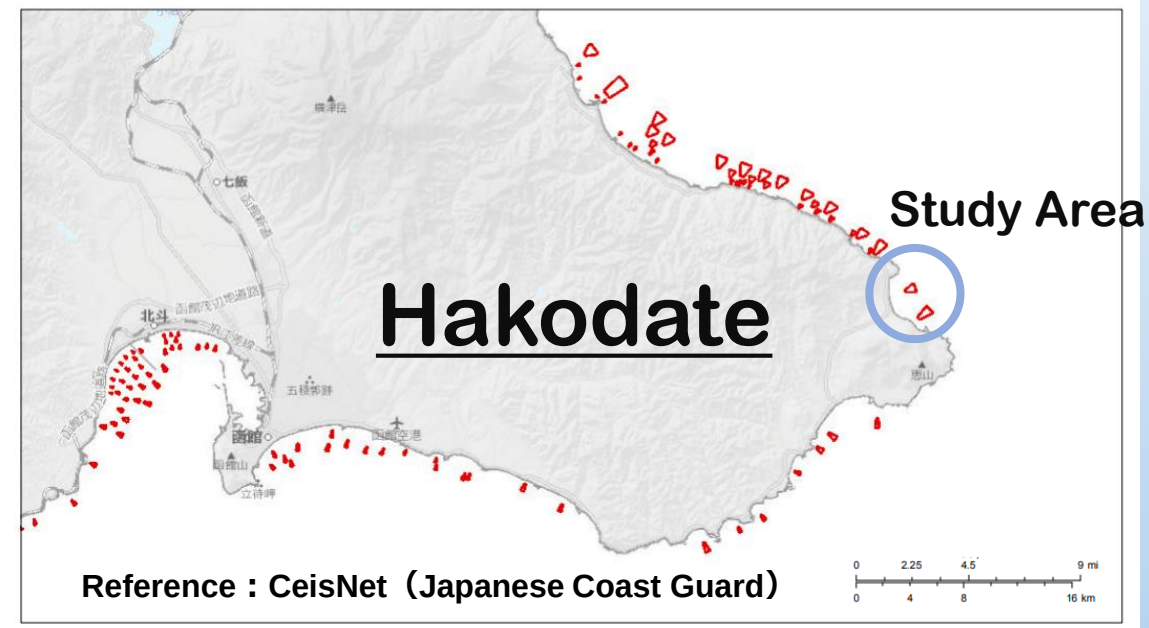
Fisheries Census 2013 in Japan

Fisheries landing of Hokkaido (2016)



- **Fisheries Landing in Hakodate : Set Net Fisheries 50%**
- **Management stabilization of Set Net Fisheries**
  => contribute to activation of regional economy





Distribution of set net fishing rights in Hakodate

- It can also be used for resource management of bluefin tune, a local issue.
- **Horizontal deployment** is possible not only in Hokkaido but also in areas that operate set net throughout Japan.

Features and challenges

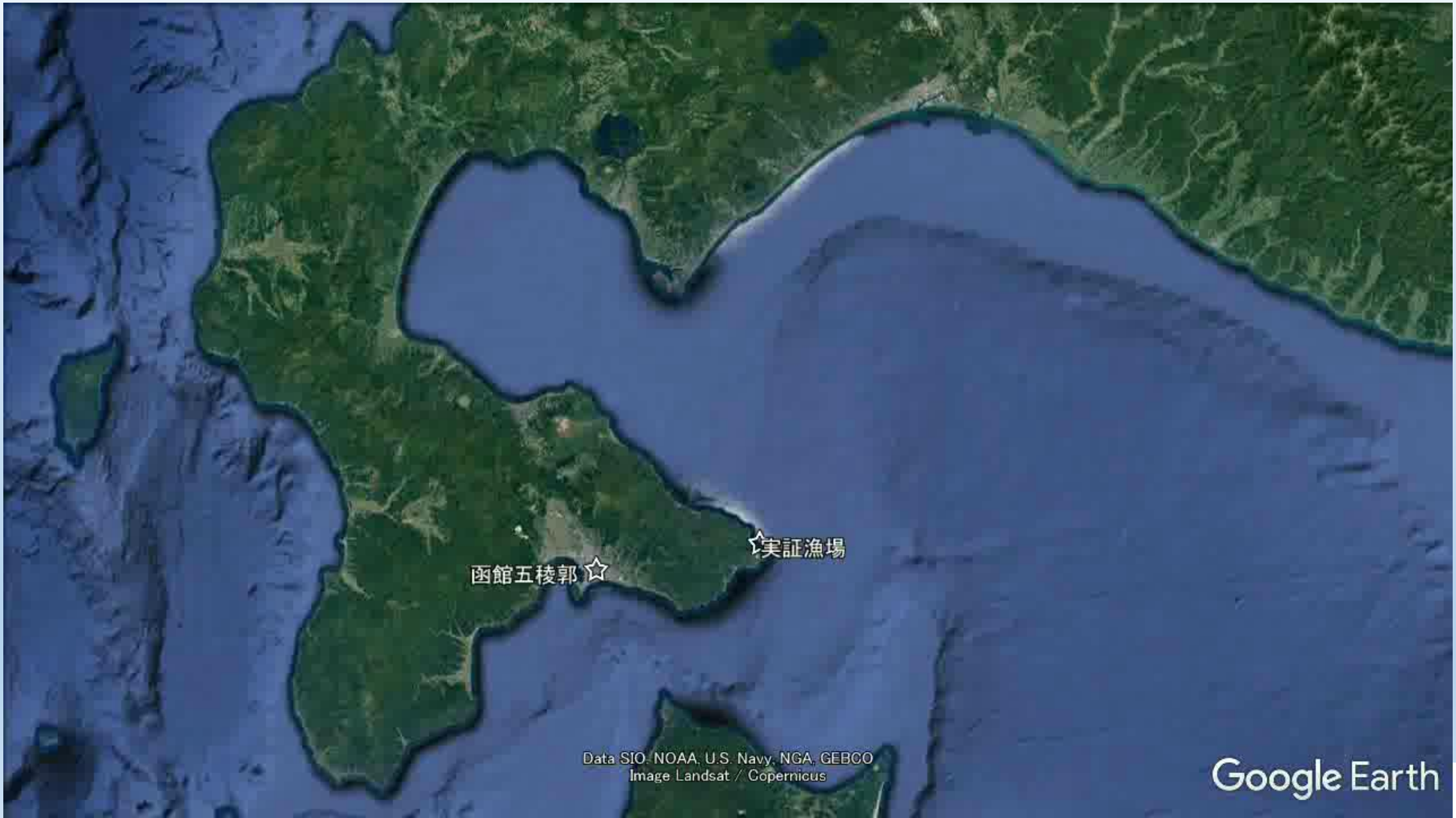
- This is an **environmentally friendly** fishing method
- "**Passive**" fishing method waiting for fish to enter the net
- The **amount and type of fish is not known** until it is actually confirmed on site
- **Understanding the current situation** and **forecasting the future** are **key** to the operation and management of set net fisheries

Support using satellite and numerical data

Motivation

- Under changing climate, it is necessary for fisher to manage the **sustainable set net fisheries** and one of solutions is to **develop the information service** including prediction of when and what kind of fish will be trapped in the set net.
- We challenge to have **co-working** and **co-designing** with a set net fisheries company to **develop of information service** in southern Hokkaido coast, along Cape Esan.

