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Prediction of Japanese common squid (*Todarodes pacificus*) fishing grounds using Generalized additive models in the Japan Sea

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### Introduction

Japanese common squid (*Todarodes pacificus*) Spawner Northward migration Northward migration Spawning ground

Investigating squid fishing grounds from 1960's (Uda, 1960; Tameishi, 2003; Kiyofuji and Saitoh, 2004) Suggesting qualitatively the environmental factor in fistribution of fishing grounds.

Multivariate model-Building such as \*GAM and \*\*GLM are now used within the fisheries context (Swartzan *et al.*,1992; Dickey & Nash,2000; Agenbag et al.,2003; Howell and Kobayashi, 2006)

> \*GAM: Generalized Additive Model \*\*GLM: Generalized Linear Model

It is very important to clarify the <u>mechanism</u> of distribution of squid fishing grounds



Autumn

Winter

spawner

### **Objectives**

- To clarify the relationship between squid fishing grounds and their oceanographic conditions in the Japan Sea
- To predict potential fishing grounds using satellite remote sensing

### **Data and Methods**

Satellite data

#### Japan Sea , 1997 - 2000



#### **Biomass data**

CPUE

CPUE data of squid jigging fishery collected by the National Research Institute of Fisheries Sciences (1997 ~ 2000)

**CPUE = Number of Catch / (Number of jigging machine x time)** 

#### **Data and Methods**

Japan Sea , 1997 - 2000



#### Seasonal change of squid fishing grounds (1997-2000, April - November)



#### Prediction of fishing grounds using the GAM with **CPUE and remote sensing data**

In(CPUE+1)=s(SST)+s(CHL)+s(SSHA)+s(Geostrophic Current)

**CPUE** 

80 100 120 140 160

CPUE

5

6

4

7

8



# Prediction of fishing grounds using the GAM with CPUE and remote sensing data Apr. – Jul.

![](_page_7_Figure_1.jpeg)

# Prediction of fishing grounds using the GAM with CPUE and remote sensing data Aug. - Nov.

![](_page_8_Figure_1.jpeg)

# Prediction of fishing grounds using the GAM with CPUE and remote sensing data

![](_page_9_Figure_1.jpeg)

# Prediction of fishing grounds using the GAM with CPUE and remote sensing data

![](_page_10_Figure_1.jpeg)

1999 Predicted < Observed 2000 Predicted = Observed

# Prediction of fishing grounds using the GAM with remote sensing data (Oct. 14<sup>th</sup> 2002)

![](_page_11_Figure_1.jpeg)

### Conclusion

Relationship between squid fishing grounds and environmental variables

\_\_\_\_ SST >> SSHA > GC >> CHL

Strong effect depend on ecological significance (Physiology, migration, ...)

Prediction of fishing grounds using the GAM analysis

- Enable to detect fishing grounds using GAM with four environmental parameter from satellite remote sensing data.
- The prediction of fishing ground will enable to be applied to navigation, improving the model more accurately. – Future work

Thank you!

### Introduction

#### Japanese common squid (Todarodes pacificus)

- Most popular of squids
- Annual catches have fluctuated widely
- Target species in TAC (Total allowable catch) system in 1998

![](_page_14_Figure_5.jpeg)

# Seasonal change of squid fishing positions (1997-2000, April - November)

![](_page_15_Figure_1.jpeg)

![](_page_15_Figure_2.jpeg)

# Prediction of fishing grounds using the GAM with CPUE and remote sensing data

![](_page_16_Figure_1.jpeg)