

**Processes of water exchange  
between coastal and open oceans,  
and their effects on plankton community  
and fish recruitments**

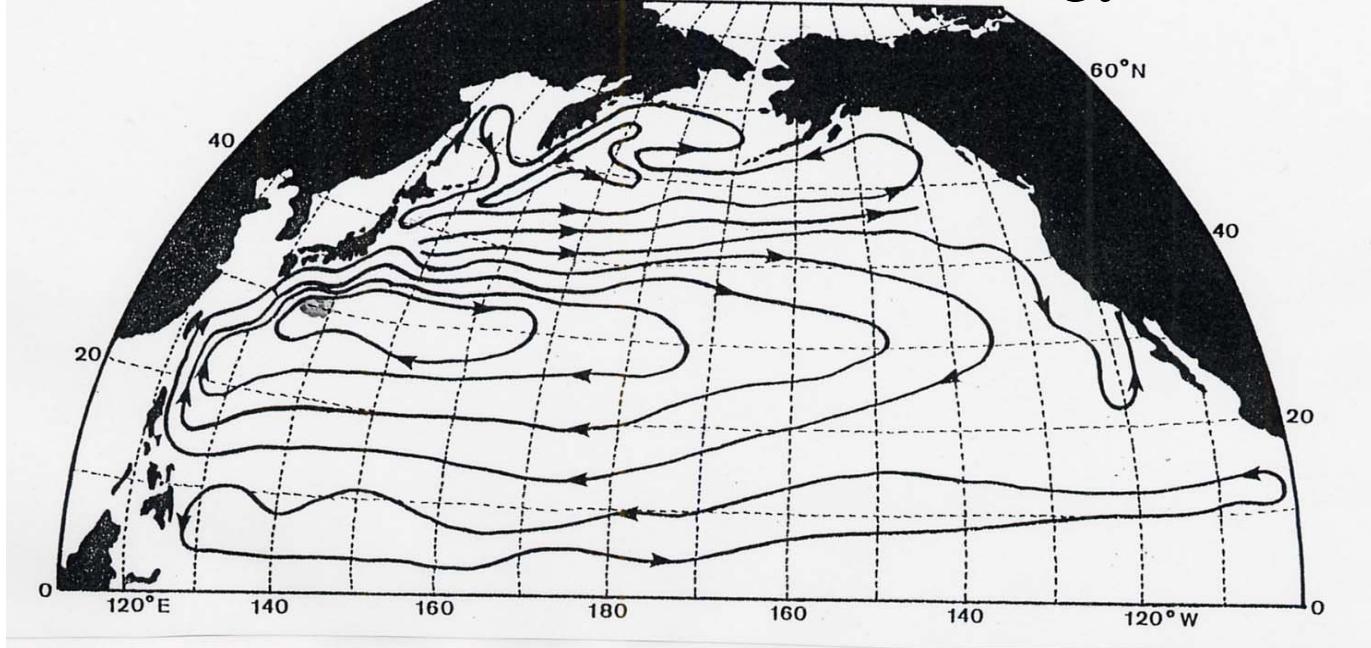
**-- focusing on the Kuroshio area –**

Takashige Sugimoto, Jun-Ichi Takeuchi  
and Takafumi Yoshida

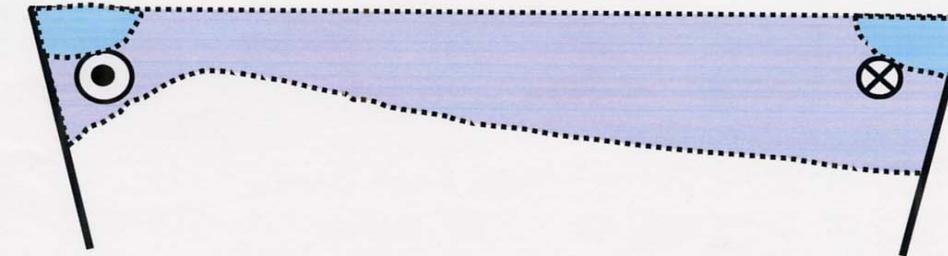
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- 1. Characteristics of the coastal boundary layers around the subtropical and subarctic gyres  
---- north-south and east-west comparison**
  
