14th PICES

The vertical and horizontal distribution of bigeye tuna (*Thunnus obesus*) and yellowfin tuna (*Thunnus albacares*) related to ocean structure

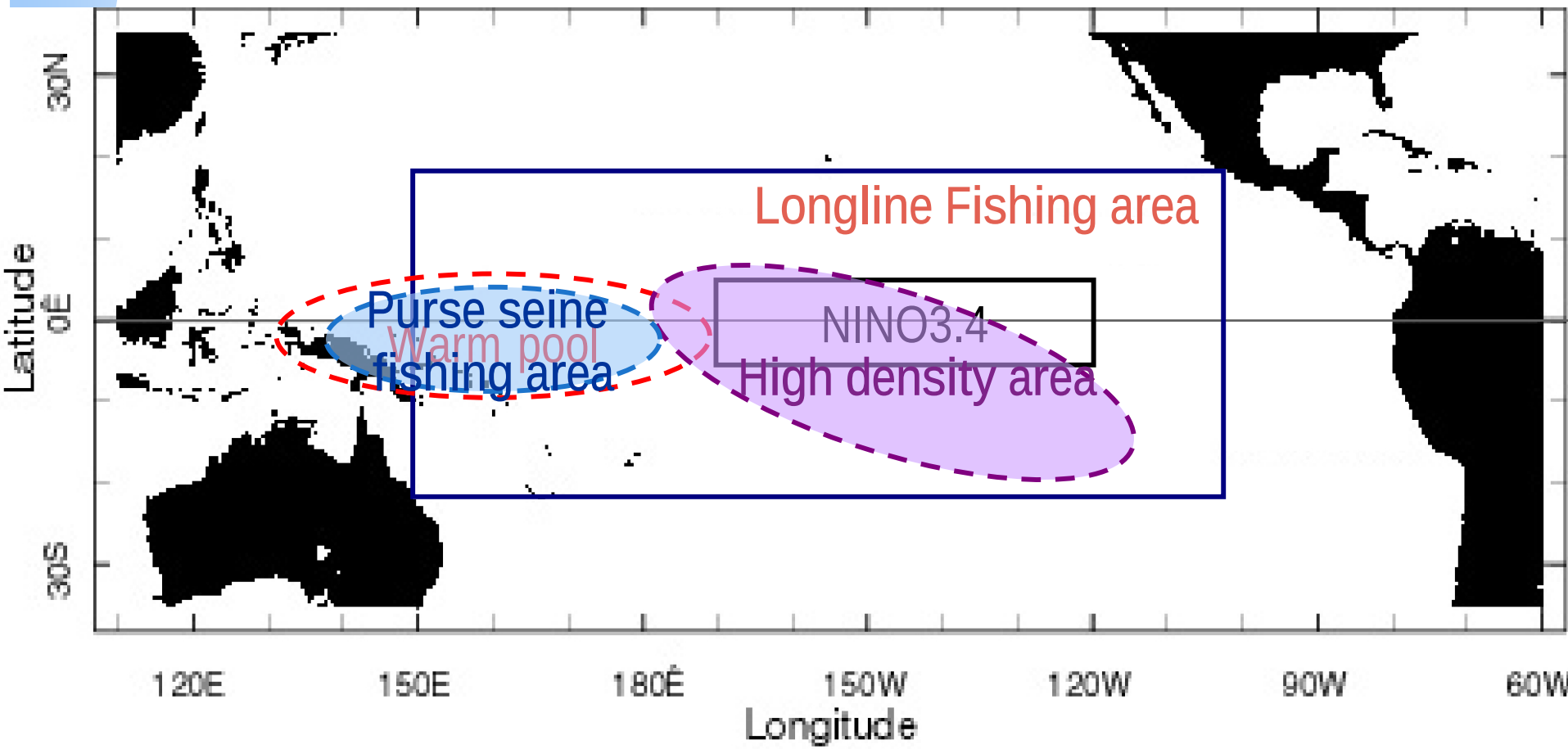
Eun Jung Kim [1,2], Suam Kim[1], Dae-Yeon Moon[2] and Jeong-Rack Koh[2]

[1]Pukyong National University

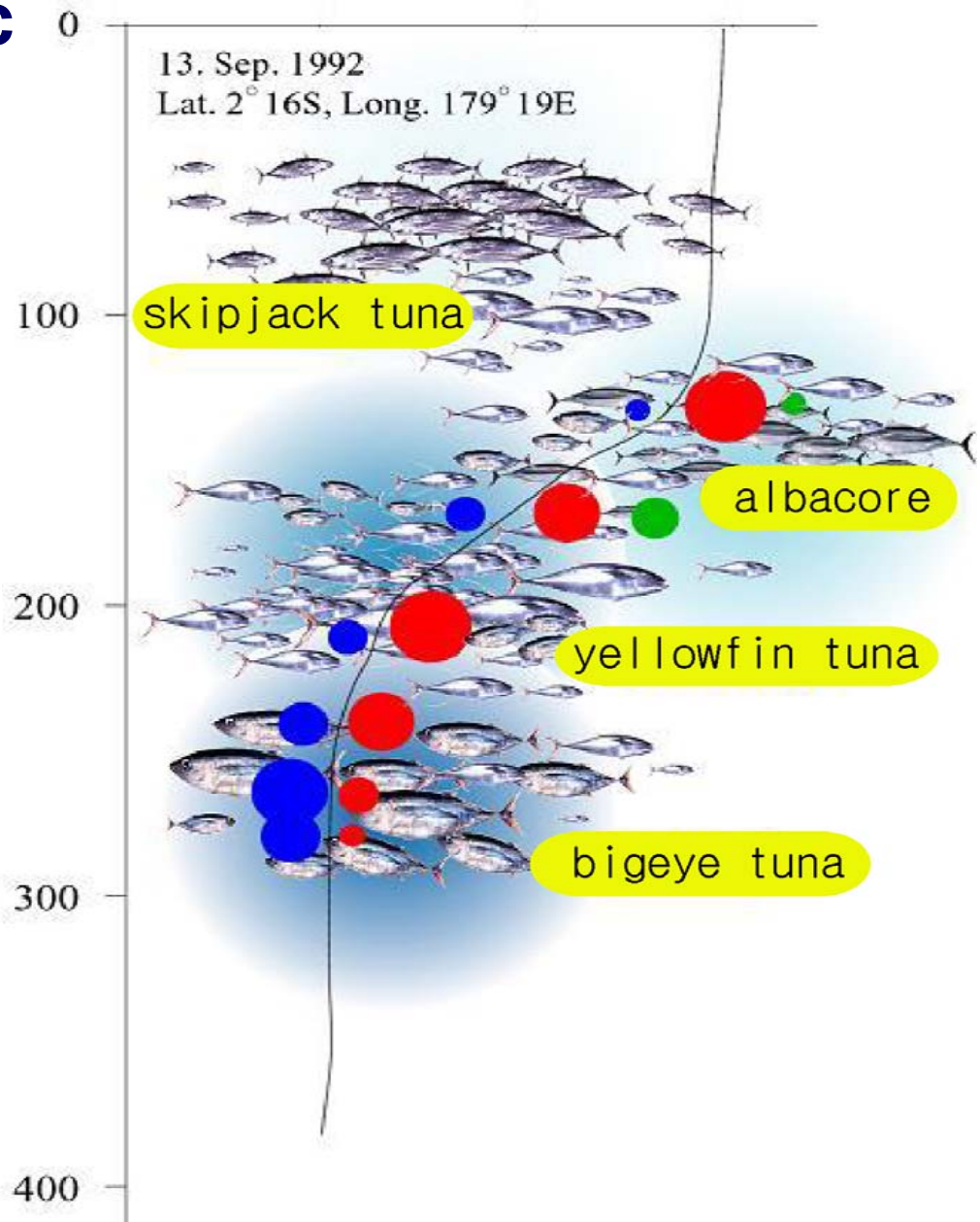
[2]National Fisheries Research & Development Institute