Study Area


実証漁場
函館五稜郭
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus
Google Earth

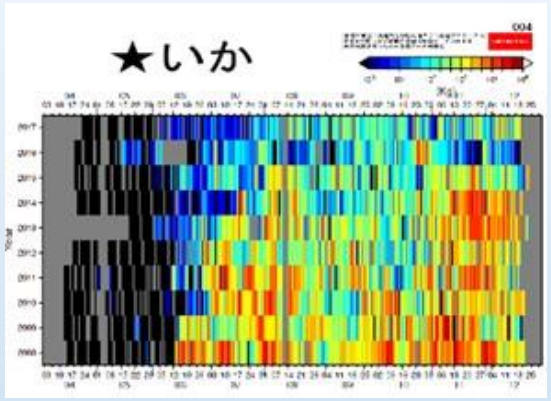
Development of prediction model

- 10 years catch data
- 10 years satellite and numerical data

- Machine Learning method (Decision Tree)

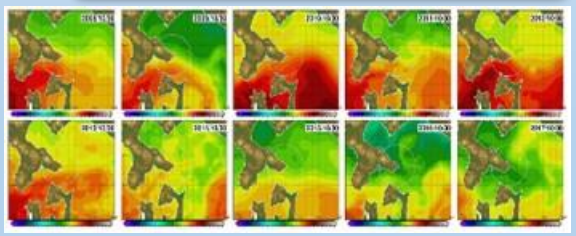
- Target species: Yellow tail, Tune, Salmon and Squid

