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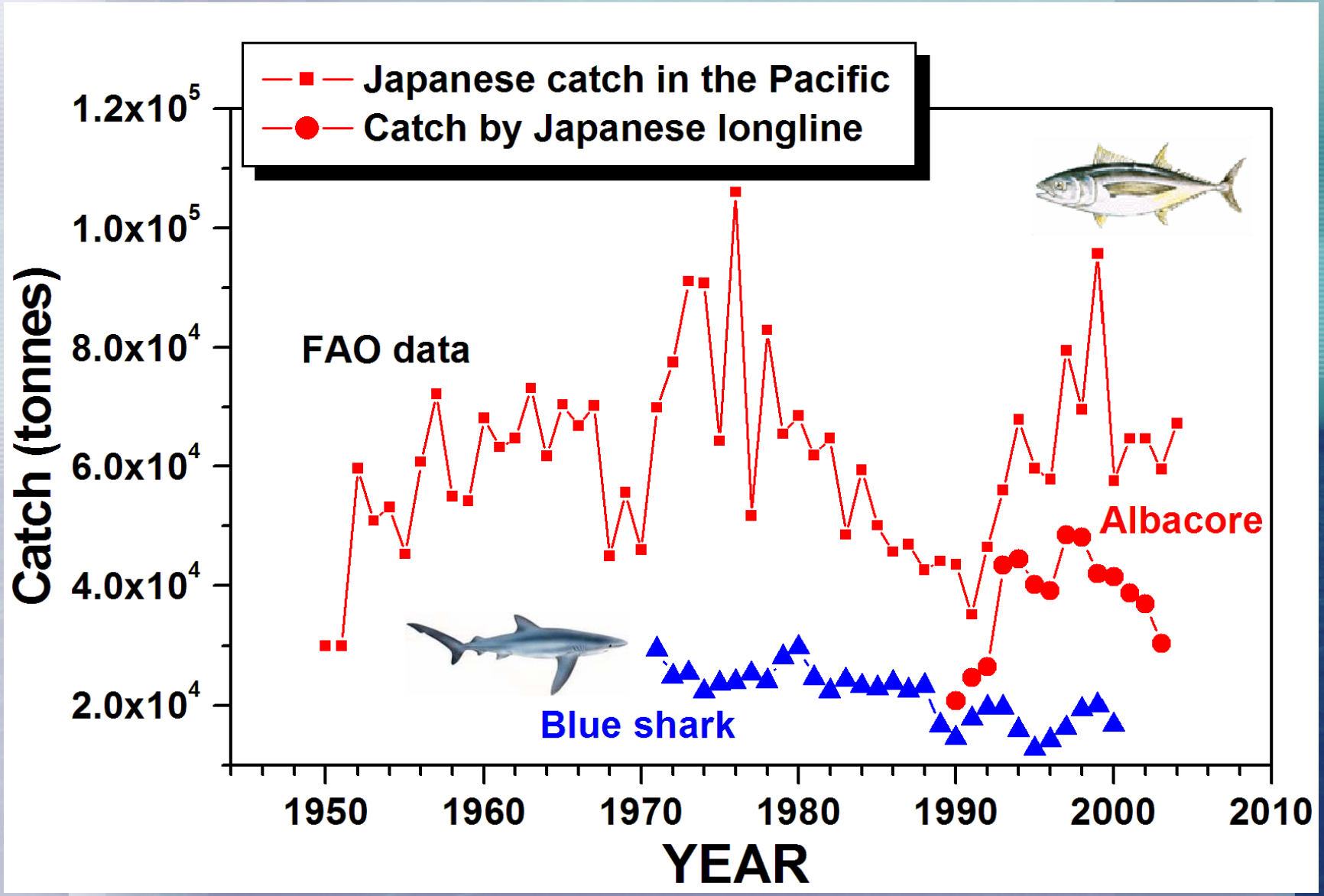
Spatial and temporal dynamics of Albacore tuna (*Thunnus alalunga*) and Blue shark (*Prionace glauca*) in the Kuroshio Extension Area

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


Japanese catch in the Pacific
Catch by Japanese longline
FAO data
Albacore
Blue shark
Catch (tonnes)
1.2x10^5
1.0x10^5
8.0x10^4
6.0x10^4
4.0x10^4
2.0x10^4
1950
1960
1970
1980
1990
2000
2010
YEAR

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)

Seasonal distribution
in relation to oceanic conditions ??

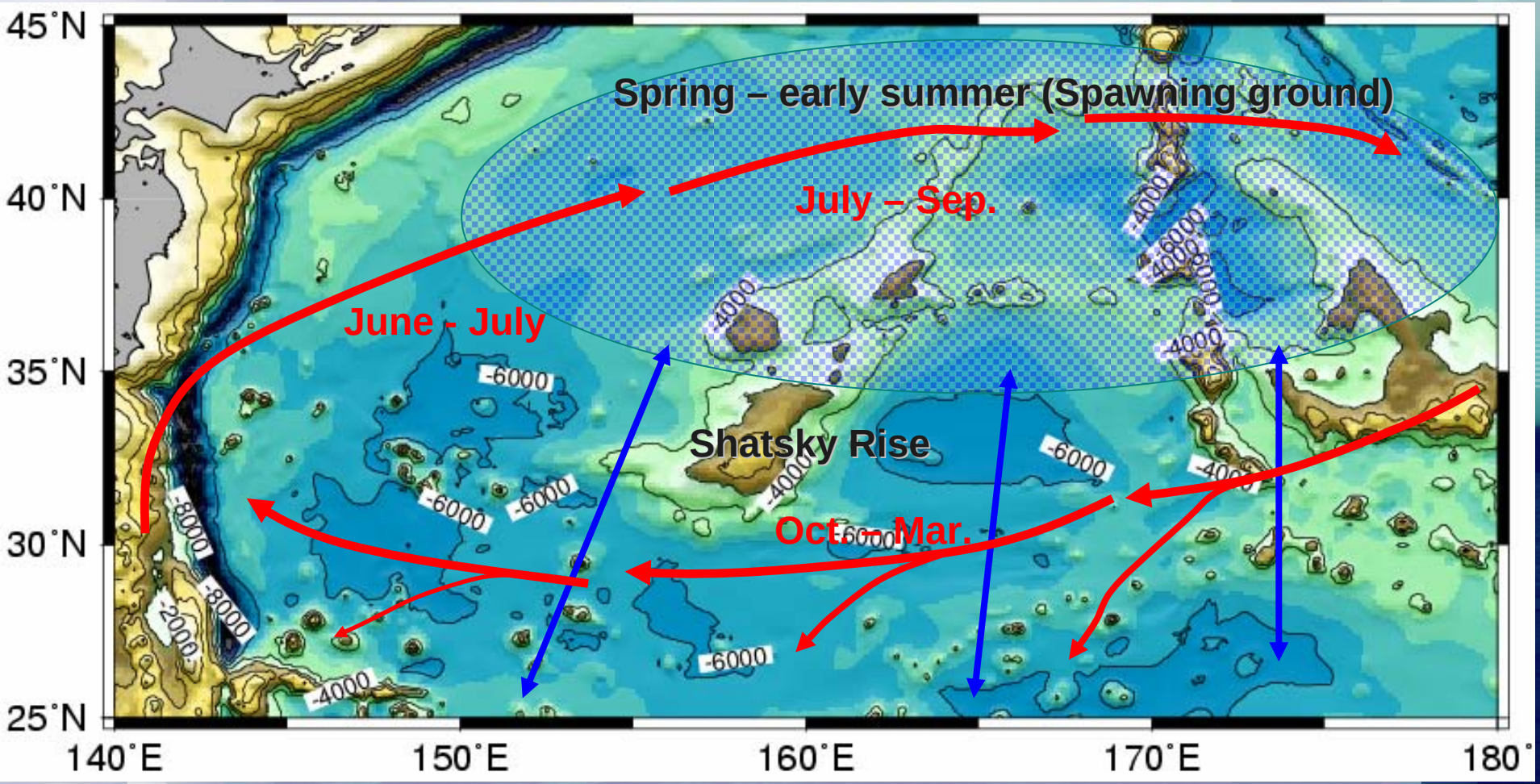
Blue Shark

Nakano (1994)
McKinnell and Seki (1998)
Bigelow *et al*. (1999)
Walsh and Kleiber (2001)
Nakano and Seki (2003)

Oceanographic conditions ??

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

Seasonal Distribution and Migration



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……

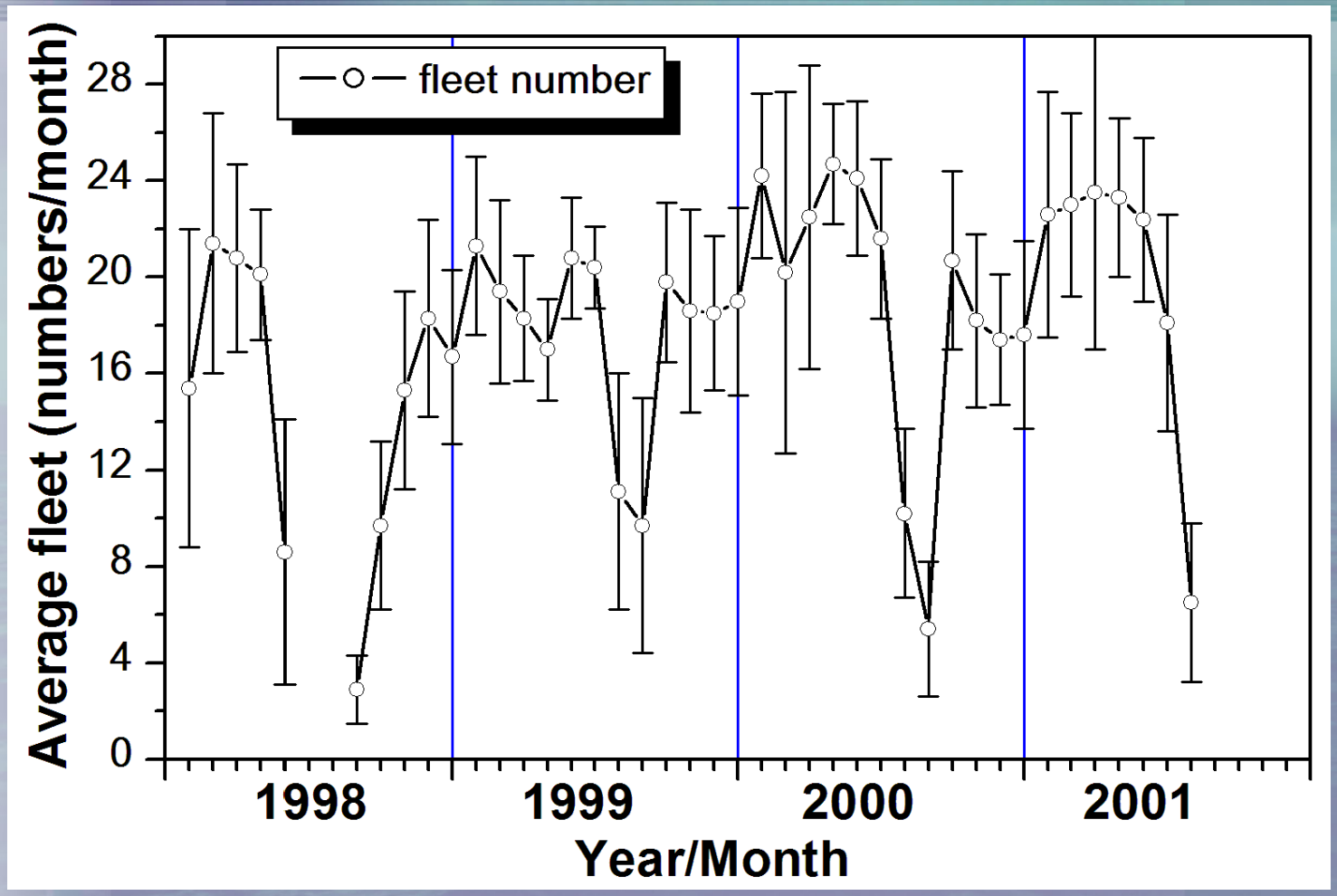
1. spatial and temporal distributions of **Albacore** and **Blue shark**