Introduction

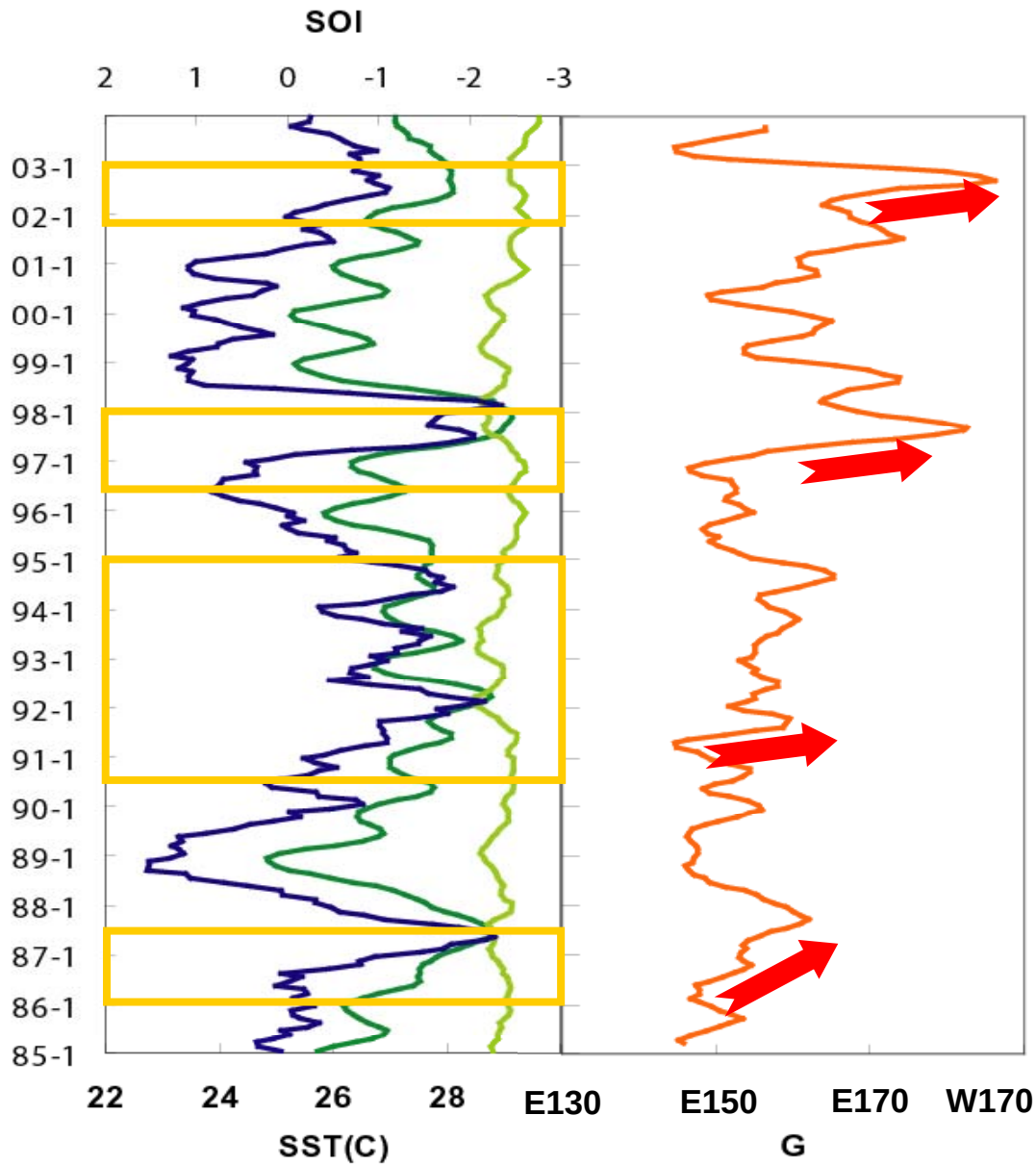
- **The tuna fishing area in the Tropical Pacific**



Schematic vertical distribution of tuna species in Pacific

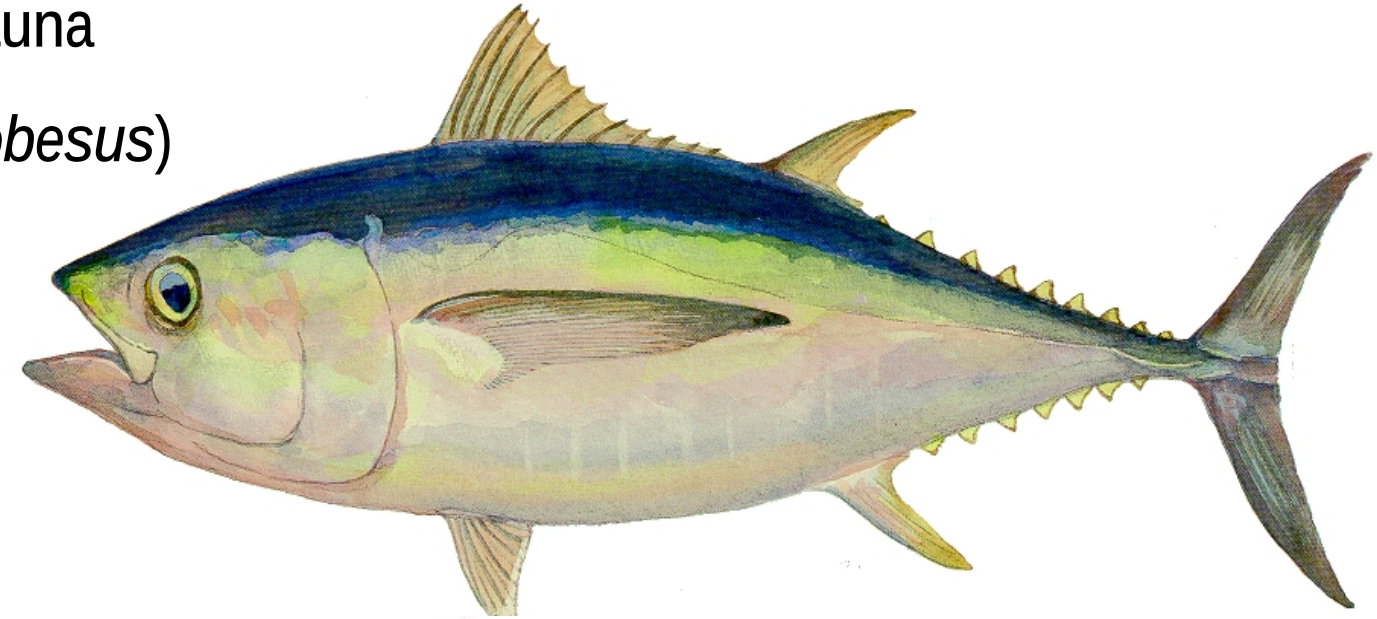


Skipjack tuna & environmental factors



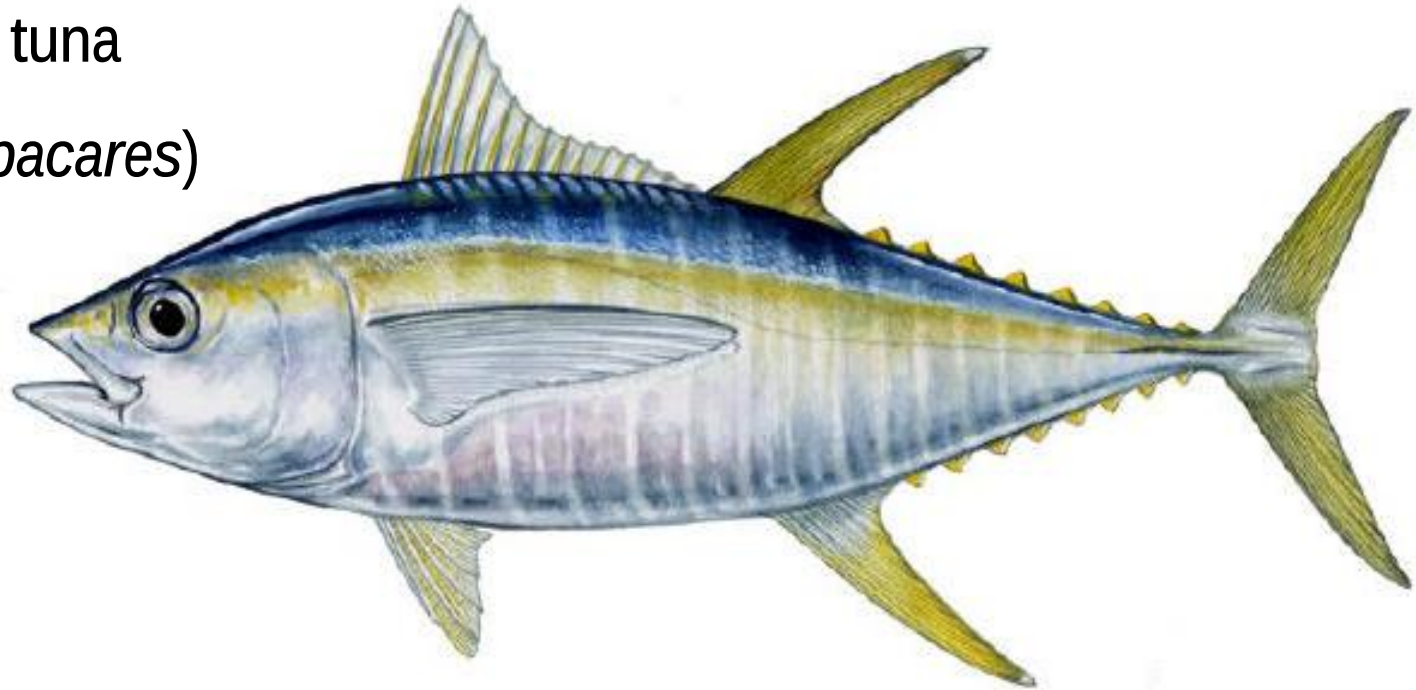
Bigeye tuna

(*Thunnus obesus*)