Development of prediction model



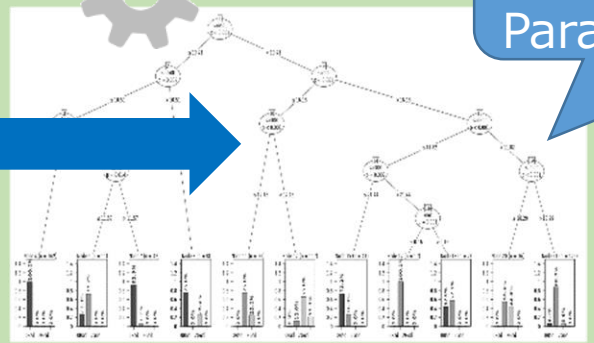
Ten years
Catch Data

1 Prepare Data Set



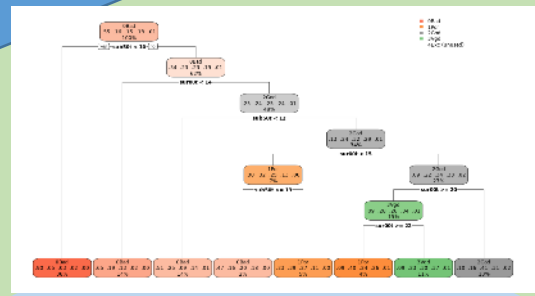
Ten years
Marine Environment Data

Learning Model

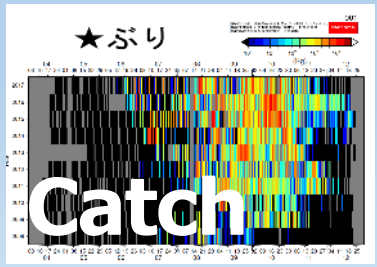


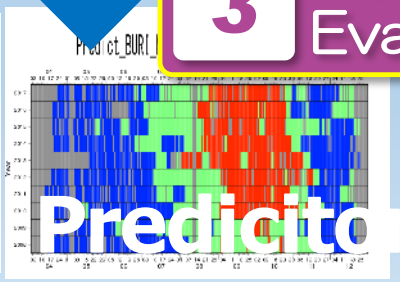
2 Model Development

Good Catch
Marine Environmental Parameters



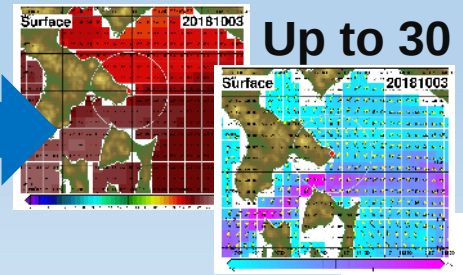
3 Model Evaluation





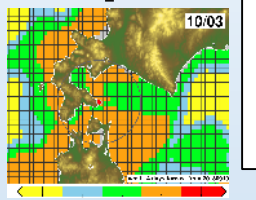
4 Prediction

Use numerical data
Up to 30 days



5 Visualization

Map



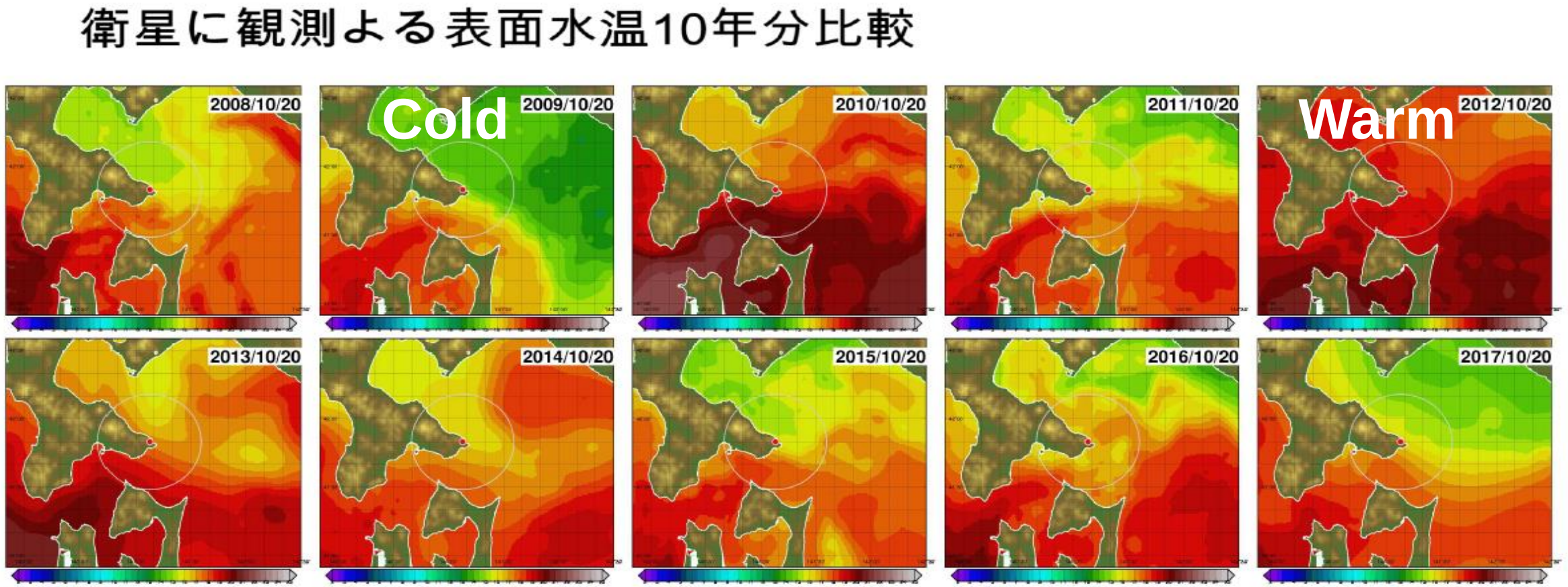
Calendor

Index

	呼称	水揚可能性
	記録的	１０トン以上
	大漁	１トン以上
	中漁	１００kg以上
	小漁	１００kg以下
	不漁	ありません

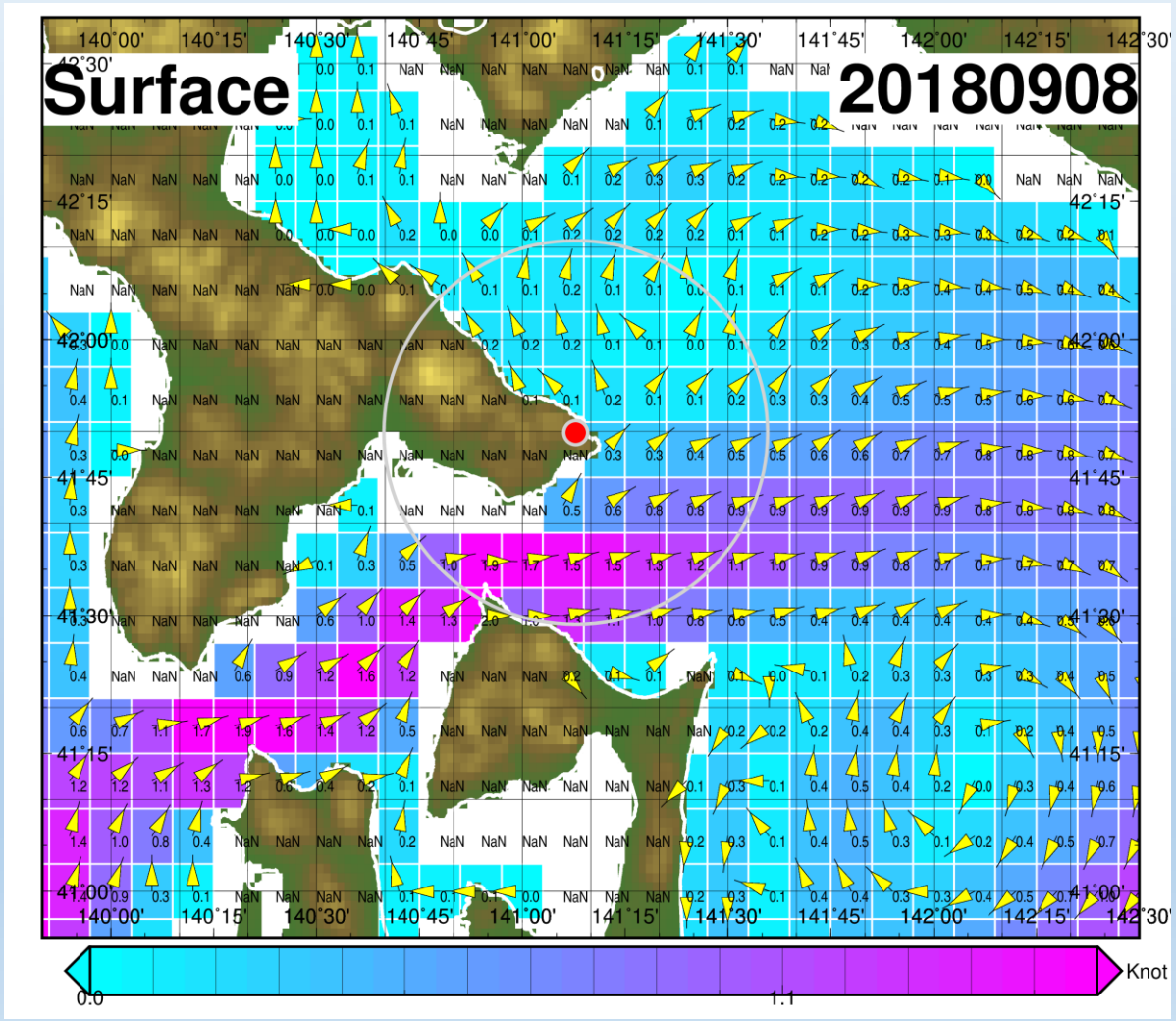
Satellite Data

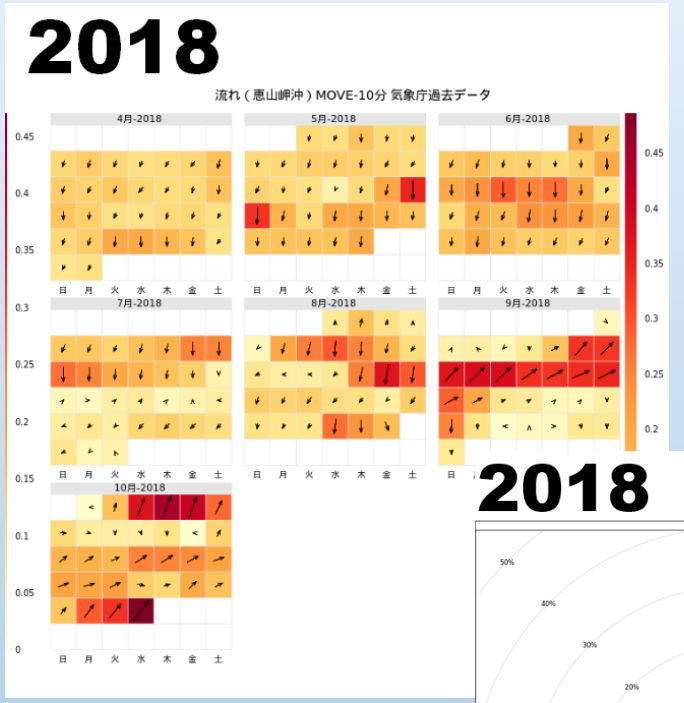
SST level4 Map （October 20, 2008-2017)