2. relationships between oceanic conditions and **Albacore**, **Blue shark** catch
   - Chl-*a*, SST, Geostrophic velocity
   - 18ºC Degree and 0.2 mg/m^3 TZCF
   - Kuroshio Extension Axis

…using Japanese longline fishery data
Satellite remote sensing data

DATA – Catch Data –

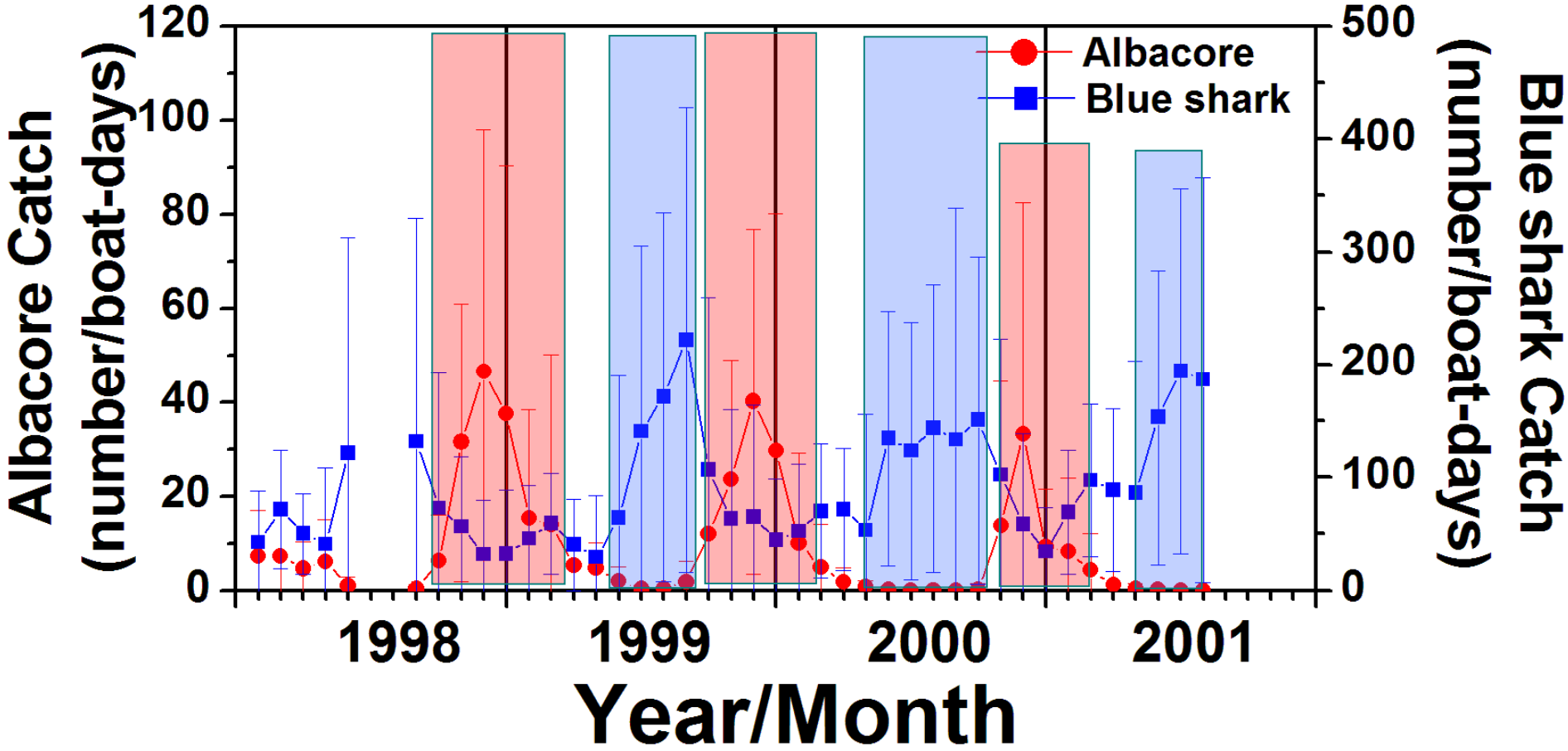
- Japanese longline Catch data (obtained from JAFIC)