- 2. Characteristics of the KR's coastal boundary layers --- frontal eddies, intrusion of KR's warm water, and coastal circulations**
  
- 3. Effect of cross-shore water exchange on the plankton community, retention of larval fish and fish migration**

# Coastal boundaries around the ocean gyres

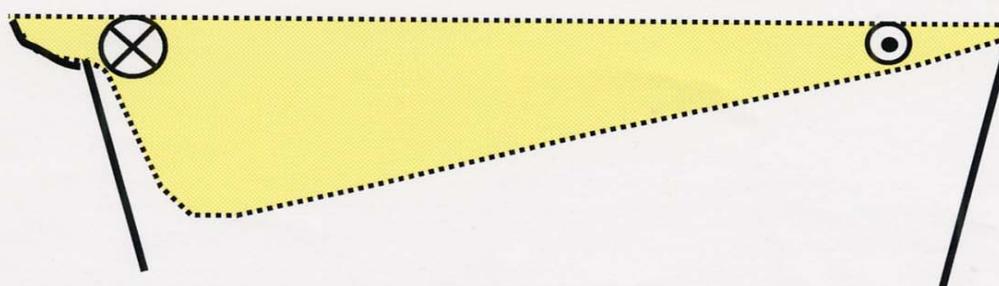


SAG



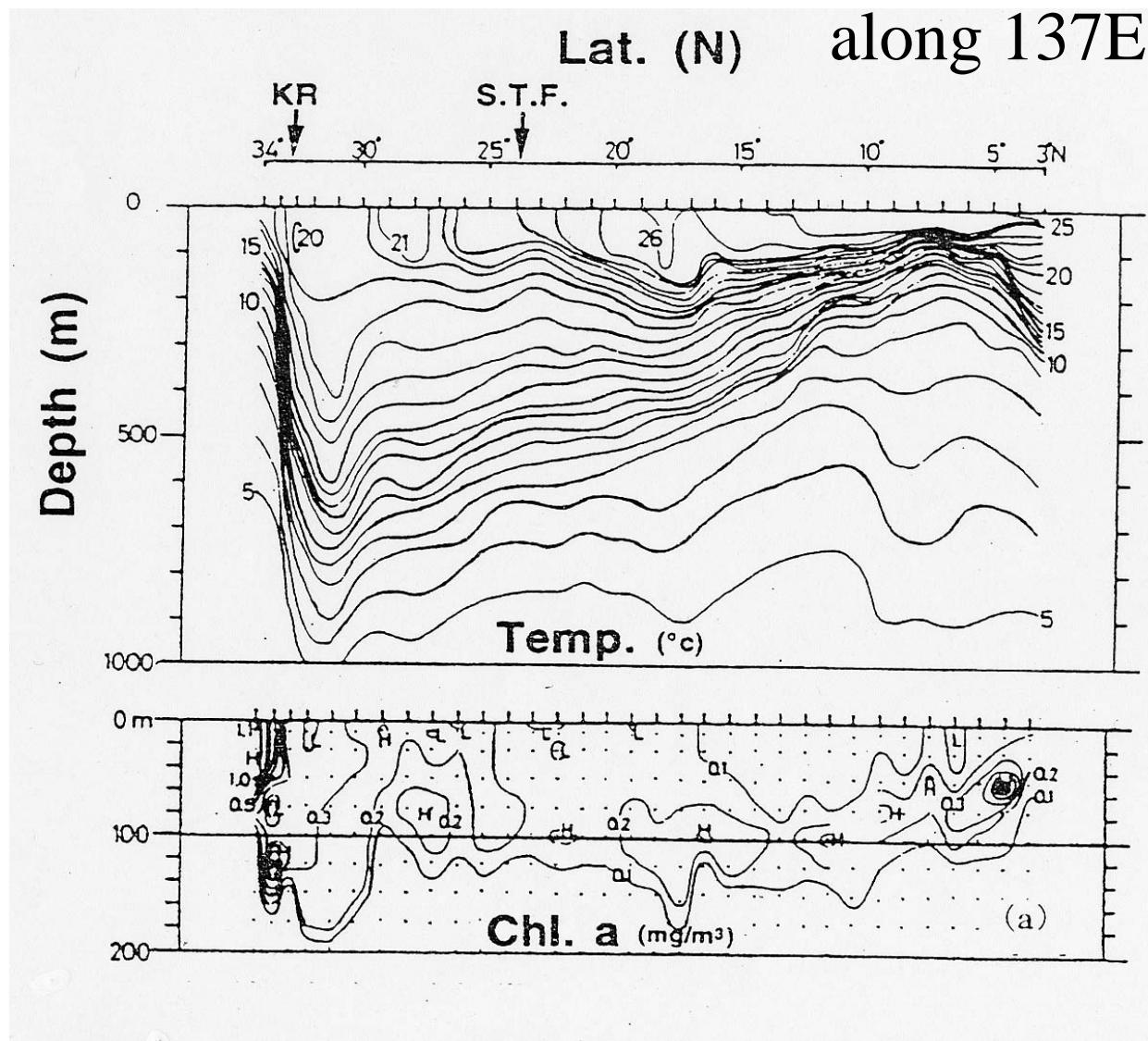