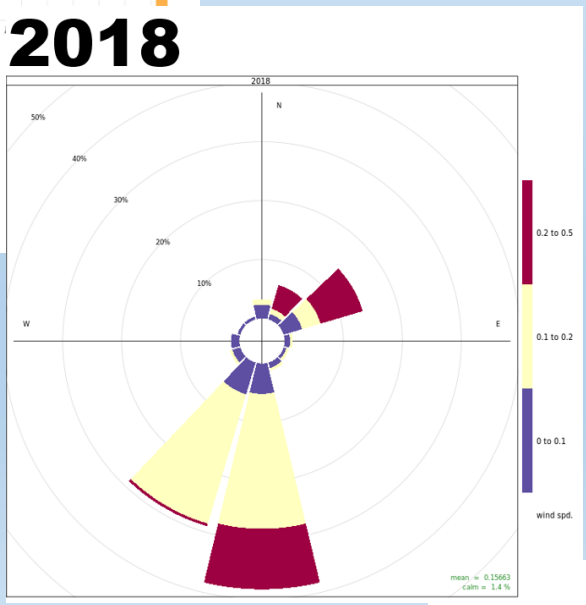


Numerical Re-analysis Data (10 Km)

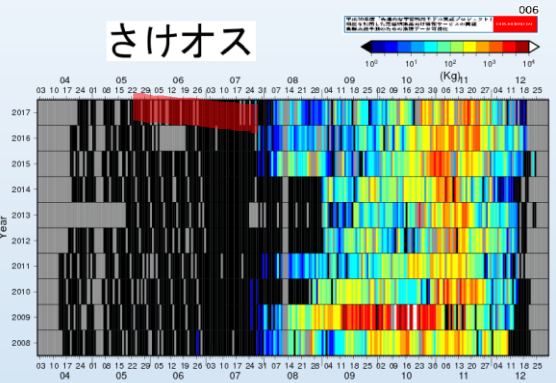
(Temp., Salinity, Velocity : 2008-2017)