CPUE = Catch numbers / boat-days

Spatial Scale = 0.25 x 0.25 degree

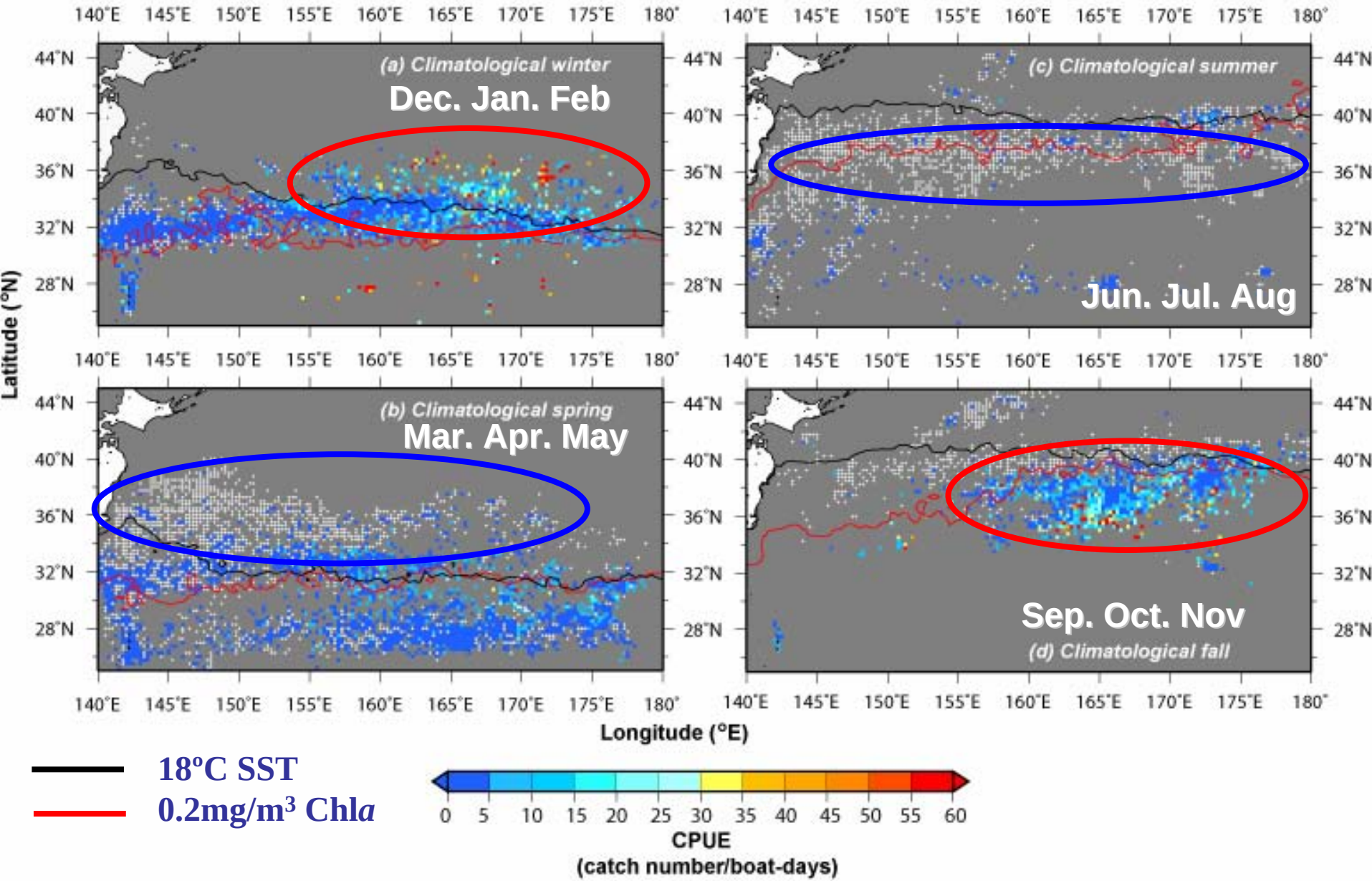
Seasonal variations of CPUE



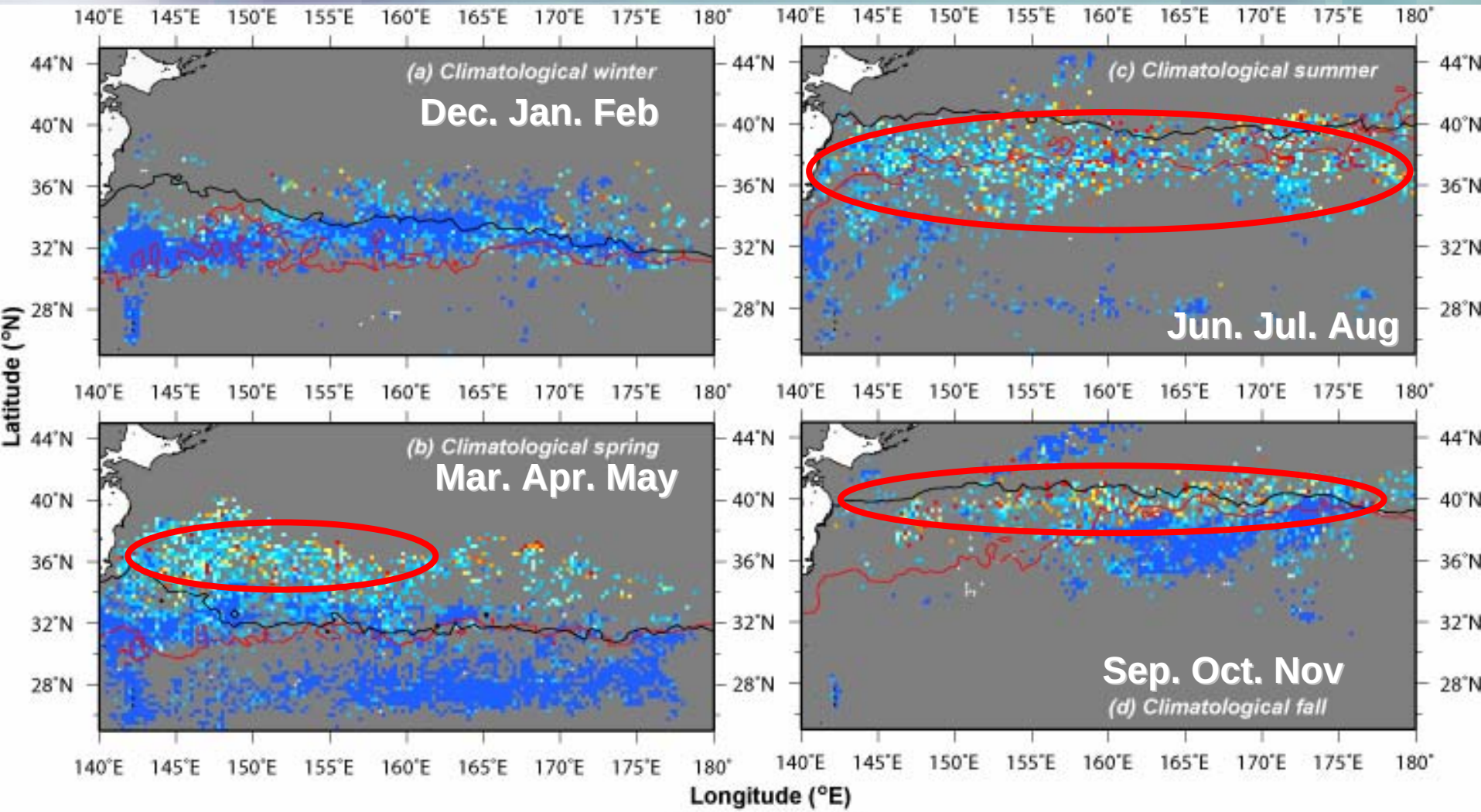
Albacore – high in fall and winter

Blue Shark – high in summer

Climatological Albacore distribution



Climatological Blue shark distribution



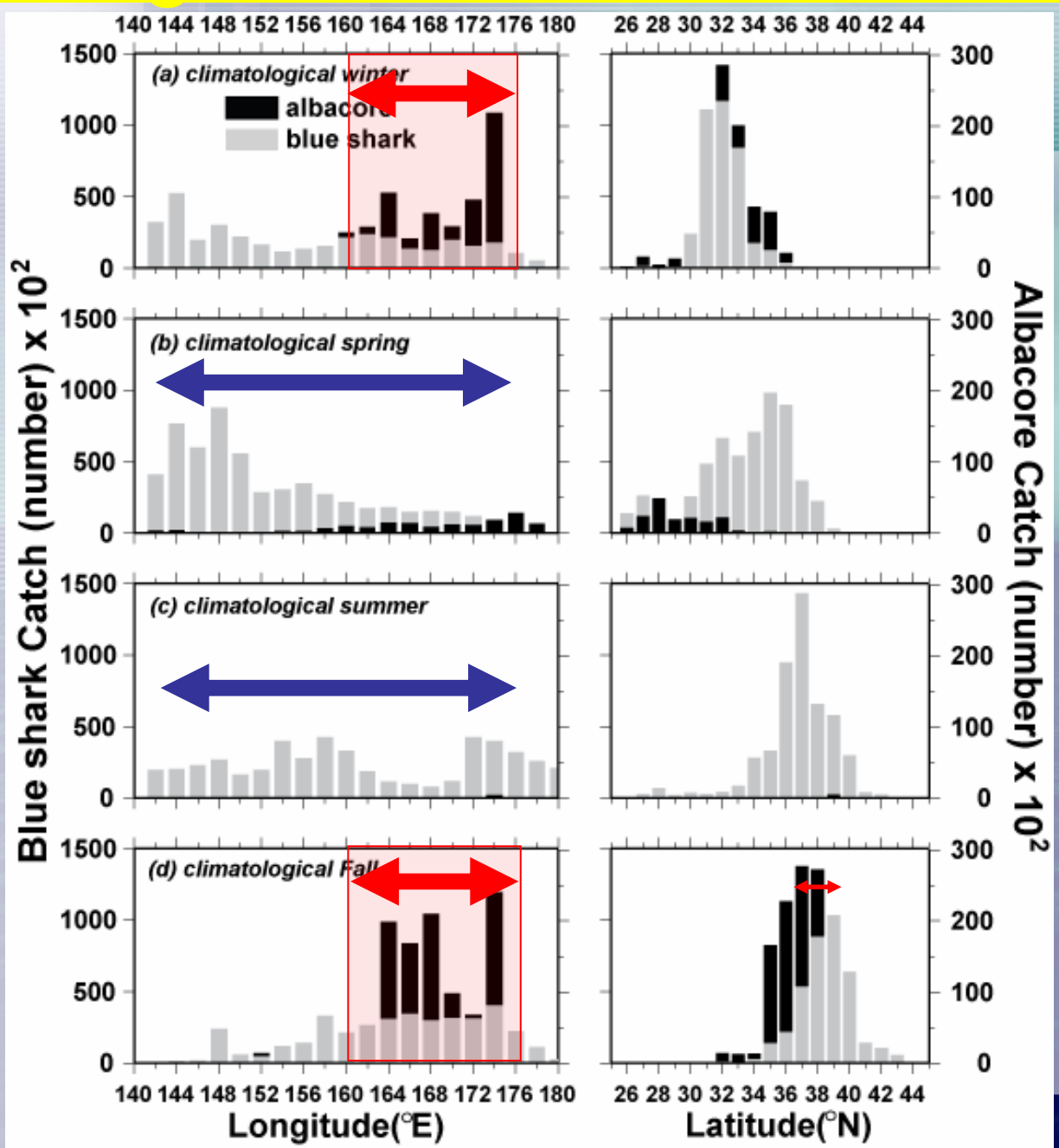
18°C SST

0.2mg/m³ Chl*a*

Blue shark CPUE
(catch number/boat-days)

0 40 80 120 160 200 240 280 320 360 400 440 480

Longitudinal and Latitudinal Distribution



Dec. Jan. Feb
Albacore & Blue shark

Mar. Apr. May
Blue shark

Jun. Jul. Aug
Blue shark

Sep. Oct. Nov
Albacore & Blue shark

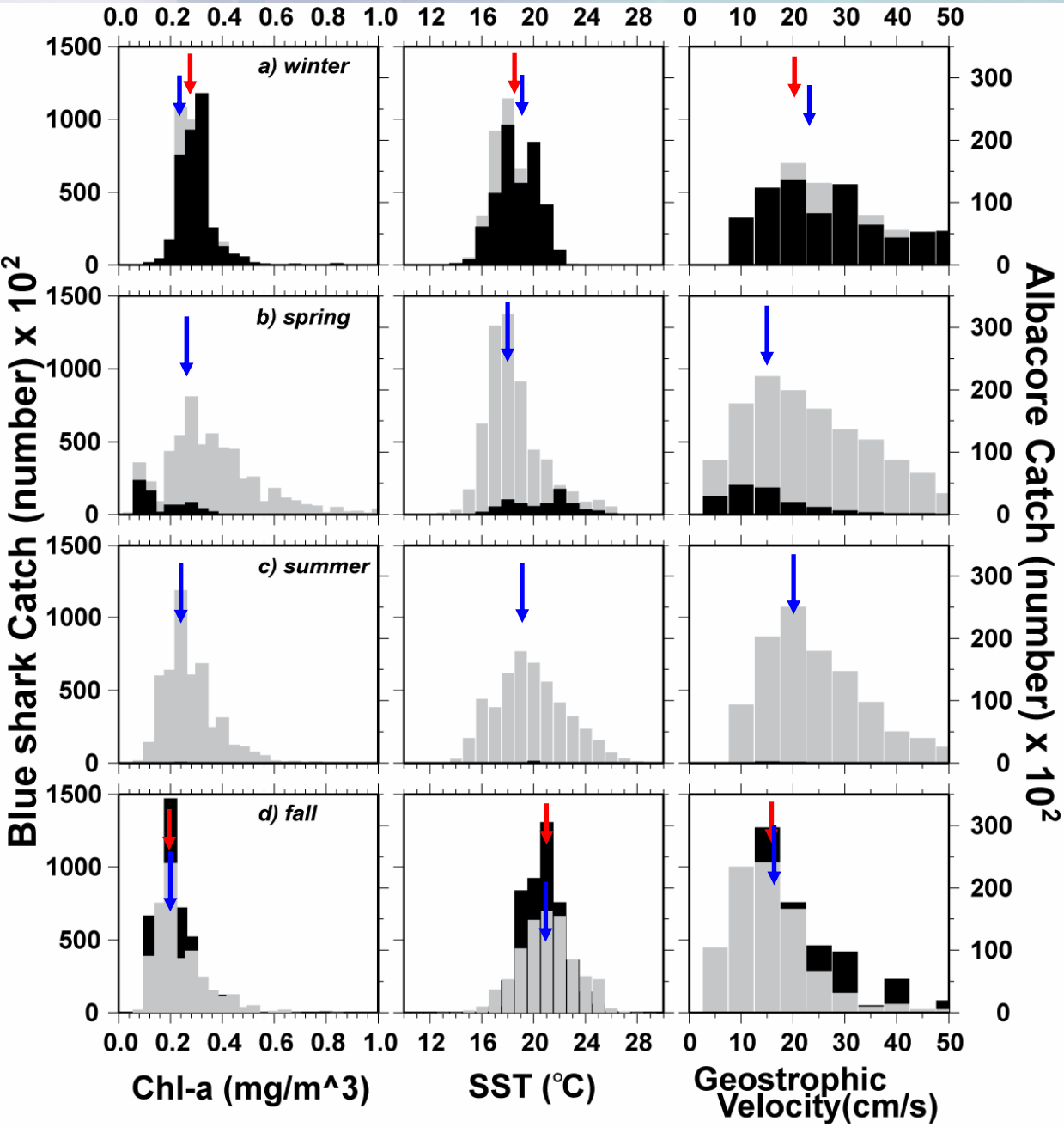
Objectives

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
   - 18ºC Degree and 0.2 mg/m^3 TZCF
   - Kuroshio Extension Axis