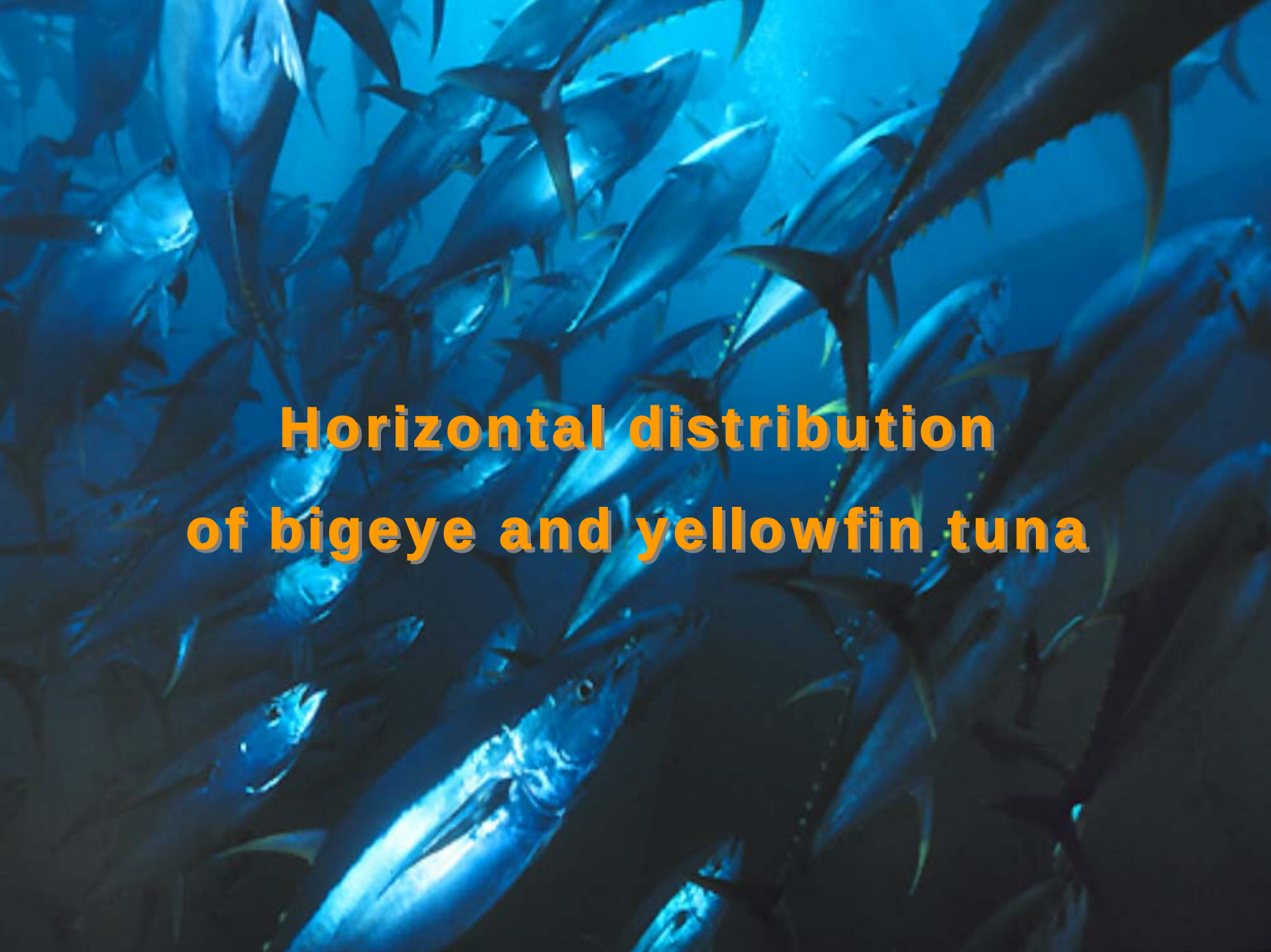
Yellowfin tuna

(*Thunnus albacares*)



Objective

- To find the response of spatial & vertical distribution of bigeye & yellowfin tuna related to the oceanographic condition


Horizontal distribution
of bigeye and yellowfin tuna

Materials & Methods

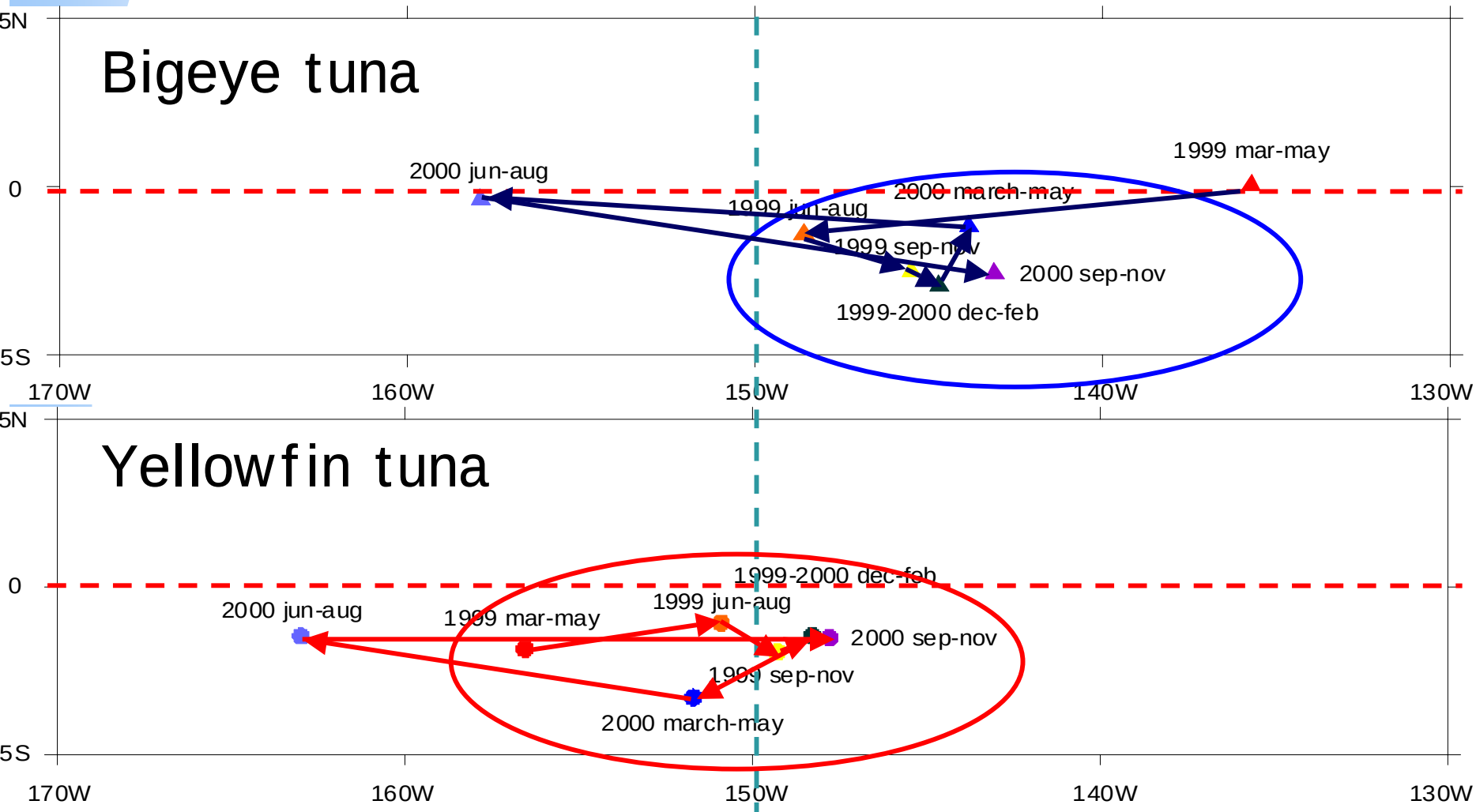
- Fishing data

- About 200 Korean longline vessels
- Jan. 1999 –Dec. 2000
- Catch numbers of bigeye and yellowfin tuna georeferenced in 5° grids of latitude and longitude.
- Fishing gravity centre of CPUE(G) in month j