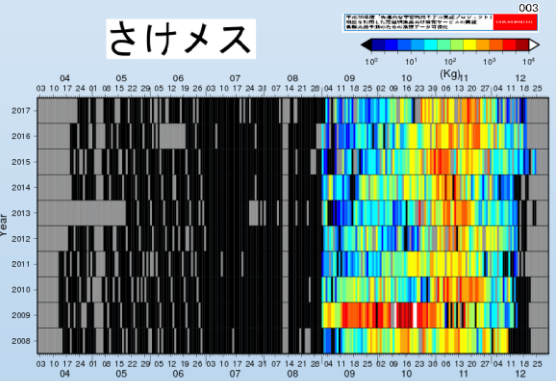


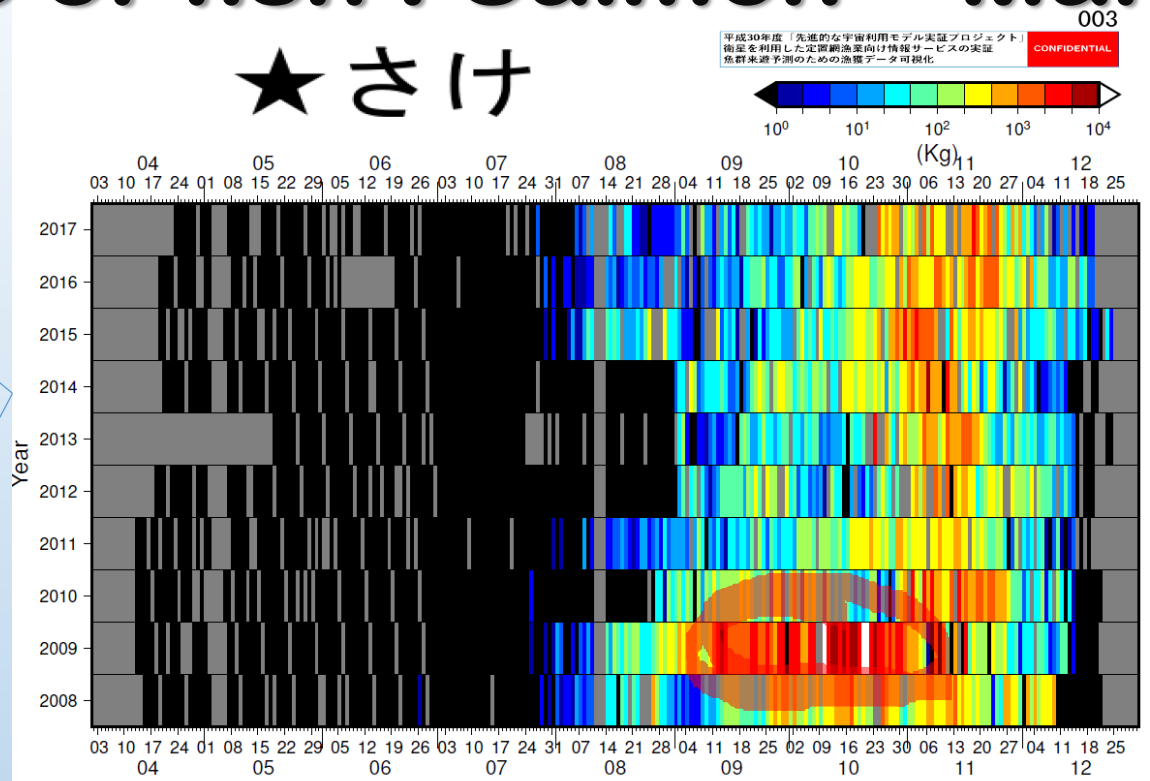


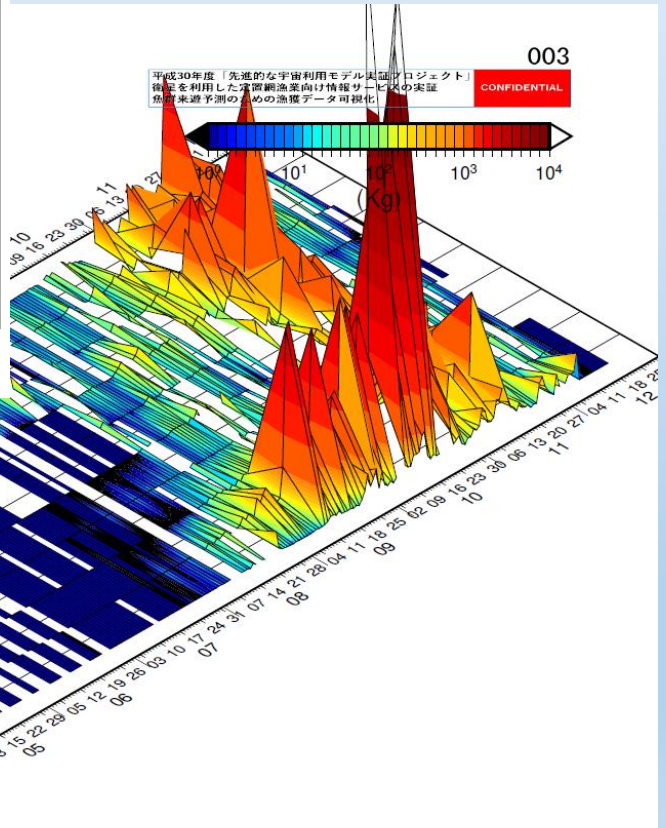


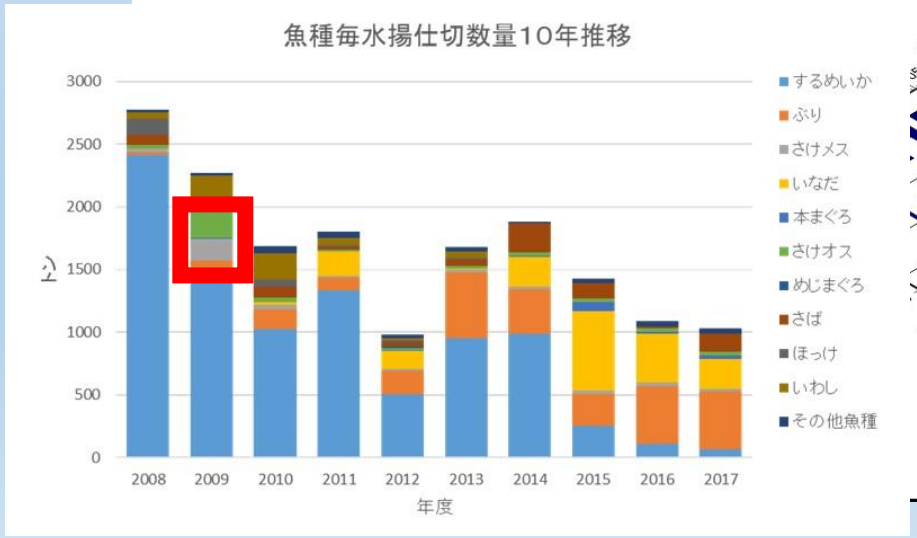
Unify the type of fish : Salmon = Male + Female





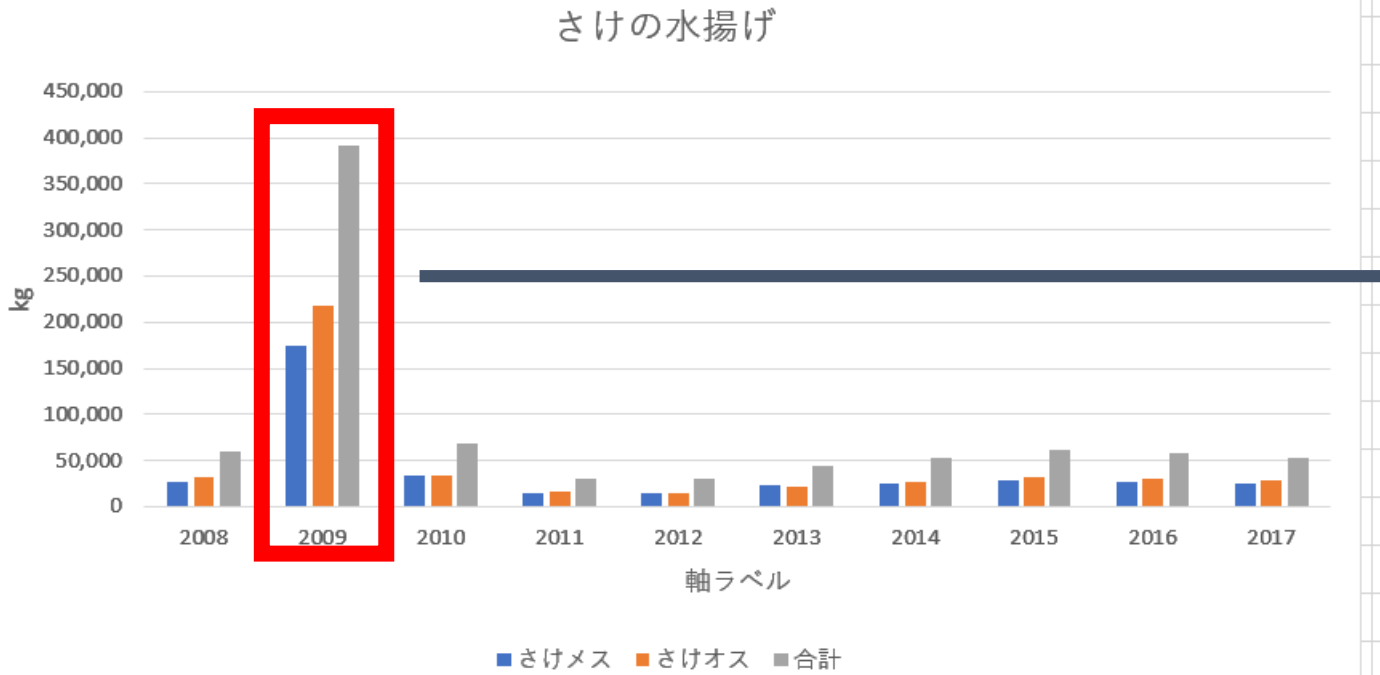






Remove abnormal years from learning data (Salmon)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
さけメス	27,238	174,049	33,878	14,340	14,737	23,121	25,578	28,703	26,904	24,769
さけオス	32,508	218,365	33,673	16,298	15,236	21,651	27,252	32,556	30,265	27,996
合計	59,746	392,414	67,551	30,637	29,973	44,772	52,830	61,259	57,169	52,765