Environmental Characteristics



Albacore & Blue shark

- 0.2 – 0.3 mg/m^3
- 18 – 20 °C
- 12 – 28 cm/s

Blue shark

- 0.2 – 0.5 mg/m^3
- 17 – 20 °C
- 10 – 30 cm/s

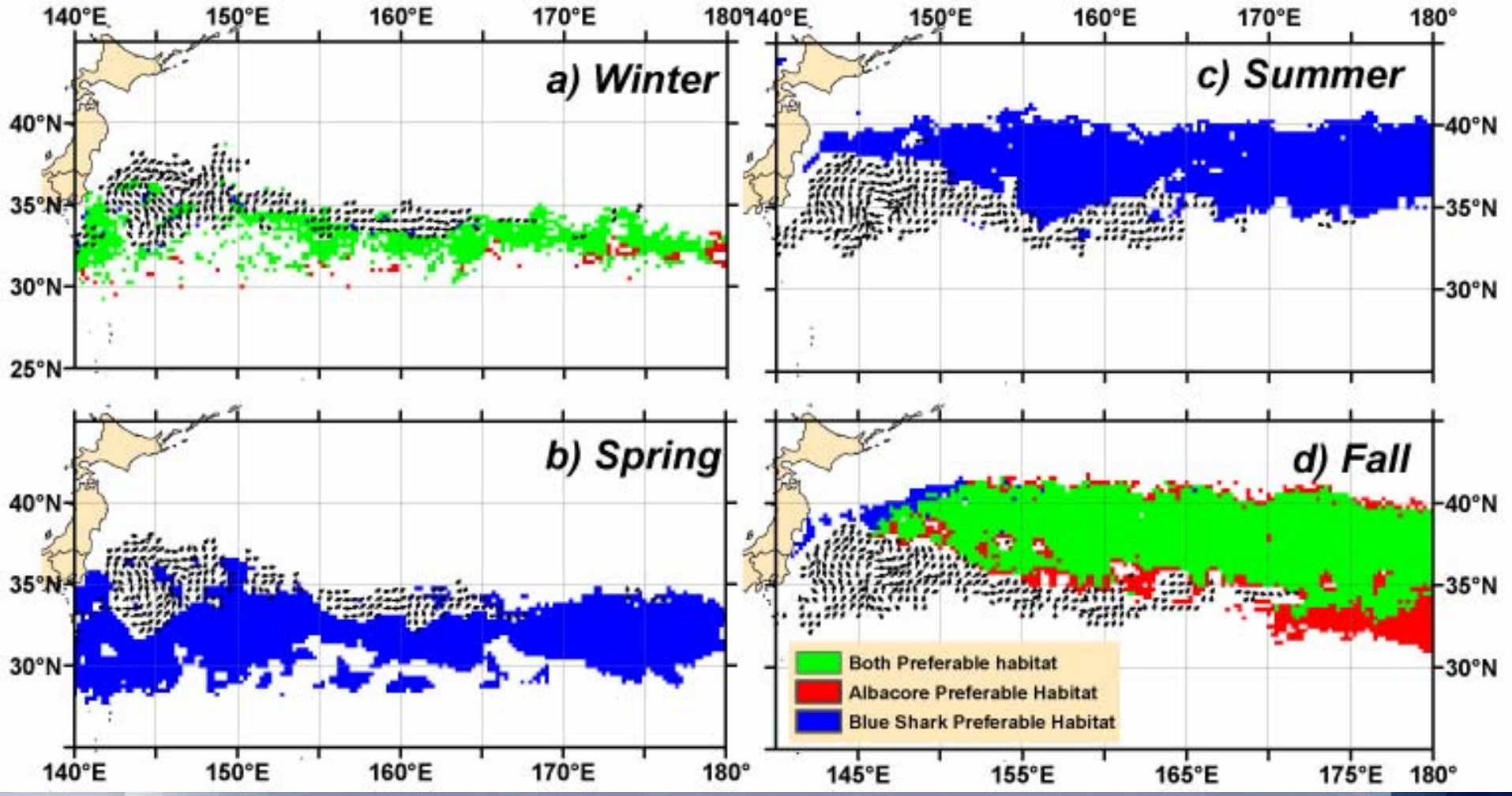
Blue shark

- 0.1 – 0.2 mg/m^3
- 19 – 23 °C
- 10 – 25 cm/s

Albacore & Blue shark

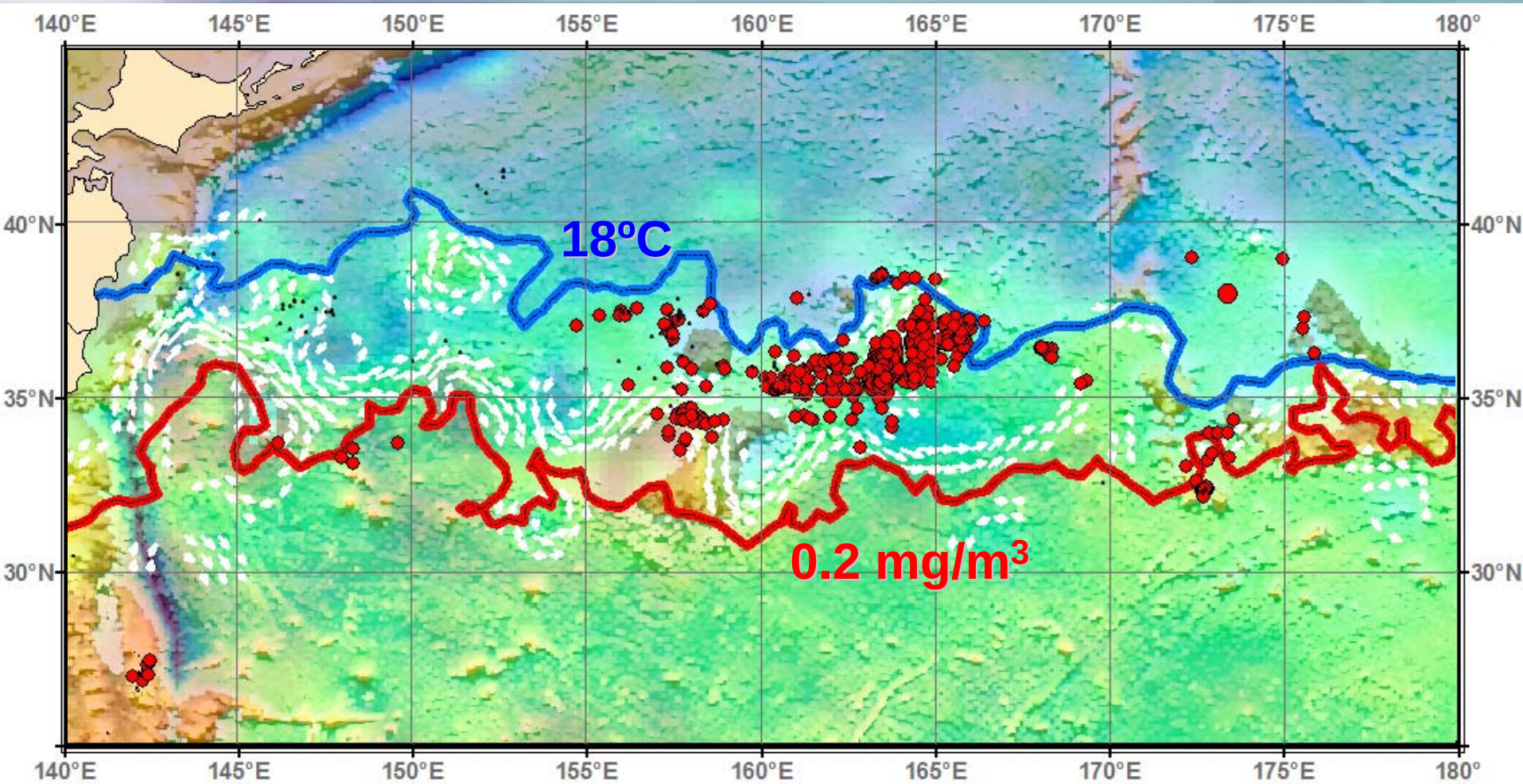
- 0.1 – 0.3 mg/m^3
- 19 – 23 °C
- 5 – 20 cm/s

Habitats for Albacore and Blue shark

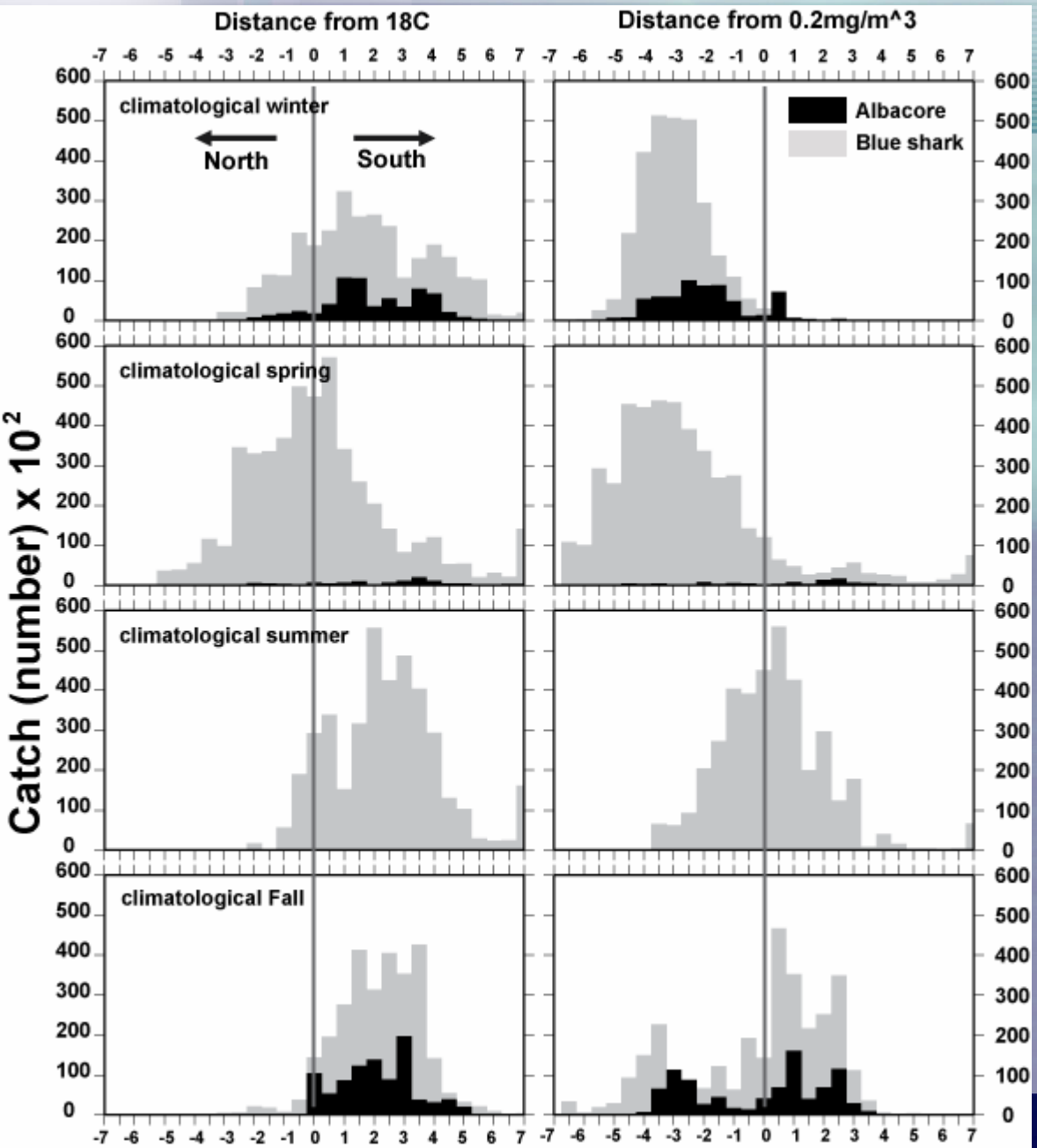


Both species – Habitat not formed in areas with velocities of more than 30 cm/s

Distances from 18 ºC and 0.2mg/m^3



Distances from 18 ºC and 0.2mg/m^3



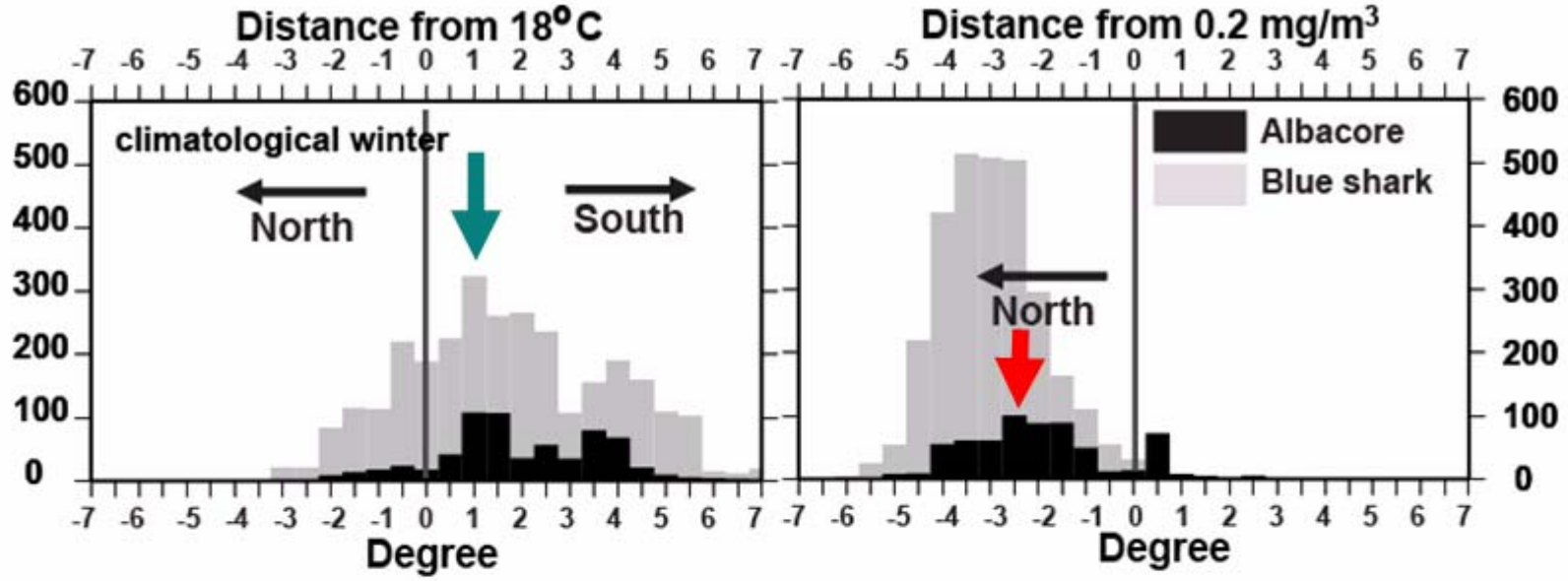
Albacore & Blue shark
south of 18 ºC
north of 0.2mg/m^3