fresh water

STG

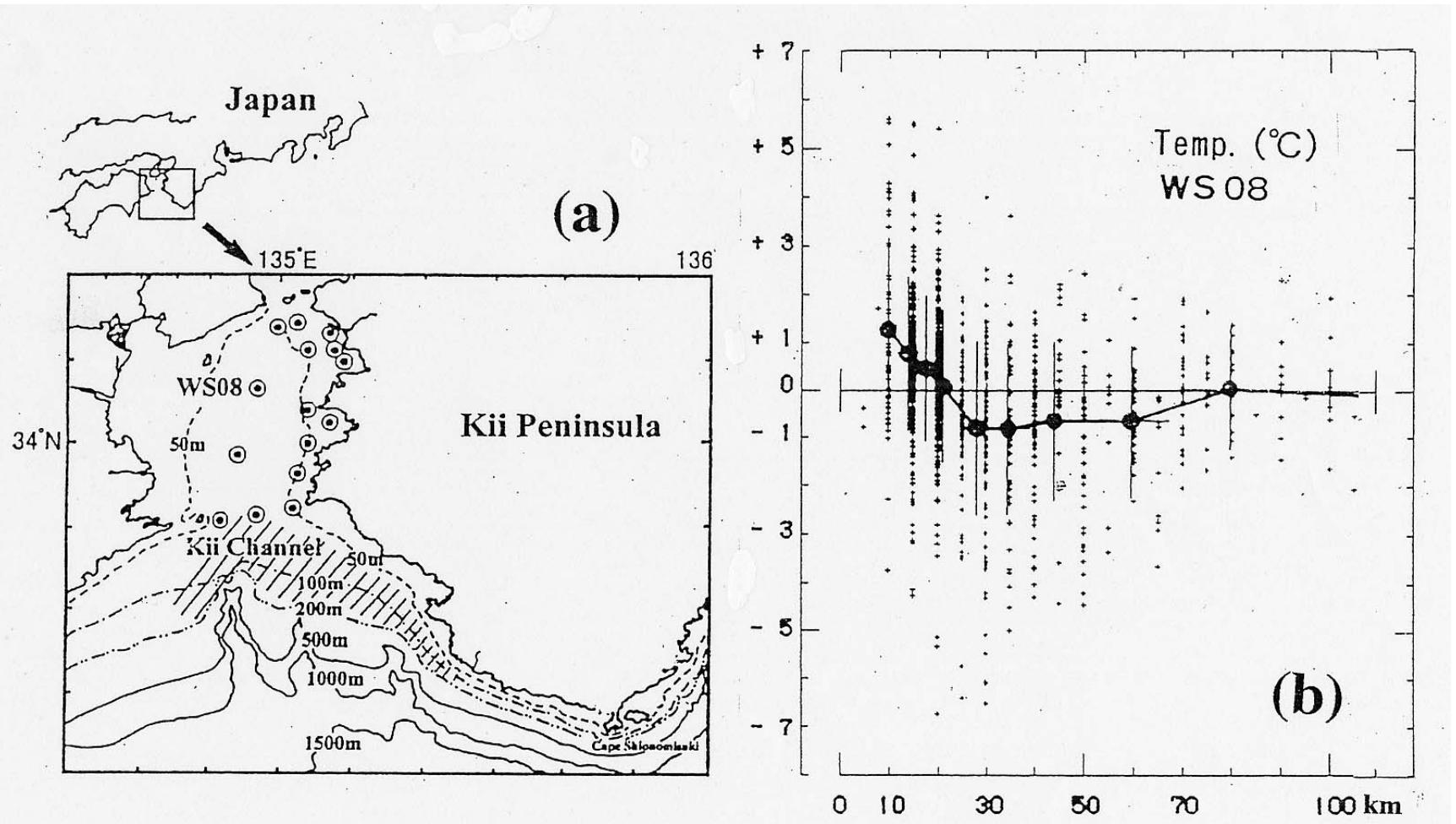


upwelling

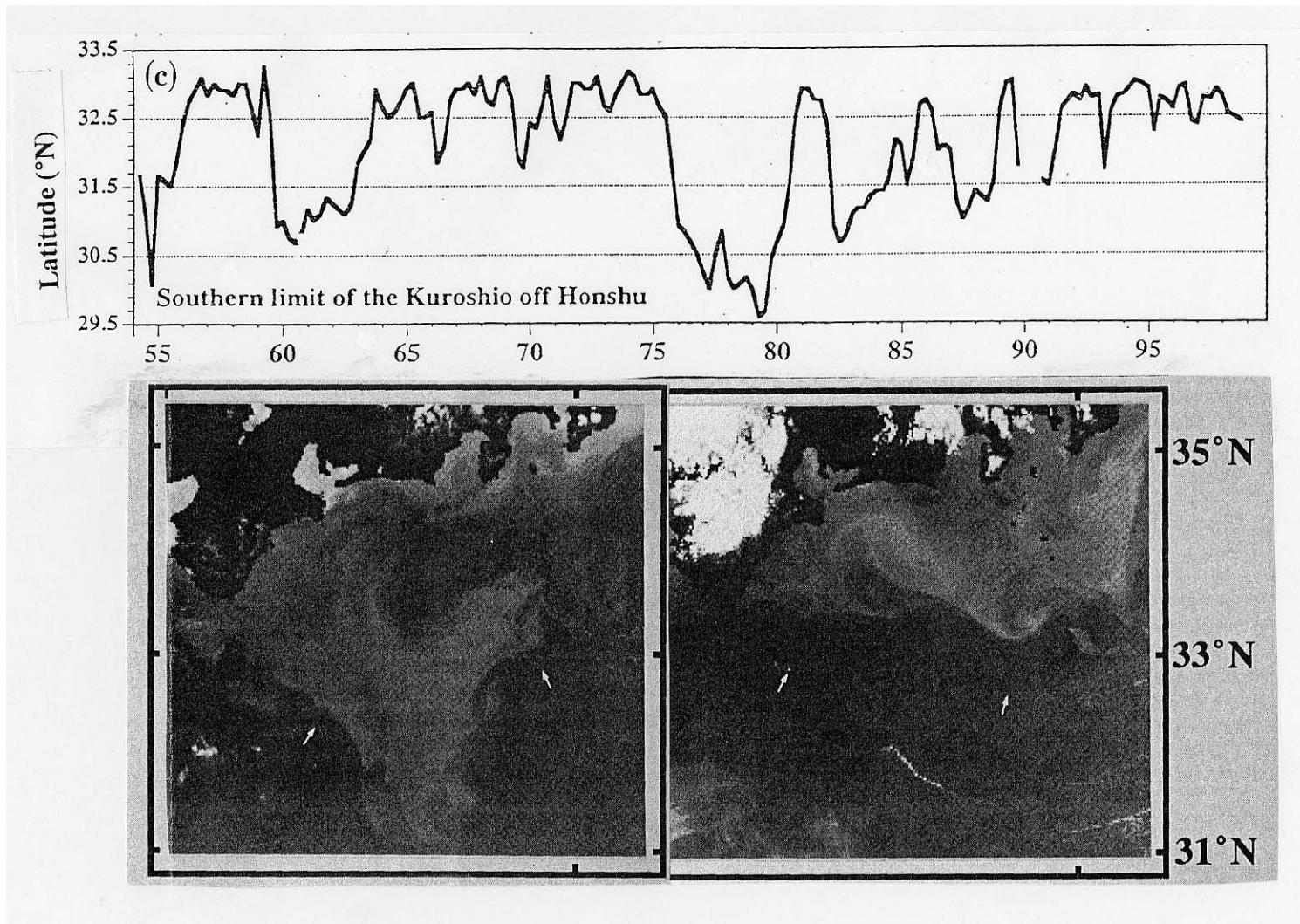
# Vertical section of water temperature and Chl-a