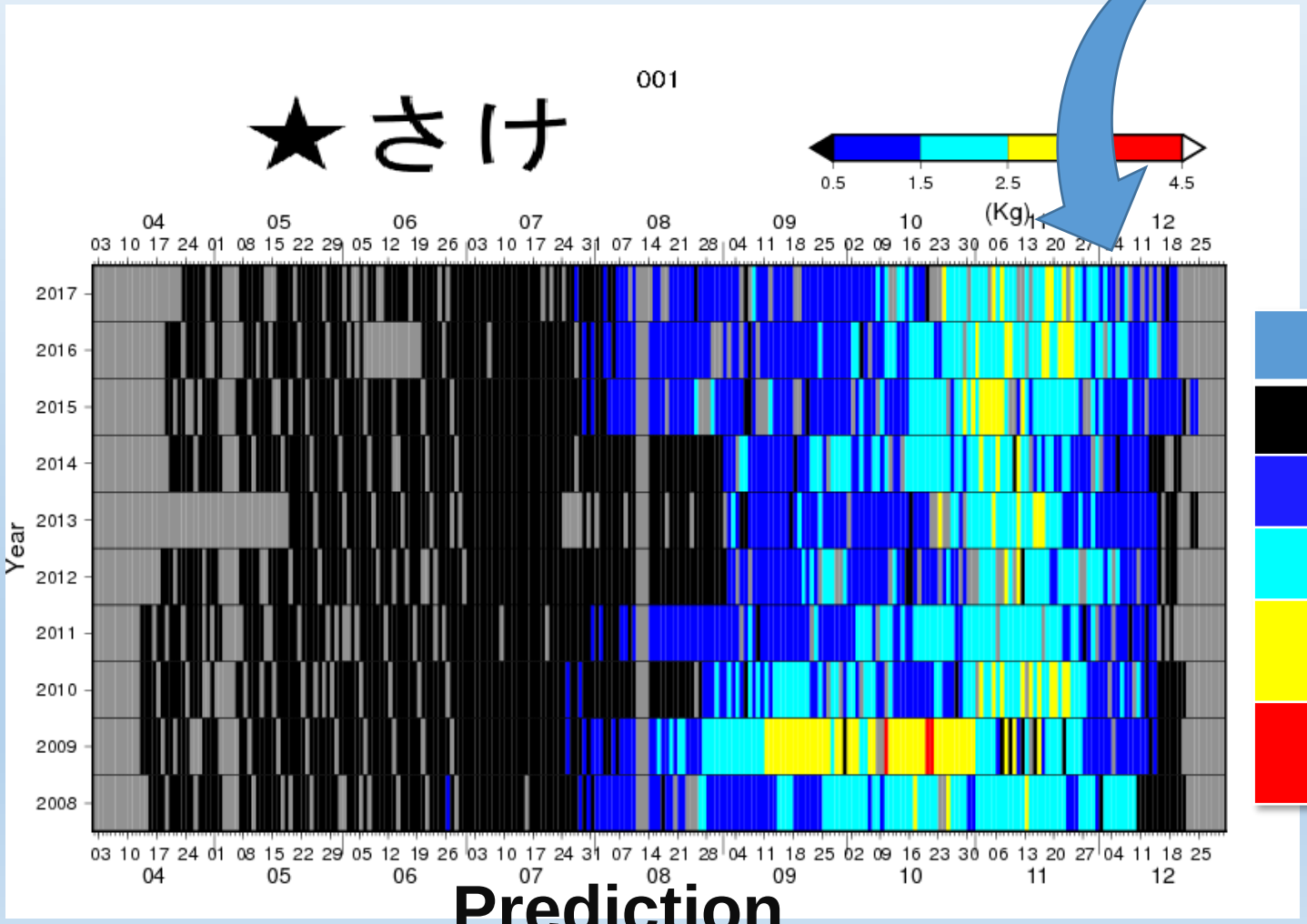
Yearly total catch was about 50 ton

Big Catch in 2009 (unusual year)

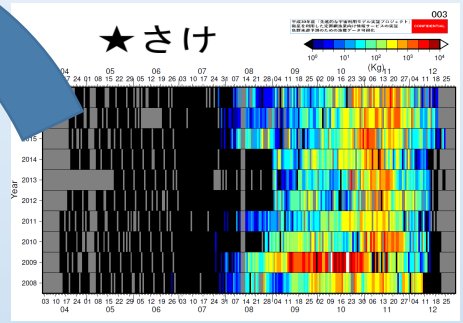
Make subjective class expression (Salmon)

Class	Amount of catch	Categorization
#0	0	No catch
#1	0 ＜Catch＜100kg	A little catch
#2	100kg ≦Catch＜ 1,000kg	Can be a business
#3	1,000kg≦ Catch 10,000kg	Good catch
#4	Over 10 ton	Big catch

Make subjective class expression (Salmon)