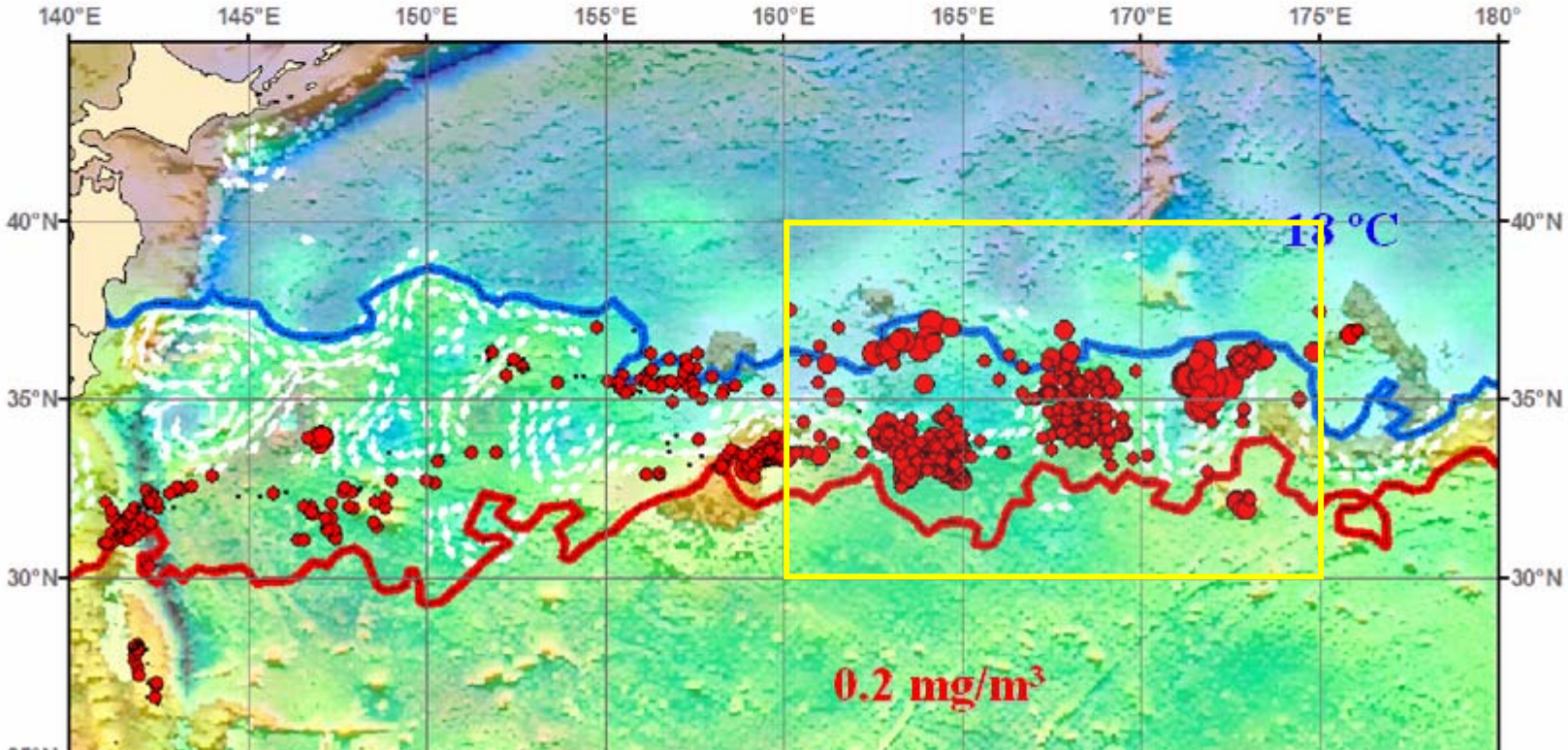
Blue shark
along 18 ºC

Blue shark
along 0.2mg/m^3

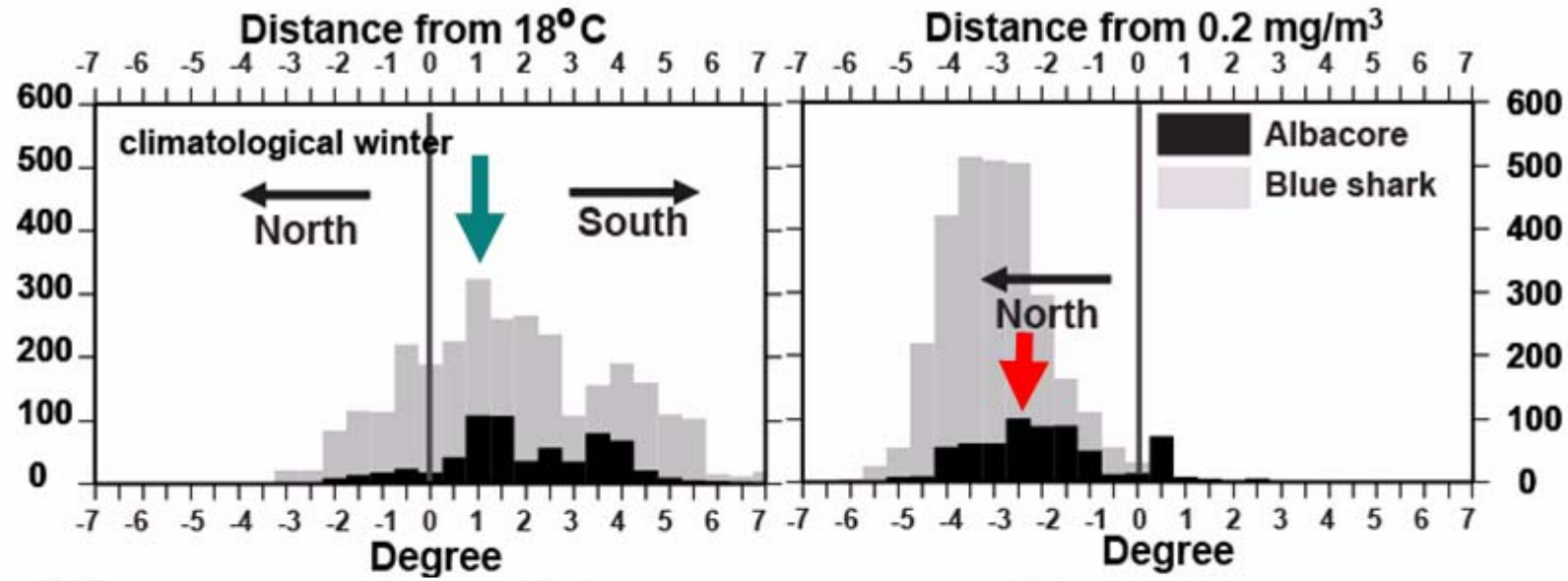
Albacore & Blue shark
south of 18 ºC
separate at 0.2 mg/m^3