$$G_j = \sum_i L_i (C_{ij}/E_{ij}) / \sum_i (C_{ij}/E_{ij})$$

Results

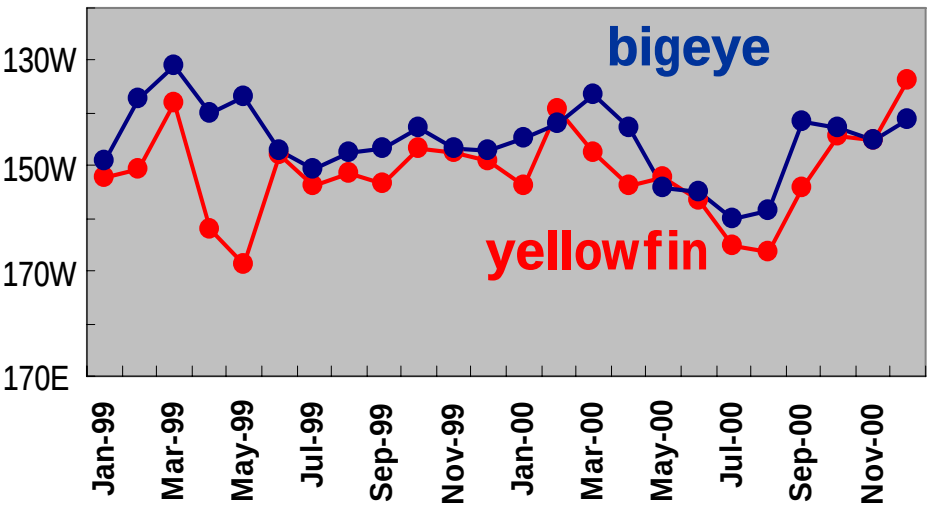
➢ Seasonal change (3 months) of fishing centroids



Results

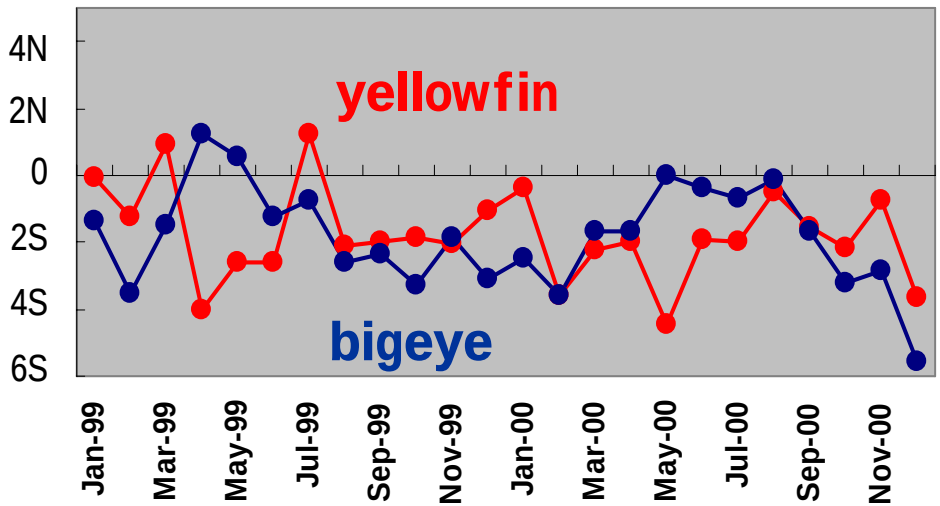
Monthly change of centroids

Longitudinal centroids



r=0.449 (<0.05)

Latitudinal centroids



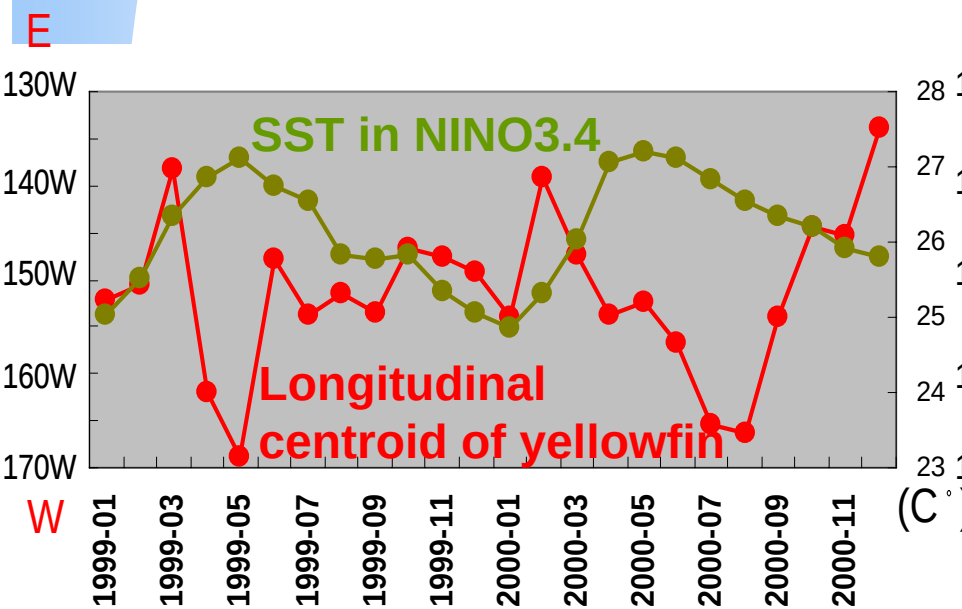
Not significant

What causes this change?

Results

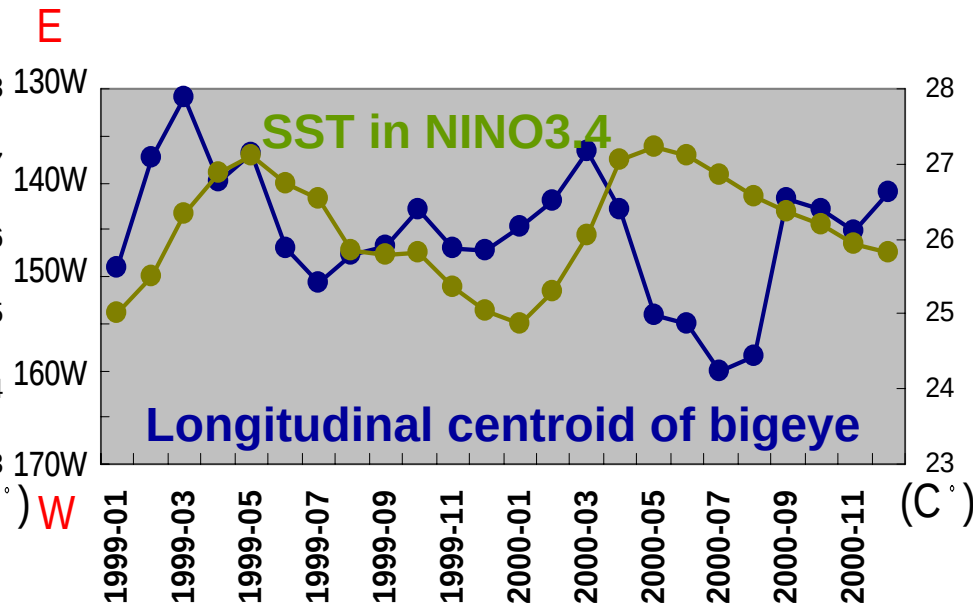
Longitudinal centroids & SST of NINO3.4

Yelloiwfin tuna



r=-0.465 (<0.05)