Prediction

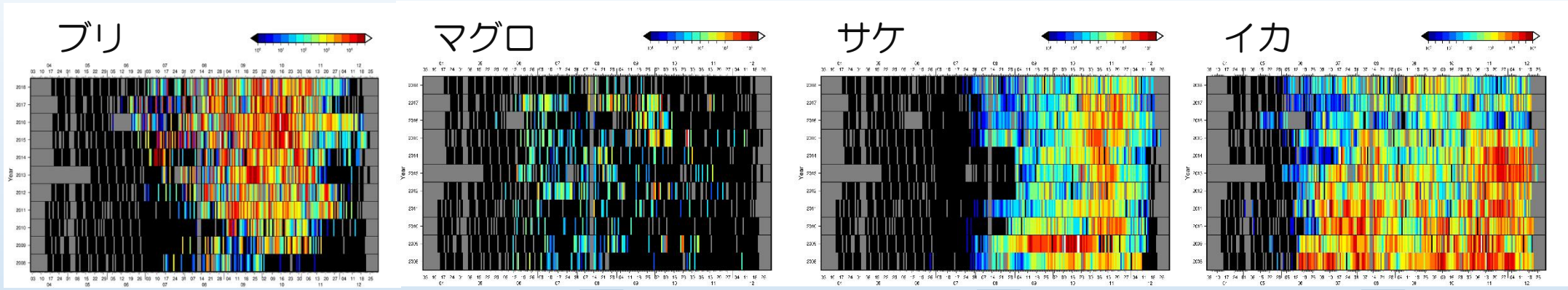


Catch

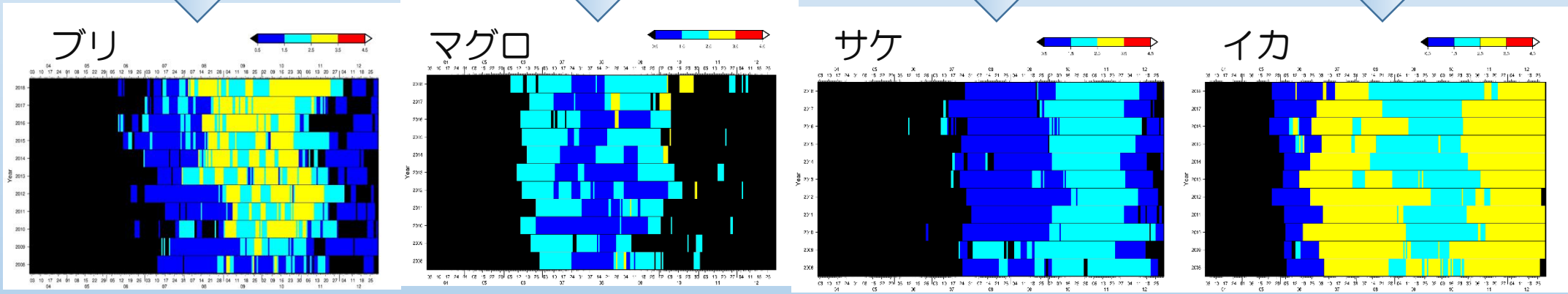
	N値	数量（★さけの場合）	肌感覚･感情
	#0	0	いない
	#1	0　＜水揚量＜100kg	ちょろちょろ
	#2	100kg ≦水揚量＜1,000kg	商売になる
	#3	1,000kg　≦ 水揚量 10,000kg	豊漁
	#4	10トン以上 （ちなみに4回だけ）	大漁

Evaluation Results

Catch



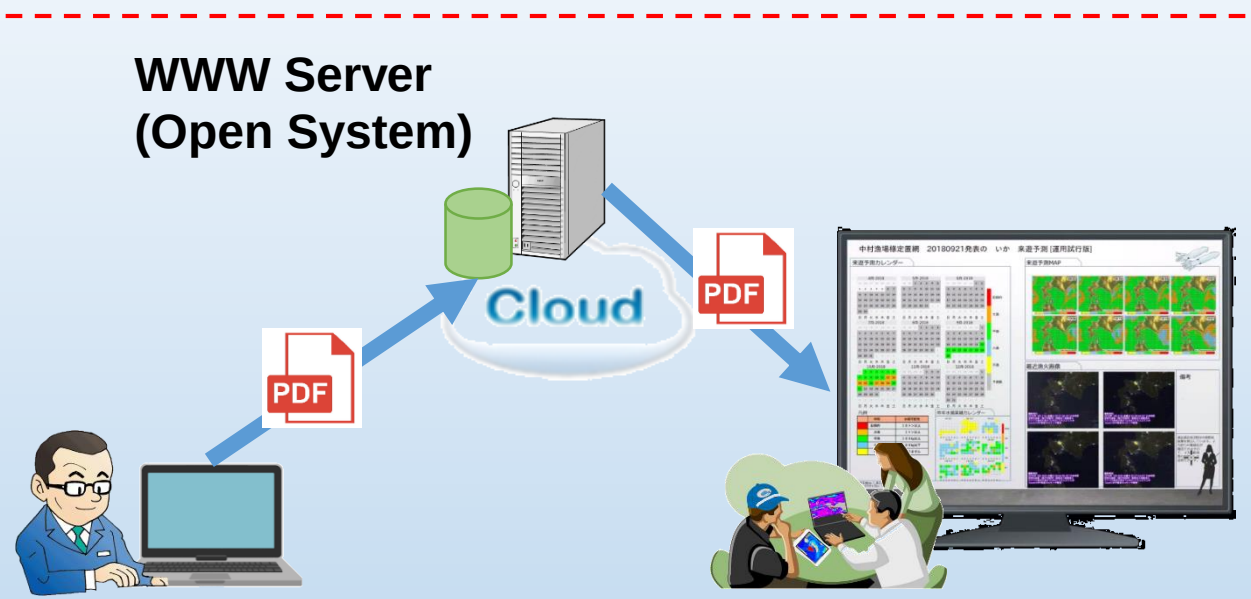
Prediction



Yellow tail	Bulefin tuna	Salmon	Squid
60%	60%	90%	60%

Experimental activities

Experimental activities



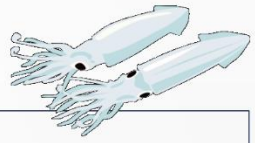
Overview of service system

Display in the TV monitor

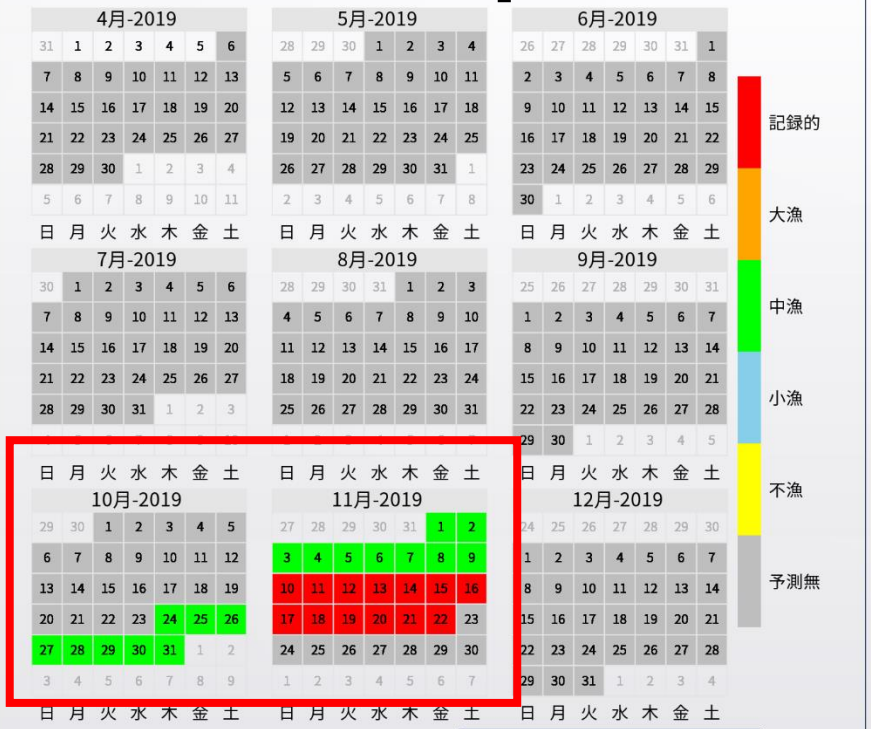
- Based on the Japan Meteorological Agency's sea temperature and current data released every day at around 22:30, a **prediction calendar and map up to 30 days ahead** is being created.
- **Signage** can be used to easily access the predicted information using fisherman's workshop (Banya) **TV monitor**.