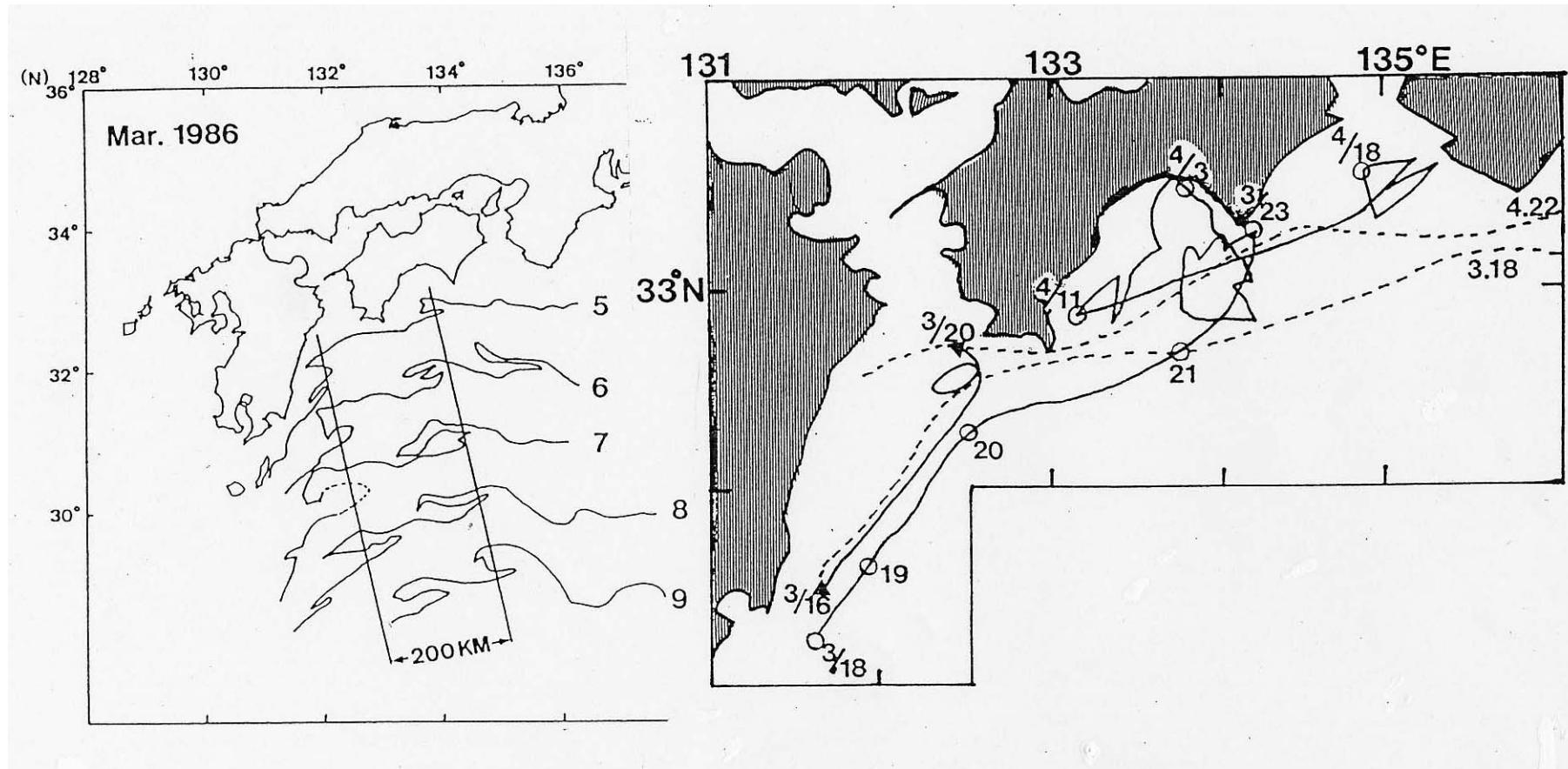
# Water temperature anomaly vs off-shore distance of the Kuroshio axis