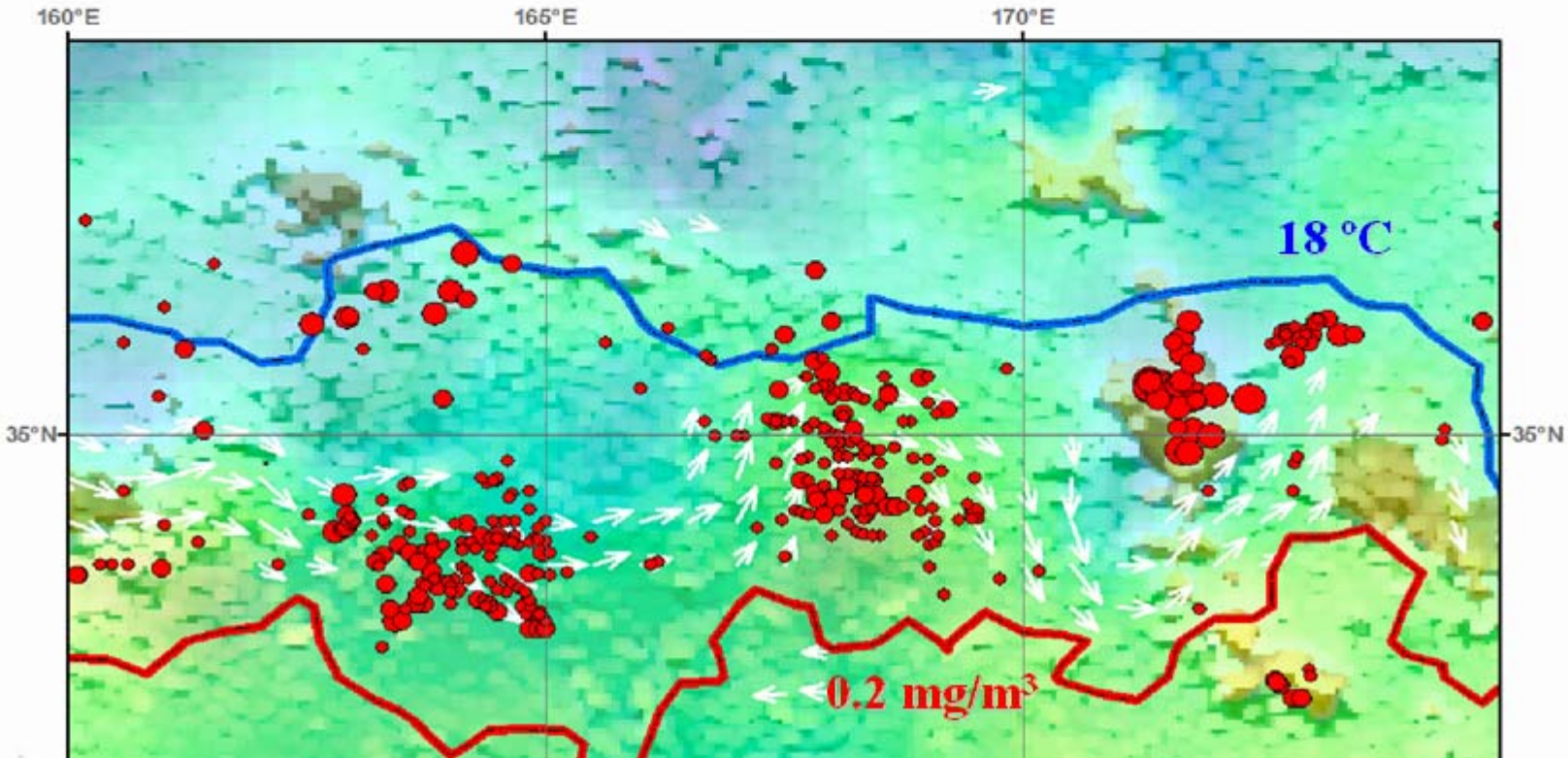
Distances from 18 °C and 0.2 mg/m³



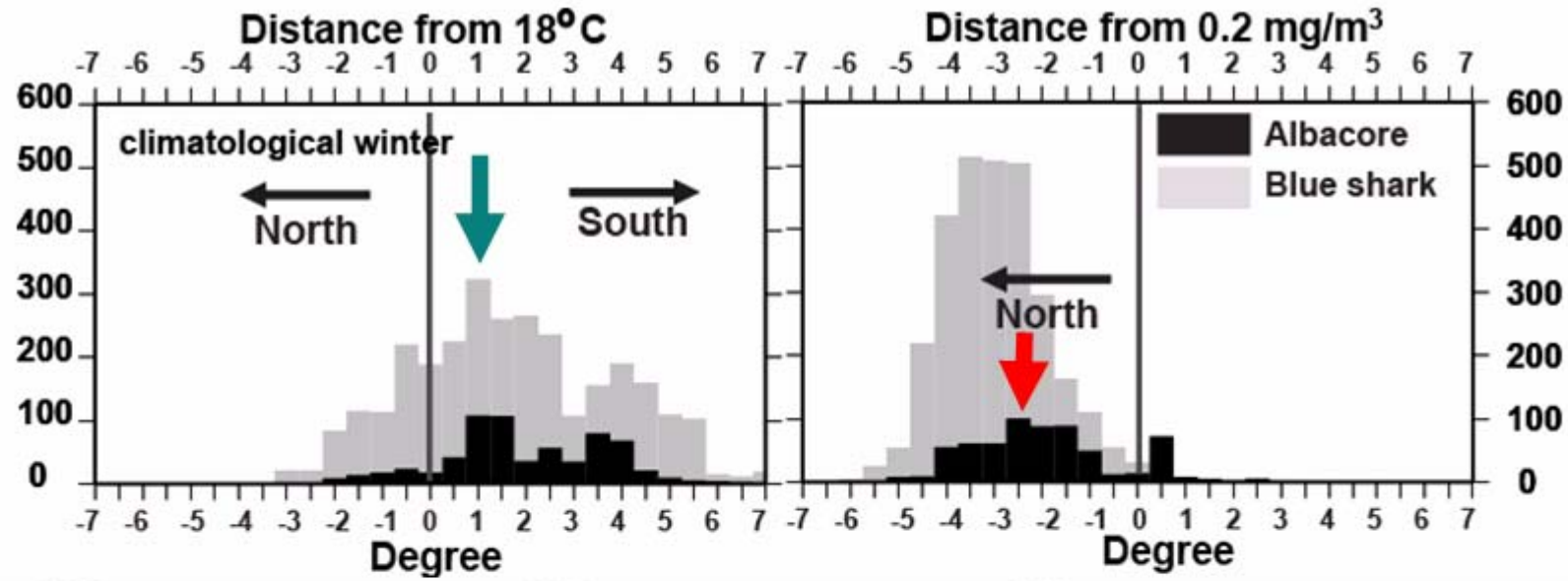


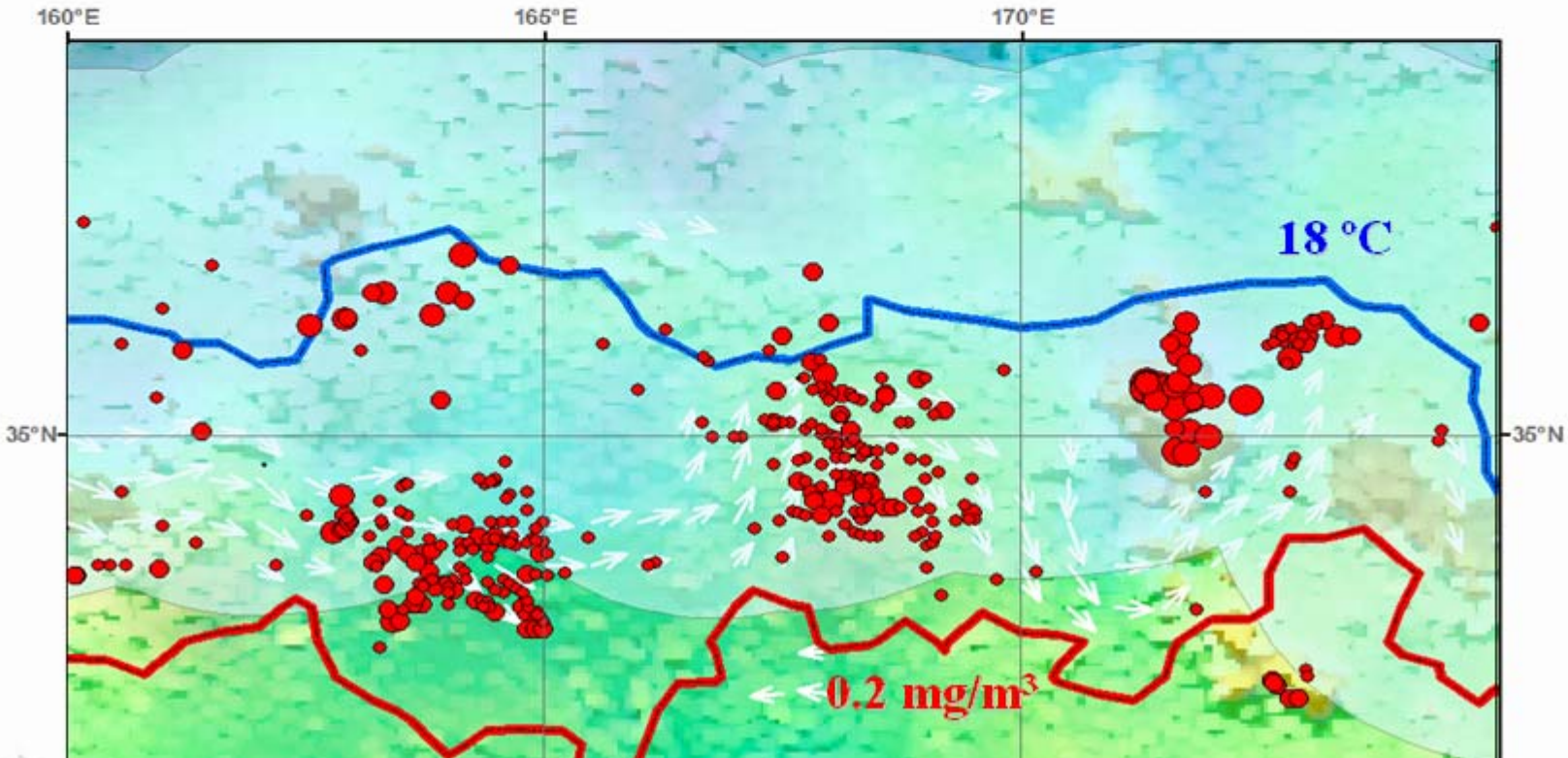
Distances from 18°C and 0.2 mg/m³



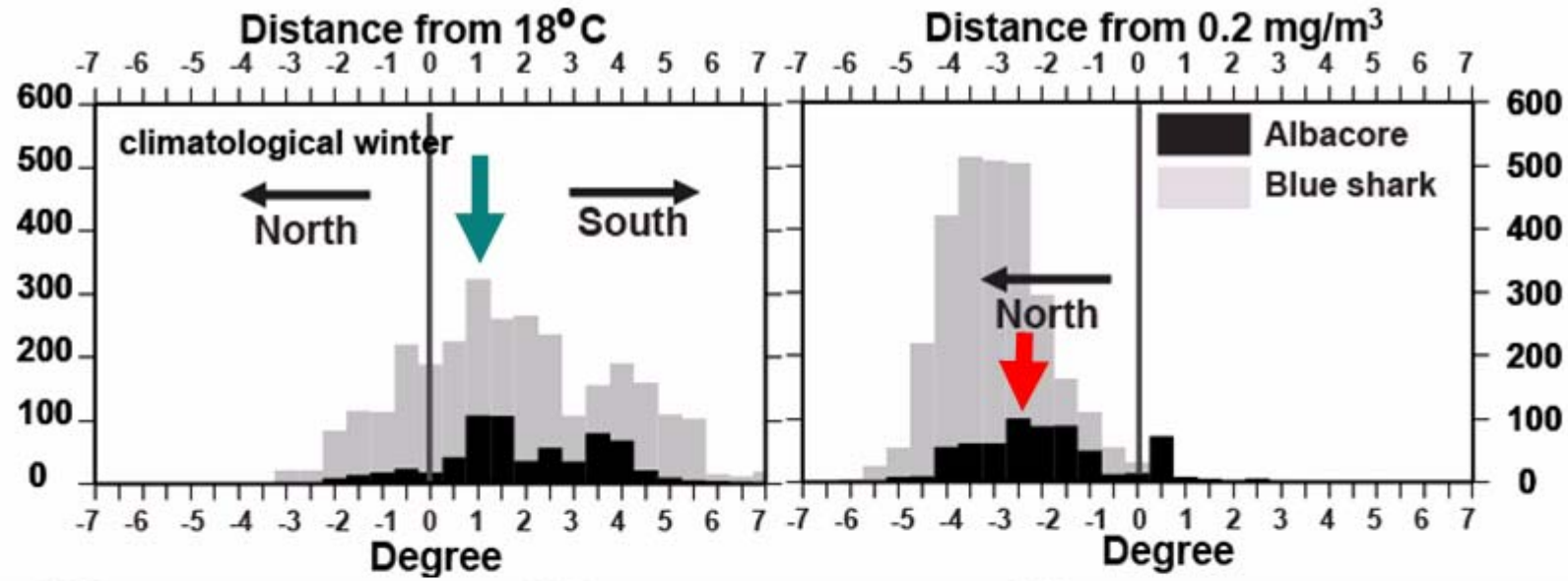


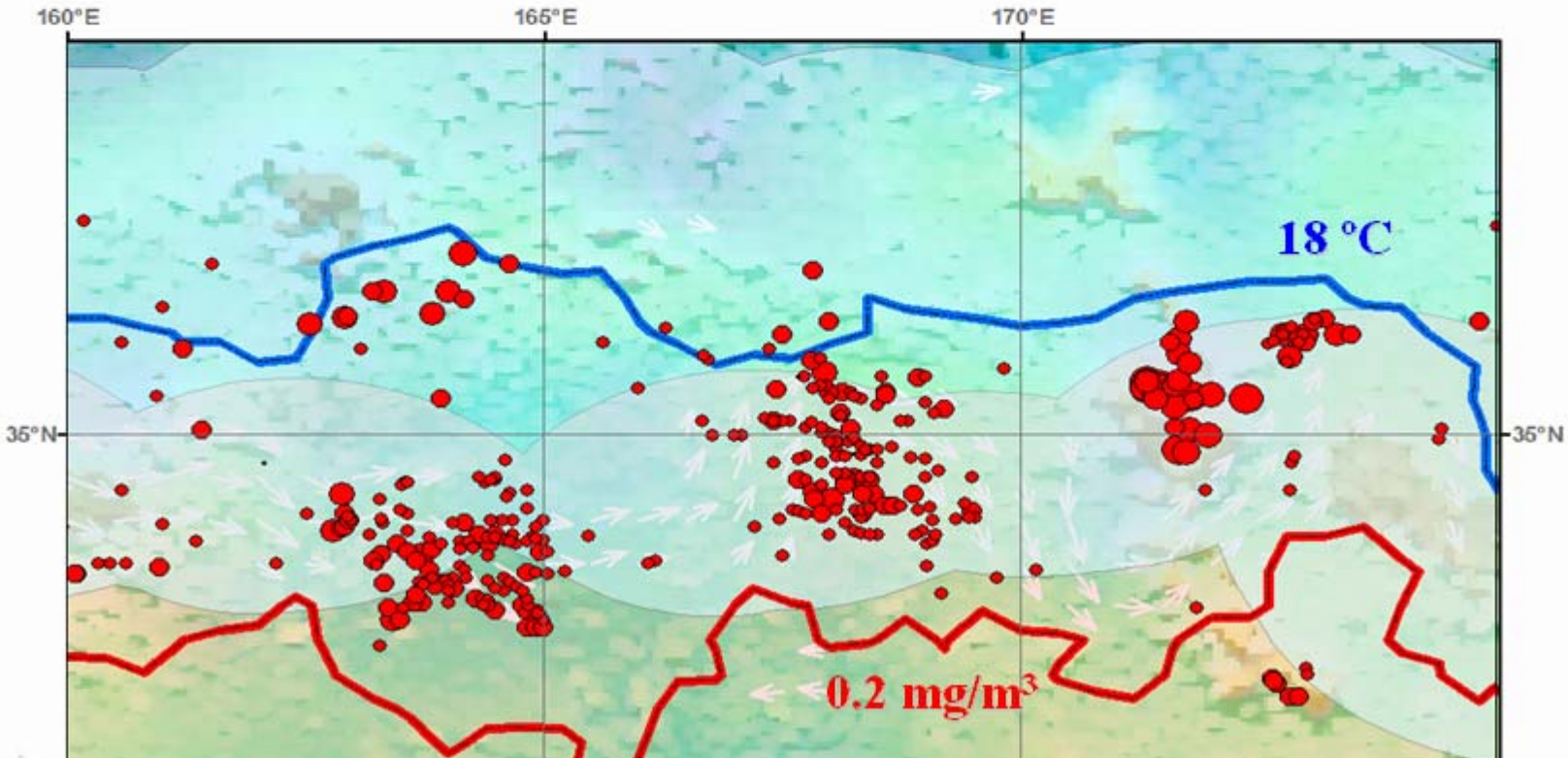
