Spatial and temporal dynamics of Albacore tuna \textit{(Thunnus alalunga)} and Blue shark \textit{(Prionace glauca)} in the Kuroshio Extension Area

Hidetada KIYOFUJI
(JIMAR, University of Hawaii at Manoa)
Evan Howell and Jeffrey Polovina
(NOAA NMFS/PIFSC)
Katsuya Saitoh
(Japan Fisheries Information Center)
Sei-Ichi Saitoh
(Graduate School of Fisheries Sciences, Hokkaido Univ.)
Background

![Graph showing catch data over time]

- **Japanese catch in the Pacific**
- **Catch by Japanese longline**

**FAO data**

- **Albacore**
- **Blue shark**

**YEAR**

- 1950
- 1960
- 1970
- 1980
- 1990
- 2000
- 2010

**Catch (tonnes)**

- $1.2 \times 10^5$
- $1.0 \times 10^5$
- $8.0 \times 10^4$
- $6.0 \times 10^4$
- $4.0 \times 10^4$
- $2.0 \times 10^4$
### Previous studies

#### Albacore
- Otsu and Ushida (1963)
- Laurs et al. (1984)
- Laurs and Lynn (1991)
- Kimura et al. (1997)
- Polovina et al. (2001)
- Zainuddin et al. (2004, 2006)
- Uosaki (2006)

#### Blue Shark
- Nakano (1994)
- McKinnell and Seki (1998)
- Bigelow et al. (1999)
- Walsh and Kleiber (2001)
- Nakano and Seki (2003)

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**Spatiotemporal distributions of 2 species in the North Pacific in relation to oceanographic conditions**

- Seasonal distribution in relation to oceanic conditions
- Oceanographic conditions
Seasonal Distribution and Migration

Spring – early summer (Spawning ground)

July – Sep.

June – July

Oct. – Mar.

Shatsky Rise

Albacore migration (modified from Otsu and Uchida, 1963)

Blue shark spawning ground (modified from Nakano, 1994)

Blue shark movement (modified from Nakano, 1994)
Objectives

To investigate:

1. spatial and temporal distributions of Albacore and Blue shark

2. relationships between oceanic conditions and Albacore, Blue shark catch
   - Chl-a, SST, Geostrophic velocity
   - 18°C Degree and 0.2 mg/m³ TZCF
   - Kuroshio Extension Axis

...using Japanese longline fishery data and Satellite remote sensing data
DATA – Catch Data –

- Japanese longline Catch data (obtained from JAFIC)

CPUE = Catch numbers / boat-days
Spatial Scale = 0.25 x 0.25 degree
Seasonal variations of CPUE

Albacore – high in fall and winter

Blue Shark – high in summer
Climatological Albacore distribution

(a) Climatological winter

(b) Climatological spring
Mar. Apr. May

(c) Climatological summer

(d) Climatological fall

18°C SST
0.2mg/m³ Chla
Climatological Blue shark distribution

(a) Climatological winter

(b) Climatological spring
Mar. Apr. May

(c) Climatological summer

(d) Climatological fall

18°C SST
0.2mg/m³ Chla
Longitudinal and Latitudinal Distribution

Albacore & Blue shark


Blue shark

Mar. Apr. May

Blue shark


Blue shark


Albacore & Blue shark
Objectives

To investigate...

1. spatial and temporal distributions of Albacore and Blue shark

2. relationships between oceanic conditions and Albacore and Blue shark distributions
   - Chl-a, SST, Velocity
   - 18°C Degree and 0.2 mg/m³ TZCF
   - Kuroshio Extension Axis
Environmental Characteristics

Albacore & Blue shark
- Chl-a (mg/m^3): 0.2 – 0.3
- SST (°C): 18 – 20
- Geostrophic Velocity (cm/s): 12 – 26

Blue shark
- Chl-a (mg/m^3): 0.2 – 0.5
- SST (°C): 17 – 20
- Geostrophic Velocity (cm/s): 10 – 30

Blue shark
- Chl-a (mg/m^3): 0.1 – 0.2
- SST (°C): 19 – 23
- Geostrophic Velocity (cm/s): 10 – 25

Albacore & Blue shark
- Chl-a (mg/m^3): 0.1 – 0.3
- SST (°C): 19 – 23
- Geostrophic Velocity (cm/s): 5 – 20
Habitats for Albacore and Blue shark

Both species – Habitat not formed in areas with velocities of more than 30 cm/s
Distances from $18 \, ^\circ \text{C}$ and $0.2 \, \text{mg/m}^3$
Distances from 18 °C and 0.2mg/m³

- Albacore & Blue shark: south of 18 °C
- Blue shark: north of 0.2mg/m³
- Blue shark: along 18 °C
- Albacore & Blue shark: along 0.2mg/m³
- Albacore & Blue shark: separate at 0.2 mg/m³
Distances from 18°C and 0.2 mg/m³

Distance from 18°C

- Climatological winter
- North
- South

Distance from 0.2 mg/m³

- North
- Albacore
- Blue shark

Locations:
- 18°C
- 0.2 mg/m³
Overlapped areas

199911

200012
Overlapped areas and CPUE

Albacore

Blue Shark

tend to be negatively correlated
Possible mechanism of aggregation

narrower overlapped area

wider overlapped area

Kuroshio extension axis

Area of Feeding opportunities

north 18C 0.2mg/m³ south

north 18C 0.2mg/m³ south
Summary

• Albacore and Blue shark
  - same habitat in fall and winter
  - different ecological significance

• overlapped areas between 18C and 0.2mg/m^2
  - narrow areas causes high catch rate