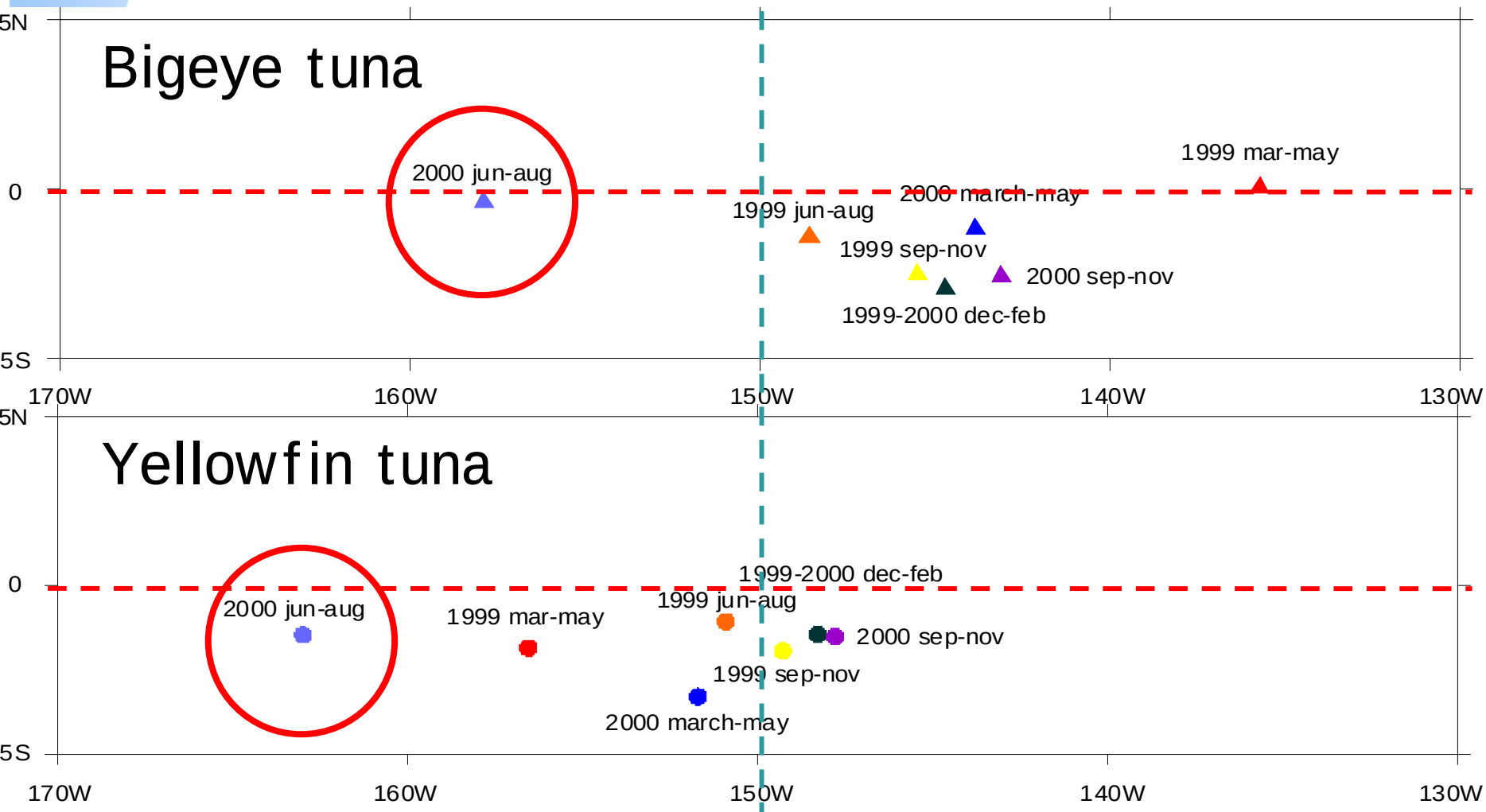
Bigeye tuna



Not significant

Results

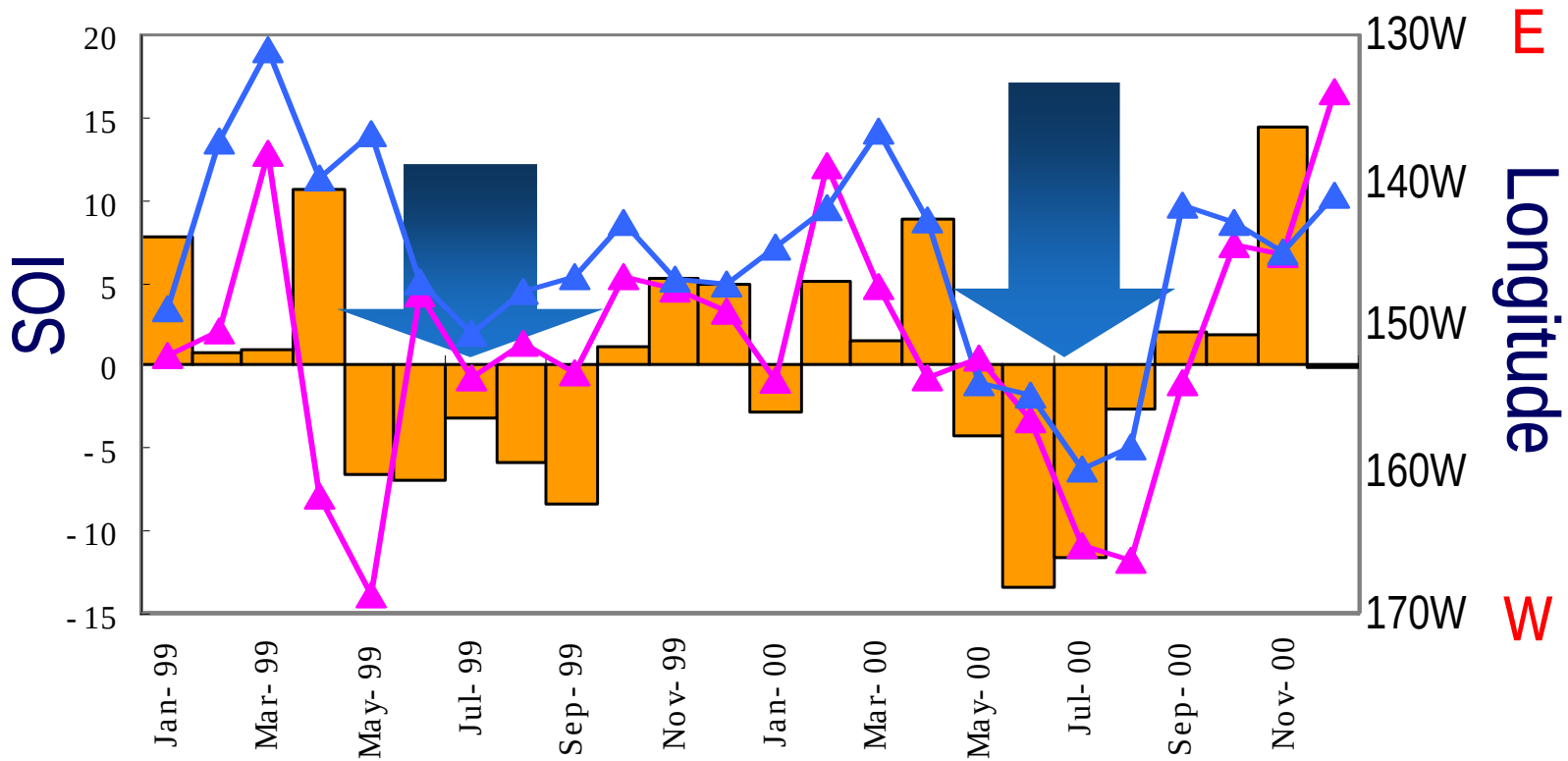
- **Seasonal change (3 months) of fishing centroid**



