Distributions of squid fishing grounds and their relationship to sea surface temperature and chlorophyll-a concentration in the Japan/East Sea

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Introduction

Japanese common squid (*Todarodes pacificus*)

- Migrates seasonally around Japan.
- 2 spawning groups maintain the stocks in the Japan Sea.
Introduction

- Japanese common squid (*Todarodes pacificus*)
  - One of the most popular squids
  - Annual catches have fluctuated largely

Sustainable fishing activity are required.

Target species in the **Total Allowable Catch (TAC)** system in 1998

It is important to manage fishing area to suit its environmental variability
Objective

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

**Step 1**
Identify squid fishing grounds by DMSP/OLS nighttime image.

**Step 2**
Extract the values of SST (NOAA/AVHRR), chl-a (Orbview-2/SeaWiFS), and at fishing grounds determined by **Step 1** (DMSP/OLS).

**Step 3**
Investigate the good parameters to estimate the potential fishing grounds.
Data and Methods

Orbview-2/SeaWiFS

NOAA/AVHRR

DMSP/OLS
Seasonal change (6 months) of squid fishing grounds

Monthly composite images

Fishing grounds were distributed in limited area (white color)
Seasonal change (6 months) of squid fishing grounds

\[ F(\%) = \left( \sum \frac{n}{\text{pixs}} \right) \times \frac{1}{N} \times 100 \]

N: days [30 or 31]
n: number of light pixels (=fishing grounds)
pixs: pixel number in a box

Warm color (High frequency) = many and continuous fishing area

High frequency area moved seasonally

May
Jun
Jul
Aug
Sep
Oct
Seasonal change (6 months) of squid fishing grounds

Northward migration for feeding
- Tsushima Strait
- East coast of Korea
- Yamato rise
- Along coast of Japan

Southward migration for spawning
- Tsushima Strait
- East coast of Korea
- Yamato rise
- Offshore of Hokkaido
Classification of fishing areas
Image classification and separability analysis by Kiyofuji and Saitoh (2004)
Classification of fishing areas

Image classification and separability analysis by Kiyofuji and Saitoh (2004)
Classification of fishing areas

Image classification and separability analysis by Kiyofuji and Saitoh (2004)
SST, Chl-a range at fishing grounds

**May**

**Jun.**

**Jul.**

Chl-a (mg·m⁻³)

SST (°C)

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May

Jun

Jul

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Maps showing Chl-a distribution across different months.
SST, Chl-a range at fishing grounds

Northern migration area
• Along coast of Japan
• Around Yamato rise

Narrow SST range
Low chl-a concentration
SST, Chl-a range at fishing grounds


Chl-a (mg·m⁻³)

SST (°C)

Aug  |  Sep  |  Oct

52°N  |  50°N  |  48°N

128°E  |  132°E  |  136°E  |  140°E
SST, Chl-a range at fishing grounds

Spawning and southward migration area
- Tsushima Strait
- East coast of Korea

High chl-a area is good condition for fishing grounds
Monthly variability of SST and High frequency fishing grounds in northern migration region

Fishing frequency

SST

High frequency fishing grounds changed northward as with SST seasonal change.

Fishing frequency in a BOX
Monthly variability of SST and High frequency fishing grounds in northern migration region

High frequency fishing grounds changed northward as with SST seasonal change.
Monthly variability of SST and High frequency fishing grounds in northern migration region

High frequency fishing grounds changed northward as with SST seasonal change.
Summary

- Fishing grounds in northward migration season distributed along coast of Japan tended to change the distribution by optimum SST range (16~20°C).

- Fishing grounds in southward migration season seem to be distributed on high chl-a concentration area.
Summary

- Fishing grounds in northward migration season distributed along coast of Japan tended to change the distribution by optimum SST range (16~20°C).

- Fishing grounds in southward migration season seem to be distributed on high chl-a concentration area.
Thank You for your attention