中村漁場様定置網　20191023発表　いか（するめいか）来遊予測

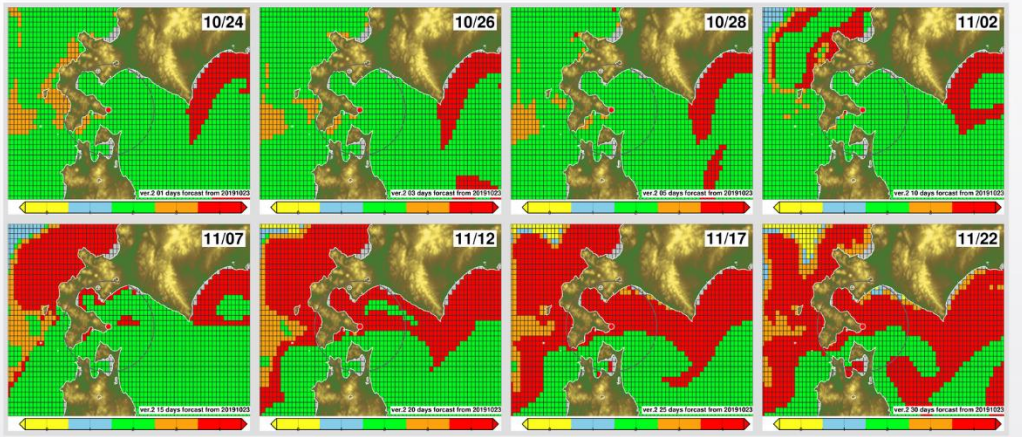
Squid Oct. 23, 2019



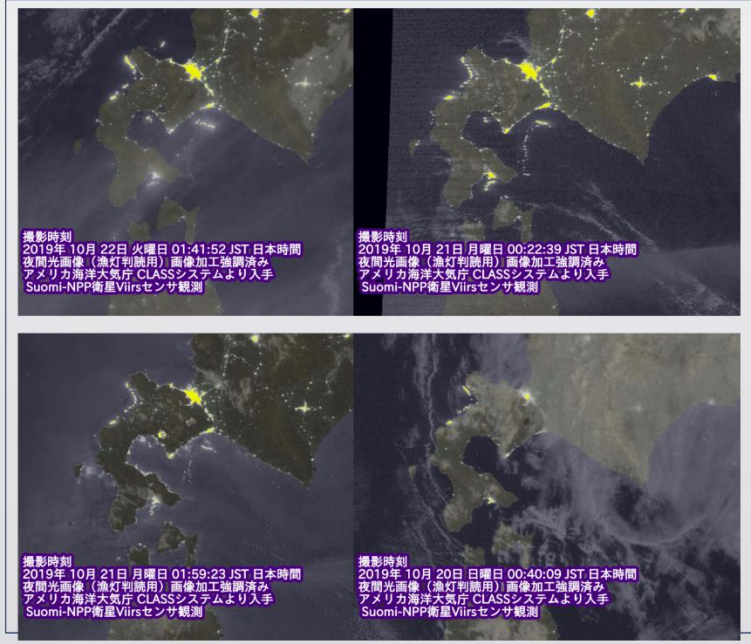
来遊予測カレンダー



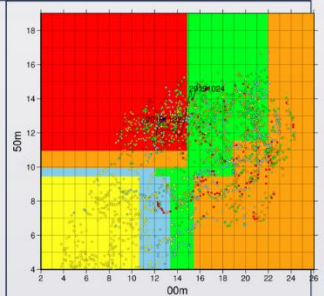
来遊予測MAP



最近漁火画像



予測根拠の可視化

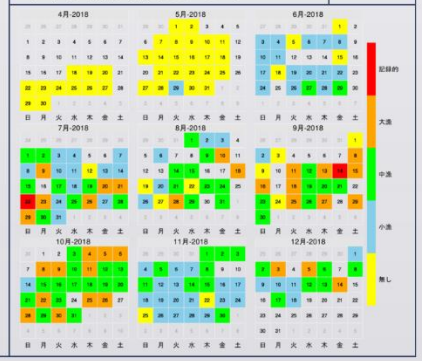


過去直近4枚の夜間光画像を掲示しています。イカ釣りの集魚灯が確認できますので、イカ魚群来遊の目安として活用できます。

凡例

	呼称	水揚可能性
	記録的	１０トン以上
	大漁	１トン以上
	中漁	１００kg以上
	小漁	１００kg以下
	不漁	ありません

昨年水揚実績カレンダー



いか来遊予測Var.2(2019版), 表示Ver.4(20190801),
発行日時（JST)2019年 10月 24日 木曜日 00:37:23 JST

Night light Images

Mid-term meeting

Effect of information service

- Lost prevention and **maximization** of the profit of fish catch and chance
- Contribution to voluntary action of the **resource conservation**
- Improvement of the **labor productivity**
  - Decision on fishing gear choice, frequency of renewal, installation and withdrawal time
  - Contribution to the way of working reform by the busy prediction
  - Labor-saving of maintenance of facilities

・・・etc.

Future aspects

- In the case of feeding migration fish (Bluefin tuna and Yellow tail), if we add habitat information on forage fish (Sardine and Mackerel), the **prediction match rate will be improved**.
- The spatial resolution of numerical model will be **improved from 10km to 2km** in next year 2020, then apply to this service.
- **Horizontal deployment** is possible not only in Hokkaido but also in areas that operate set net throughout Japan.

Summary

- We challenge to have **co-working** and **co-designing** with a set net fisheries company to **develop of information service** for set net fishereies in southern Hokkaido coast, along Cape Esan.
- The novel **machine learning** method was employed for **developing of prediction model** using satellite and numerical data.

Thank you for your attention !