Results

- **Anomaly of SOI (Southern Oscillation Index)**

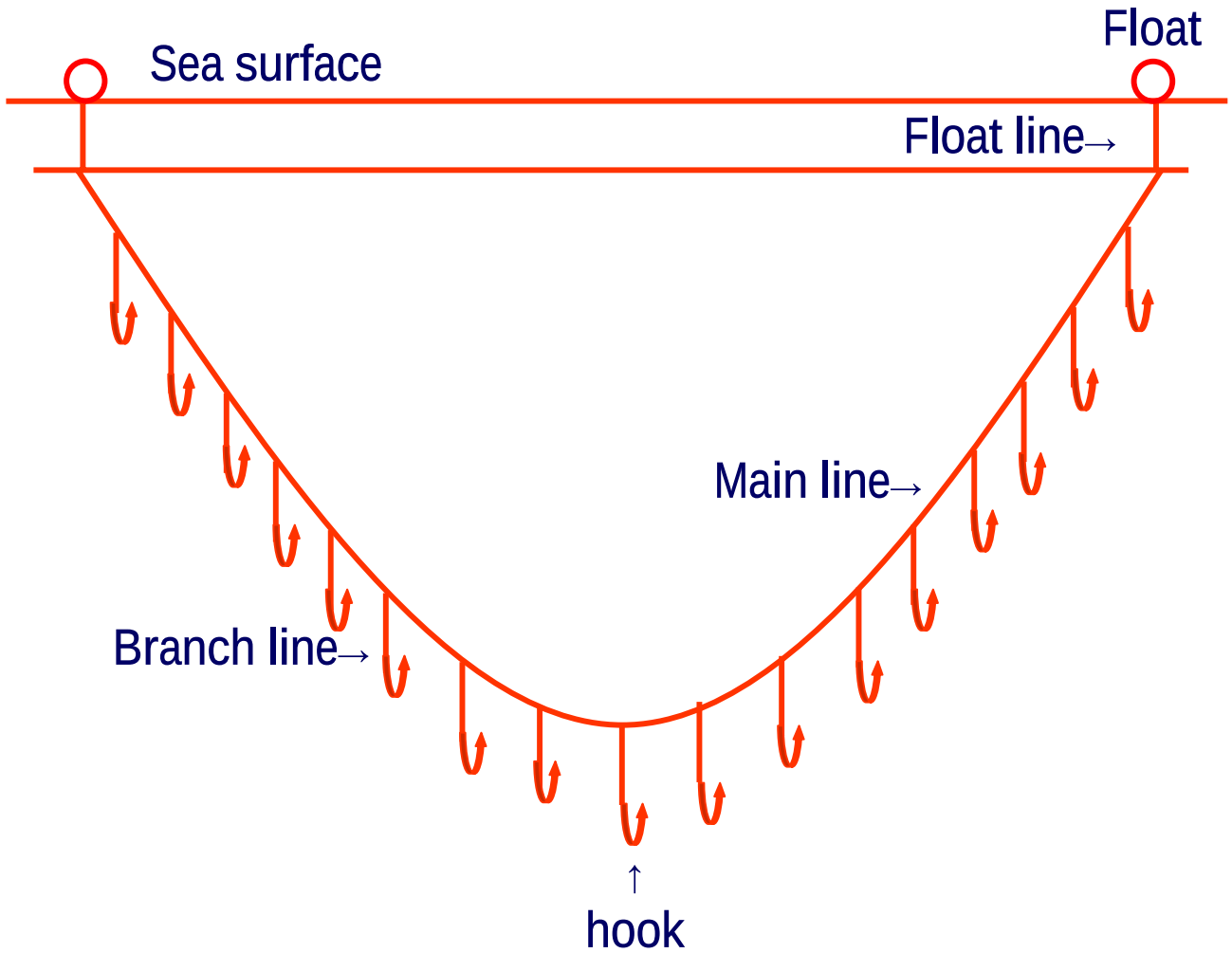
with longitudinal centroids




Vertical distribution
of bigeye and yellowfin tuna

Materials & Methods

- **Schematic view of a "basket" of tuna longline gear**



Materials & Methods

☐ Fishing data

- **One fishing vessel, Sinyoung 53**
- **August 1999 – October 2000**
- **Catch per hook of 211 sets of longline setting**

Materials & Methods

- to calculate the depth of each hook…

Yoshihara formula (1951,1954)

$$D_j = h_a + h_b + L\{(1+\cot^2\varphi^\circ)^{1/2} - [(1-2j/n)^2 + \cot^2\varphi^\circ]^{1/2}\}$$

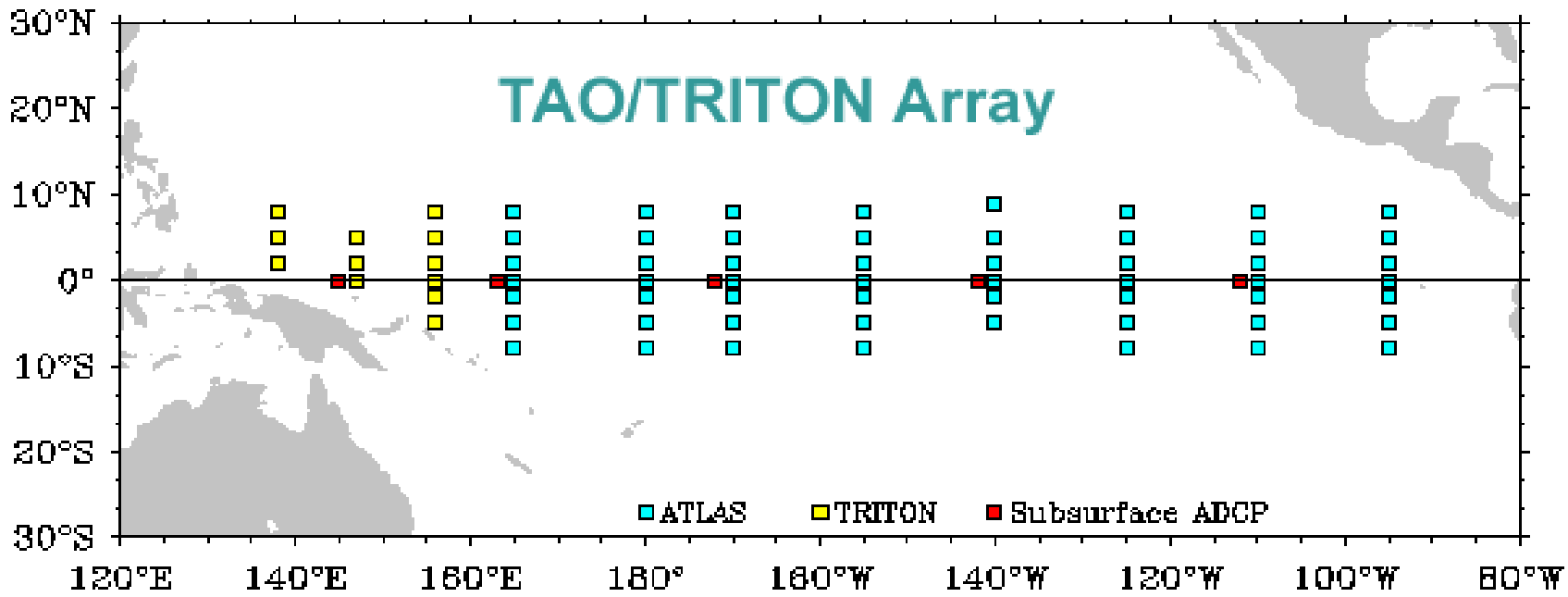
No. of hook	1 (17)	2 (16)	3 (15)	4 (14)	5 (13)	6 (12)	7 (11)	8 (10)	9
Depth (m)	120-190m		191-260m		261-330m		331-400m		
	131	164	207	247	286	322	351	372	379

Materials & Methods

- **Environmental data (TAO buoy data)**

  (http://www.pmel.noaa.gov/tao/index.html)

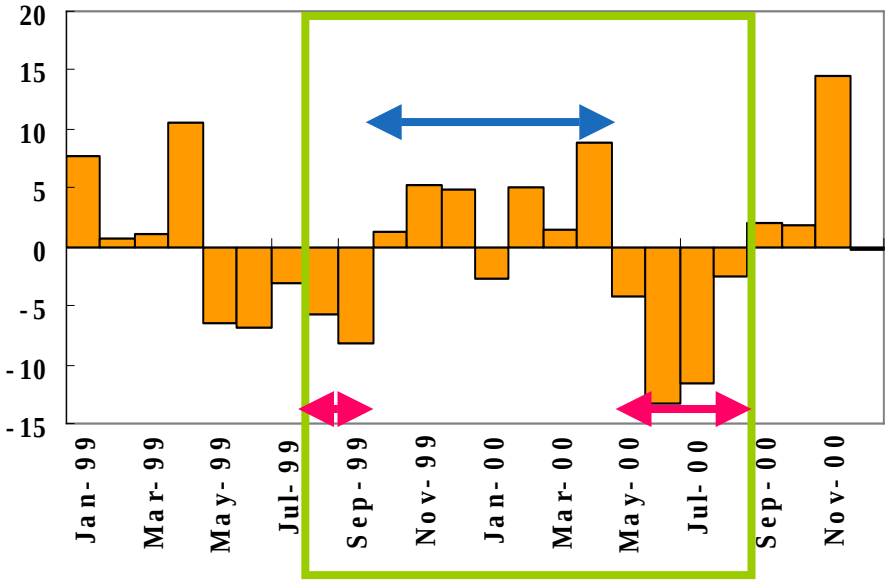
  Subsurface temperature (0-500m)