Distances from 18 °C and 0.2 mg/m³



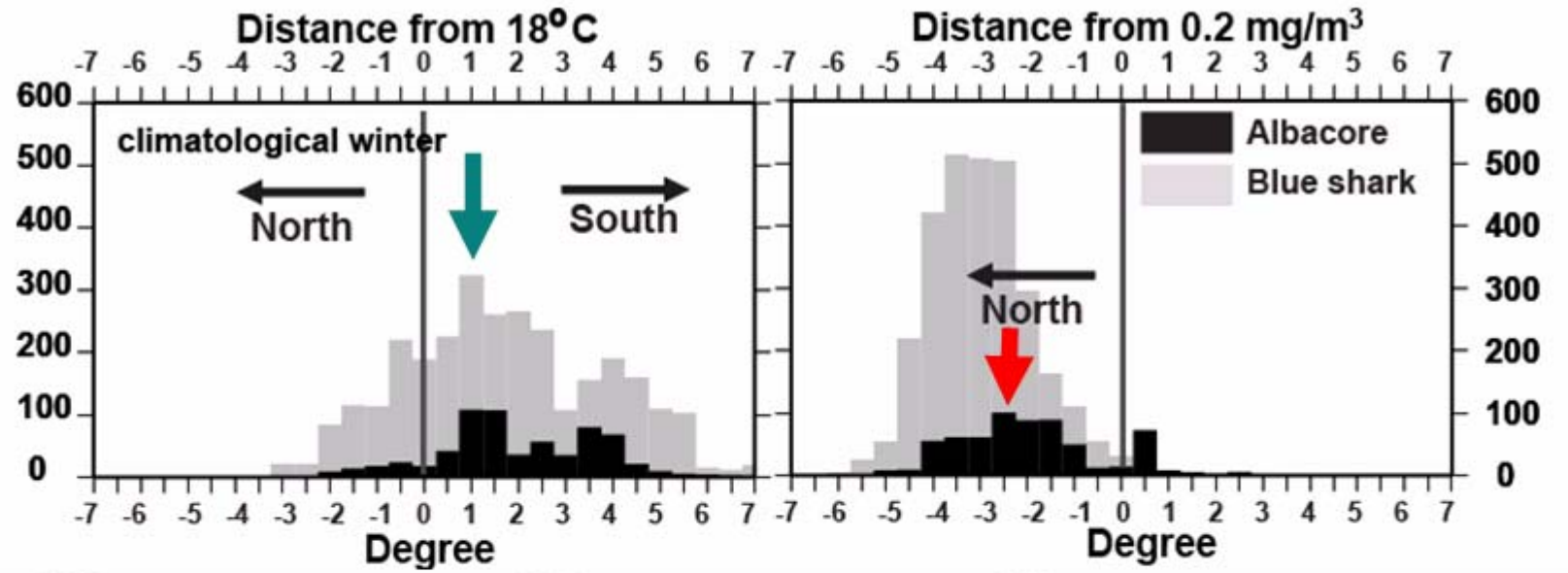


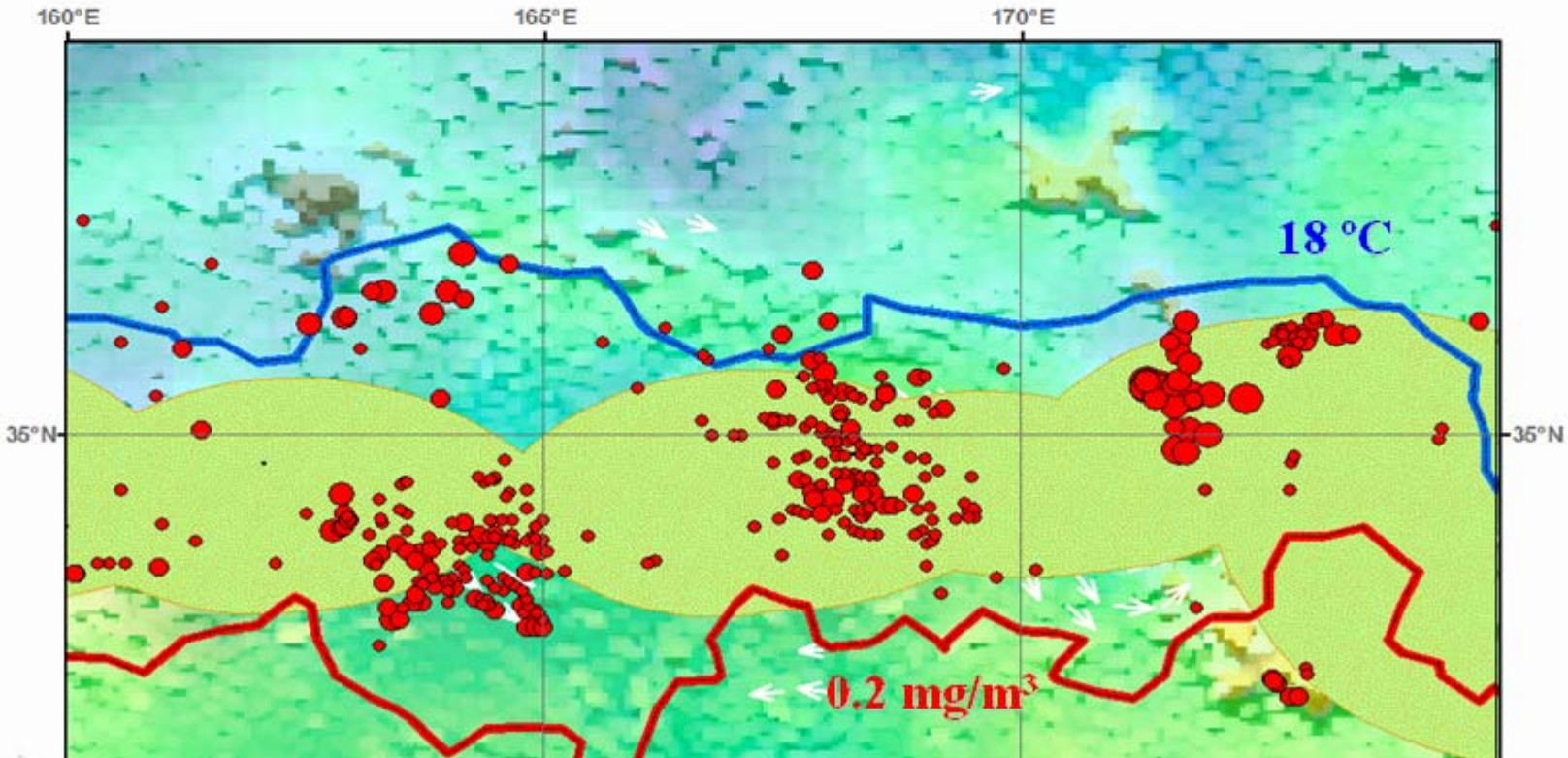
Distances from 18 °C and 0.2 mg/m³



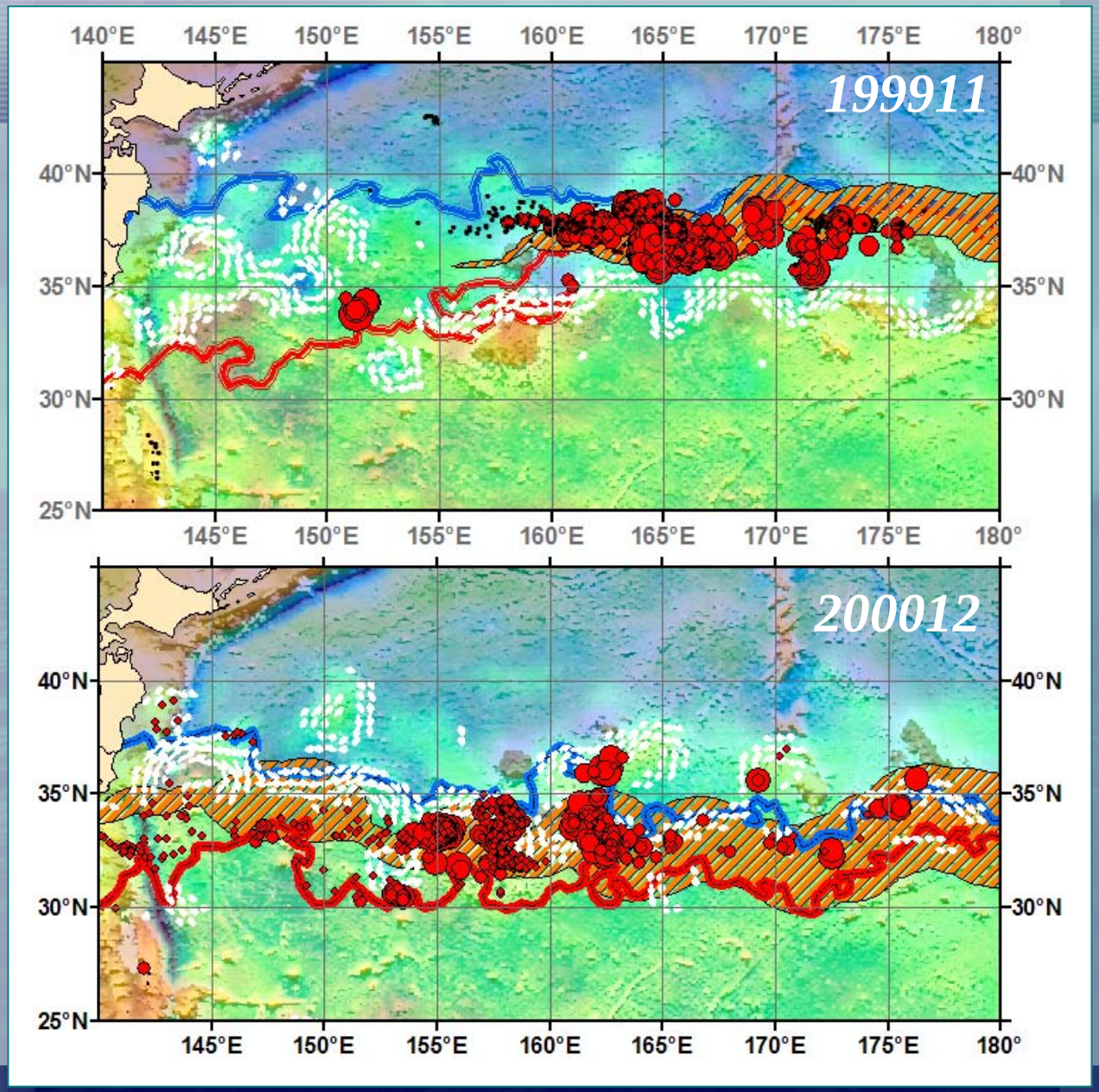


Distances from 18°C and 0.2 mg/m³



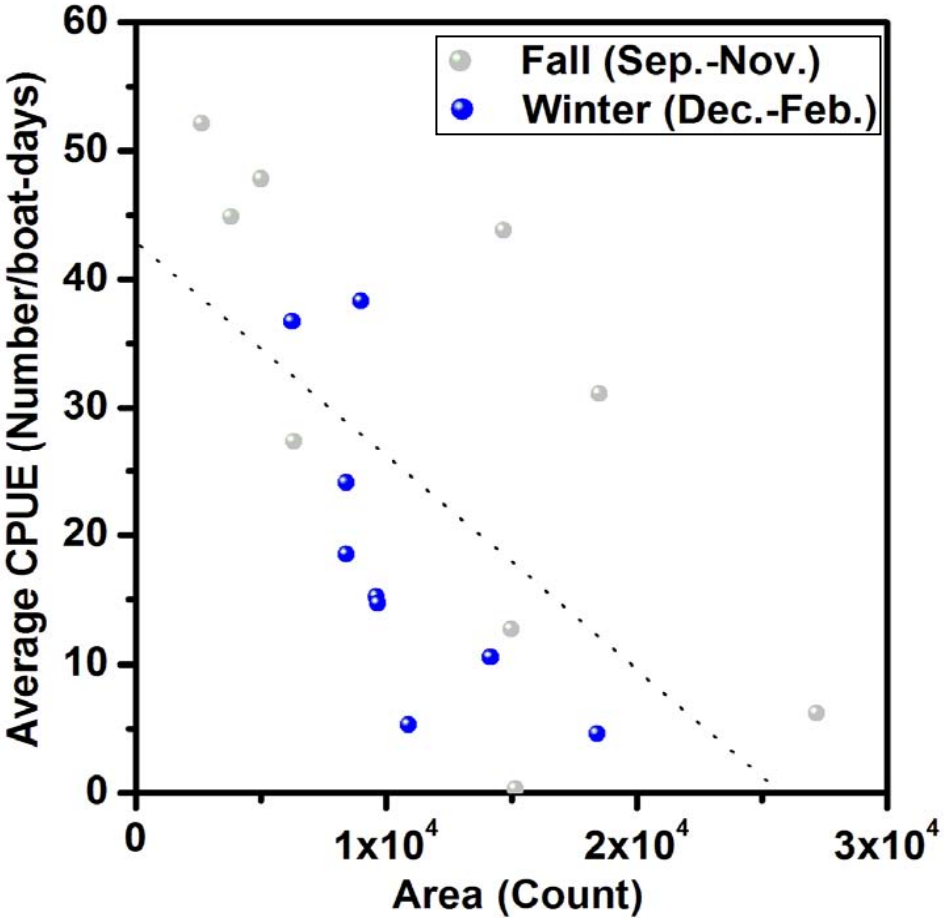