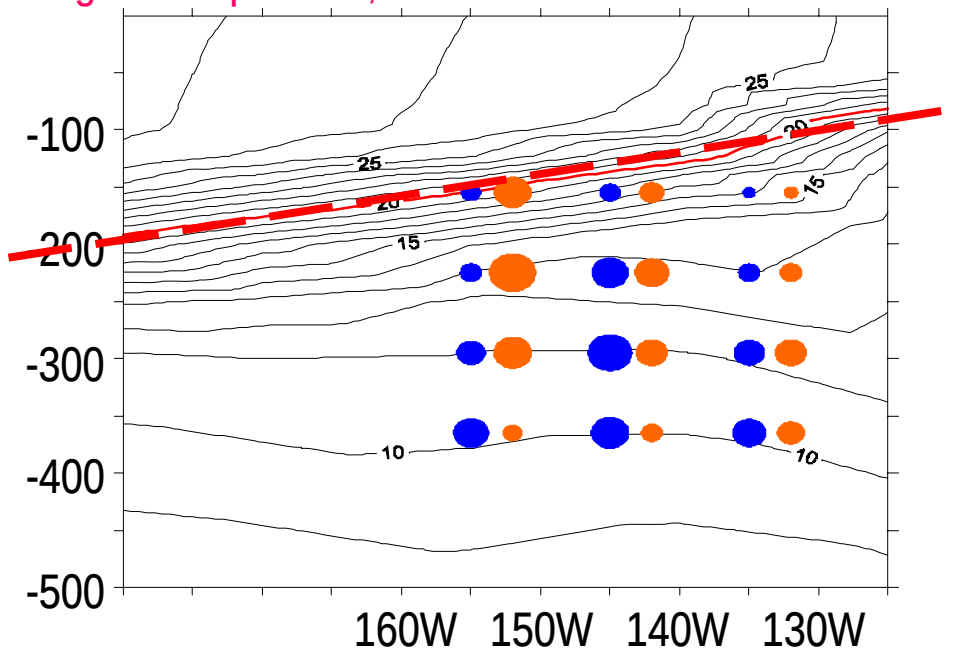
Results

- CPUEs of bigeye and yellowfin tuna in four depth

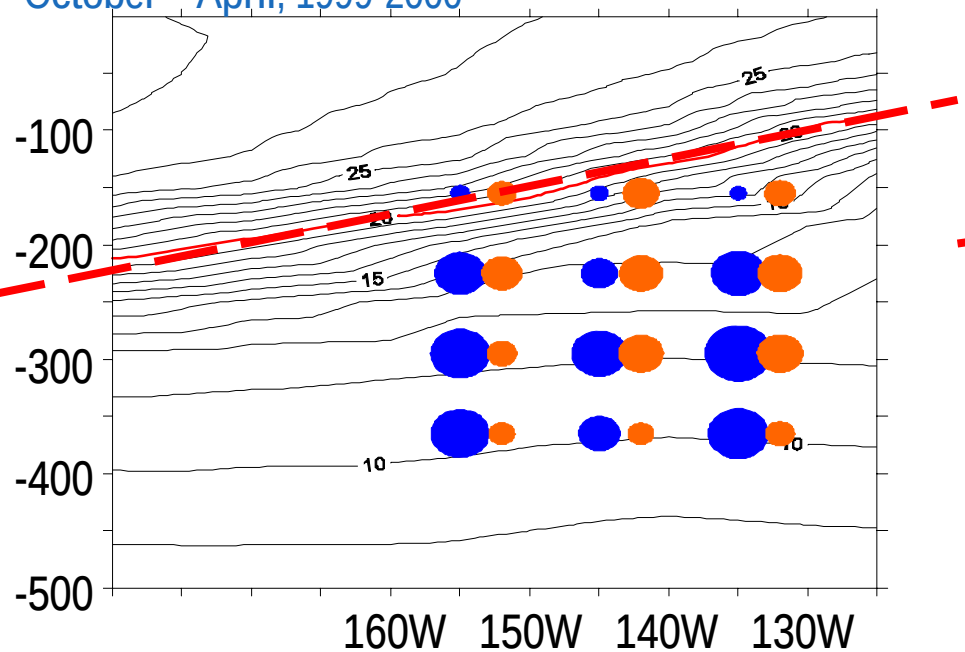
SOI anomaly



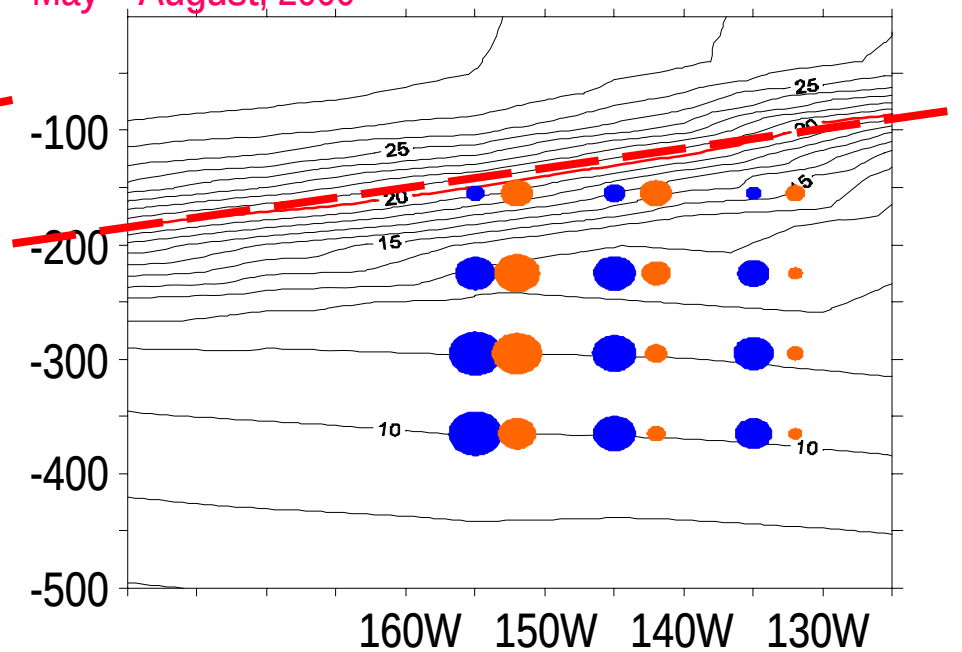
August – September, 1999



October – April, 1999-2000



May – August, 2000



Summary

- Spatial distribution with season was not clear, but catch locations of both species look coherent longitudinally.
- Bigeye tuna seem to distribute further east than yellowfin tuna.
- El Niño might affect on the longitudinal fishing grounds of both species. However, yellowfin tuna response more sensitively to the environmental change than bigeye tuna.

Summary

- Bigeye tuna located in deeper depth than yellowfin tuna.
- When the SOI was negative (i.e., thermocline was shallow in the western area), the tuna distributions seemed to be located more in the western area, and vice versa.
- The vertical movement was not clear from our study.

Future study

- ✓ Use of more vertical data over longer period
- ✓ Investigation on distribution of several tuna species under dynamical ocean structure


Thank You !

Part 3.