Overlapped areas

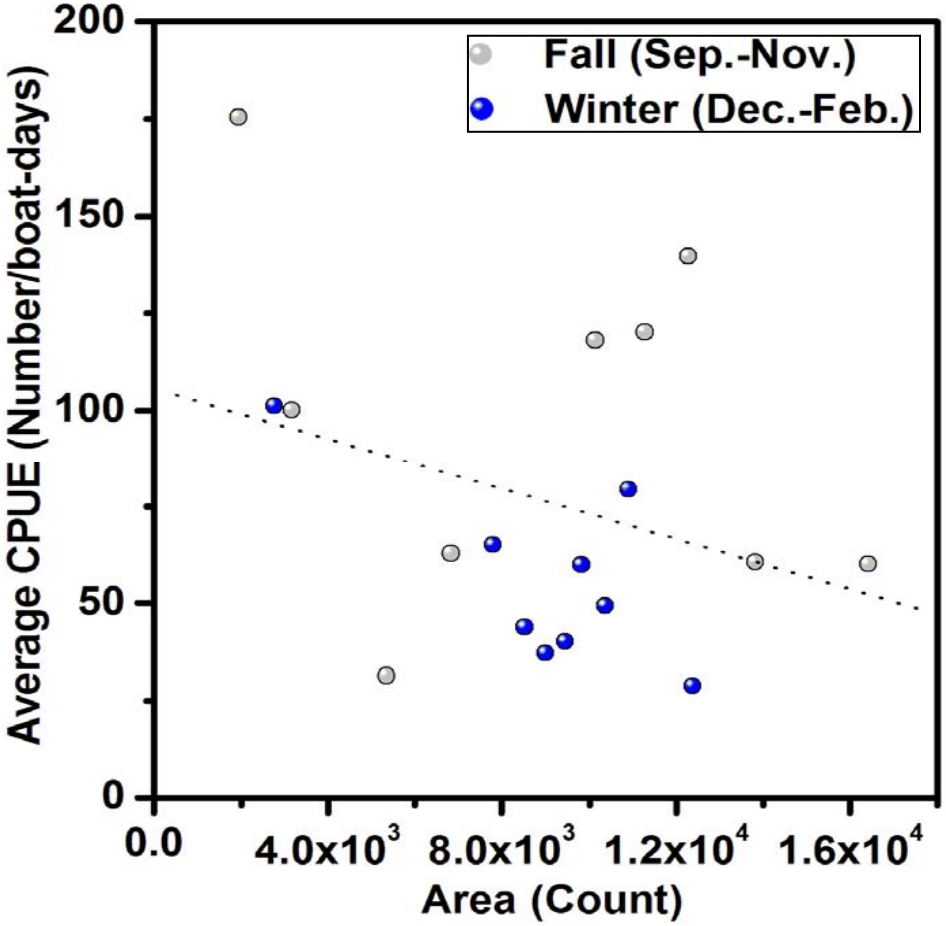


Overlapped areas and CPUE

Albacore

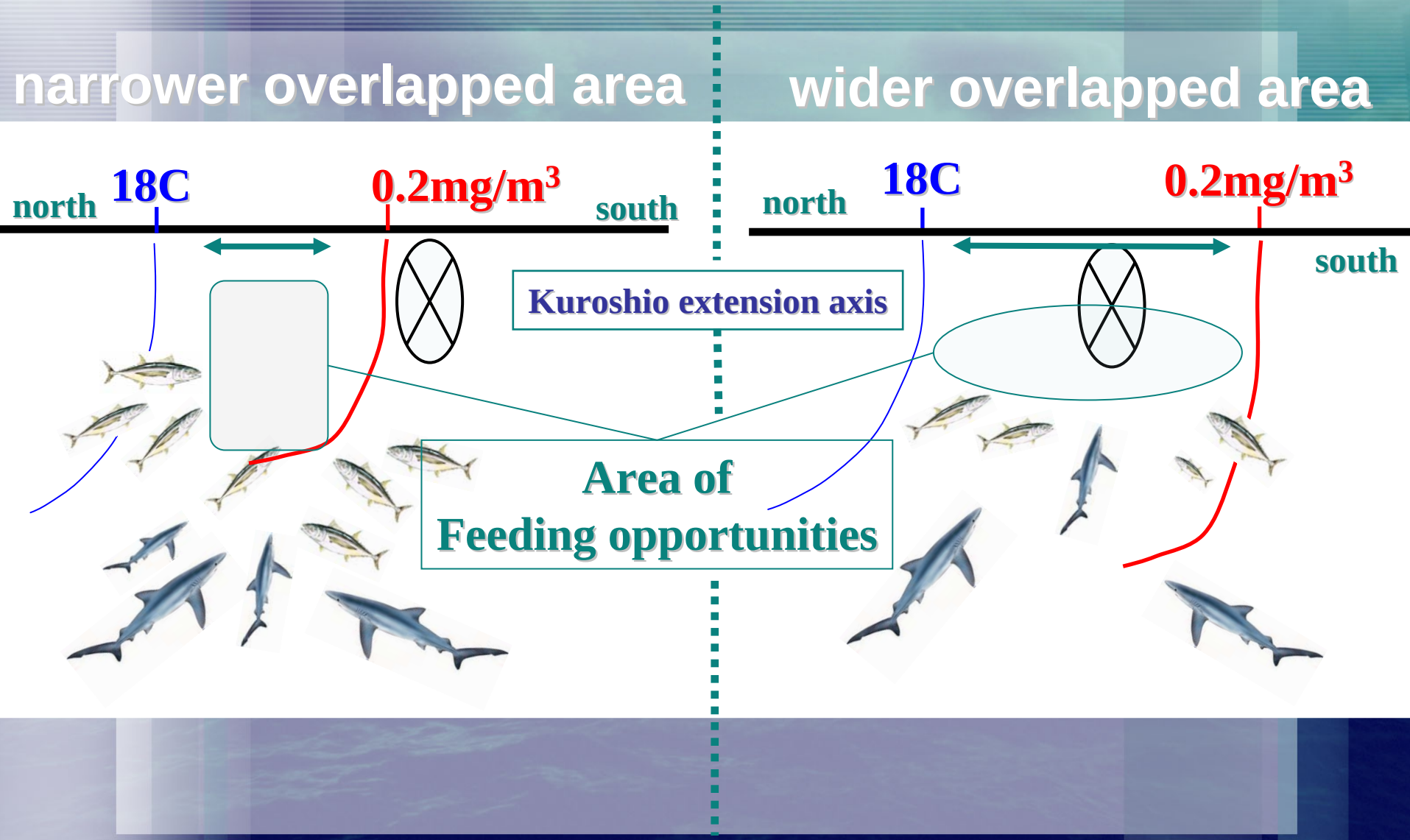


Blue Shark



tend to be negatively correlated

Possible mechanism of aggregation



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