Bait selectivity

Materials & Methods

- Bait were used…

Mackerel

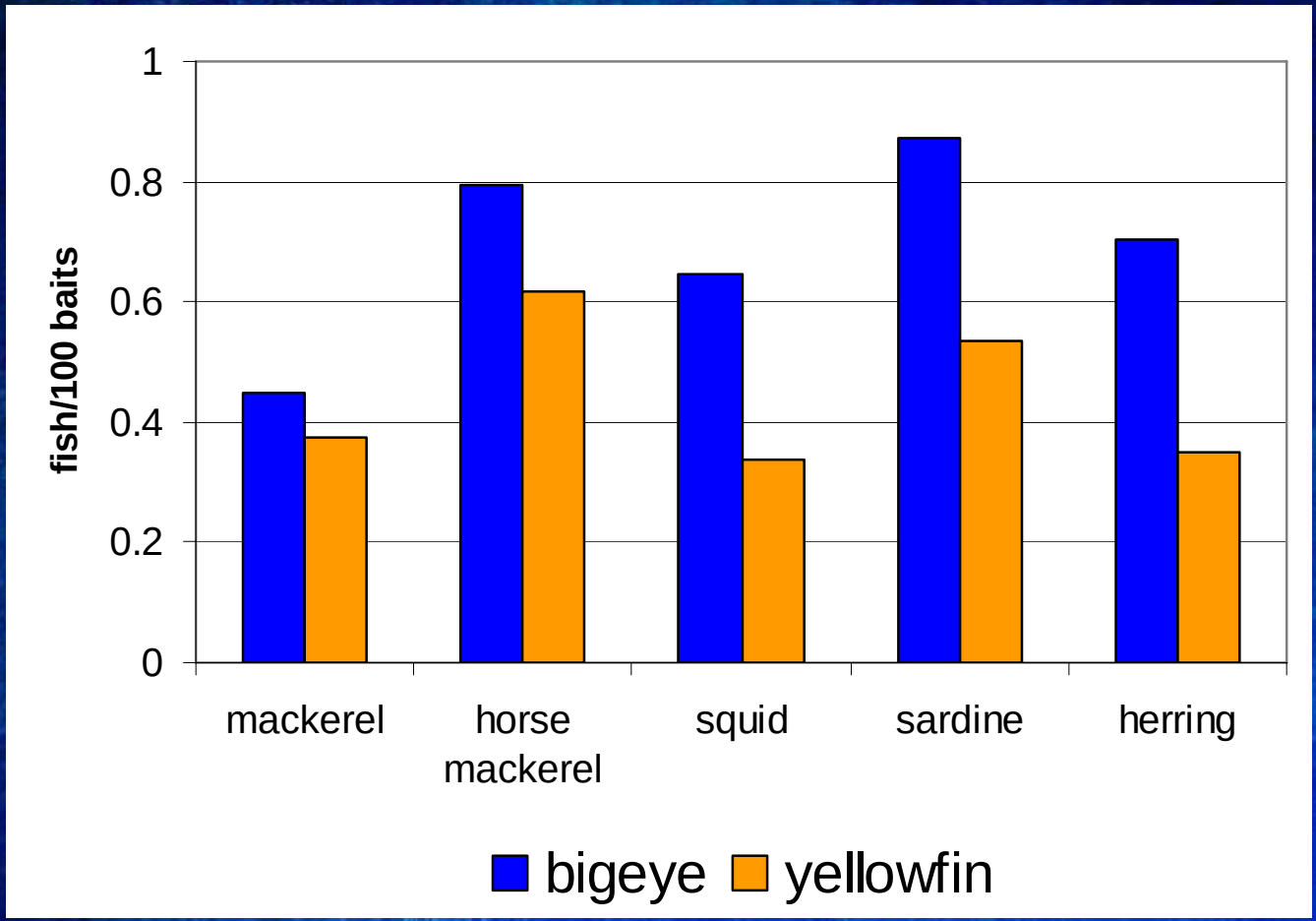
Horse mackerel

Squid

Sardine

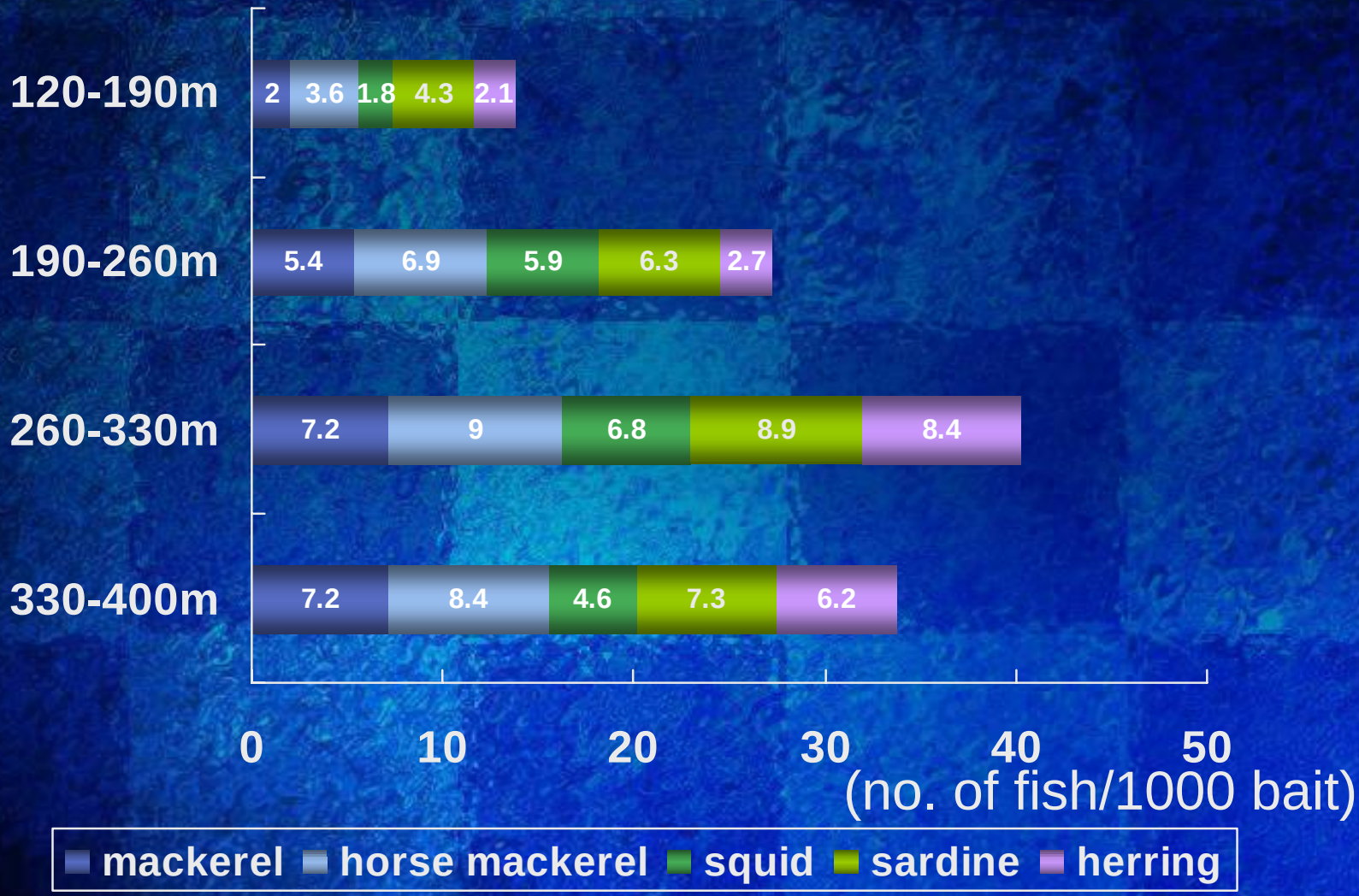
Herring

Results & Discussion



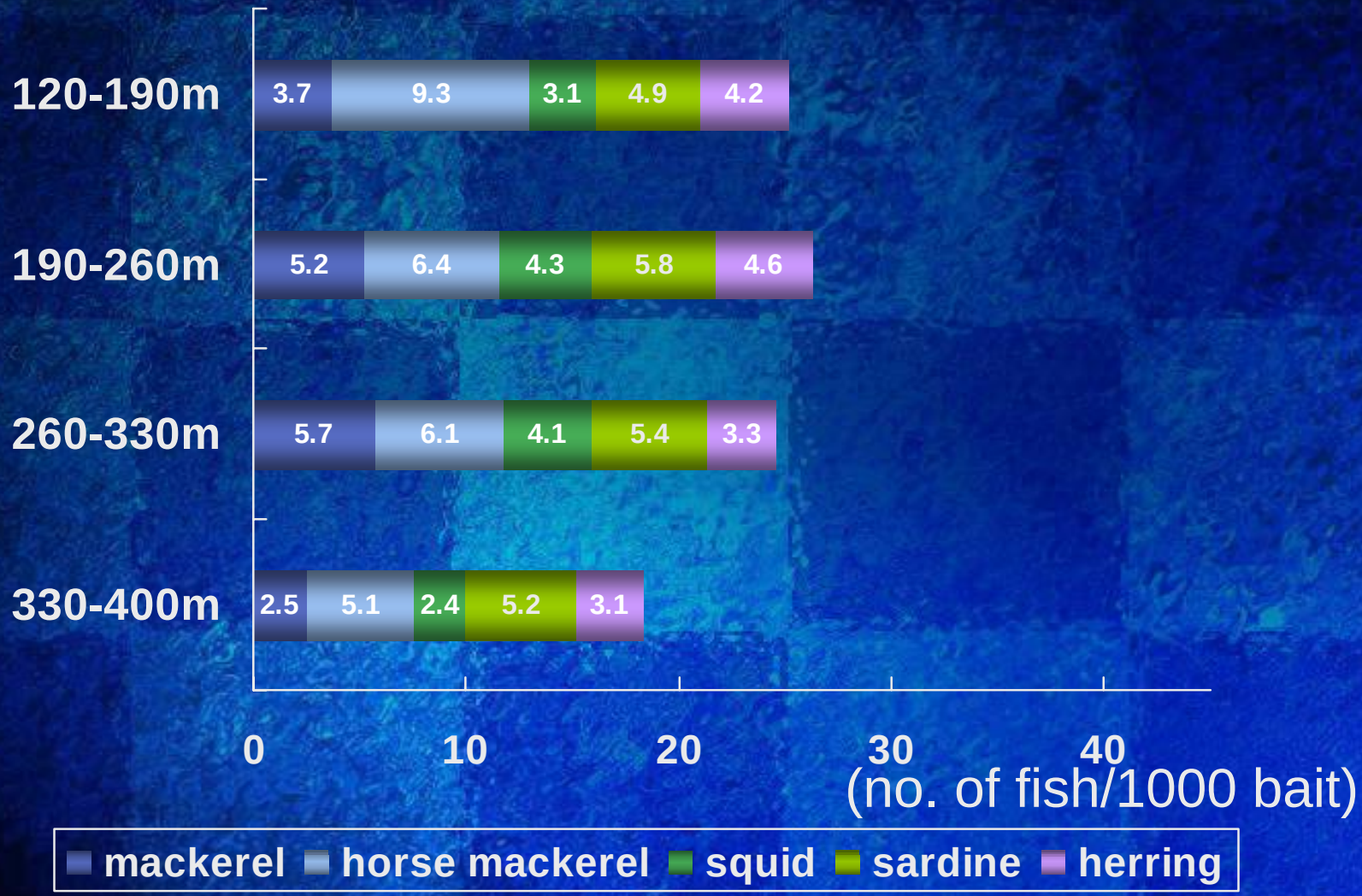
Results

☐ Bait selectivity of bigeye tuna



Results

☐ Bait selectivity of yellowfin tuna



Summary

- Sardine and horse mackerel are the efficient bait for bigeye and yellowfin tuna.
- The order of bait efficiency is not change even the depth difference in both species.