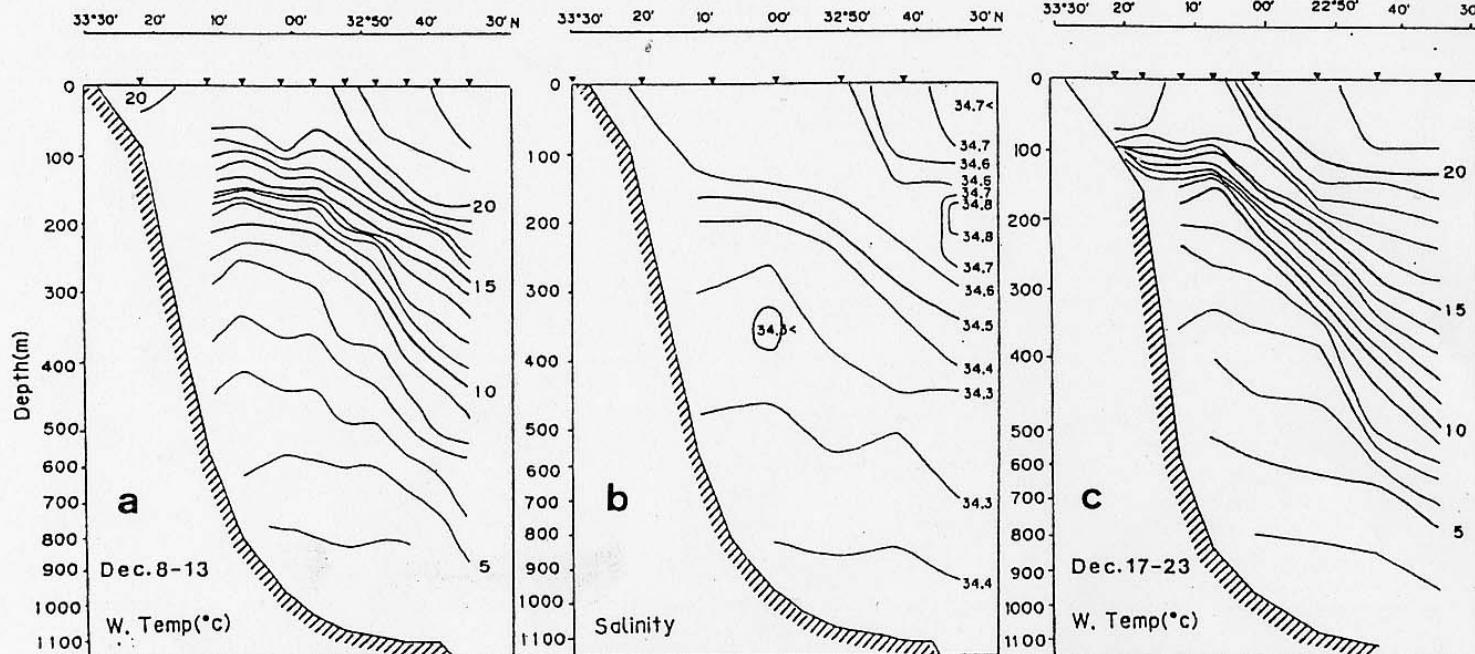
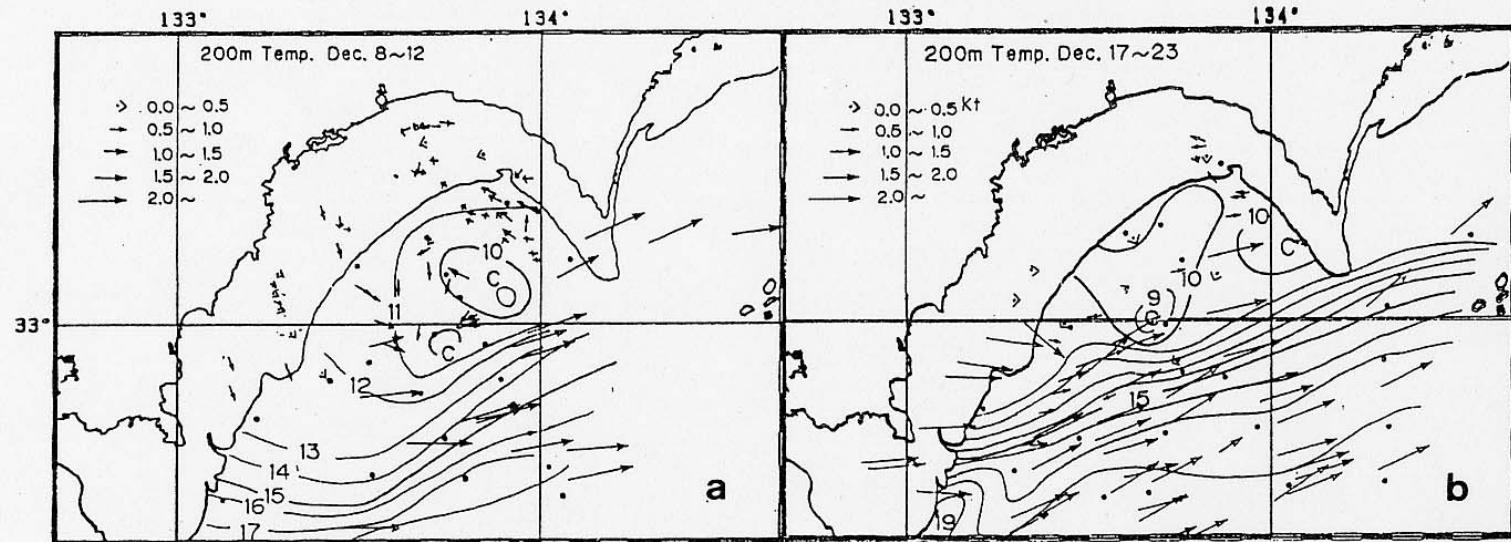


# Southernmost latitude of the Kuroshio axis south of Honshu



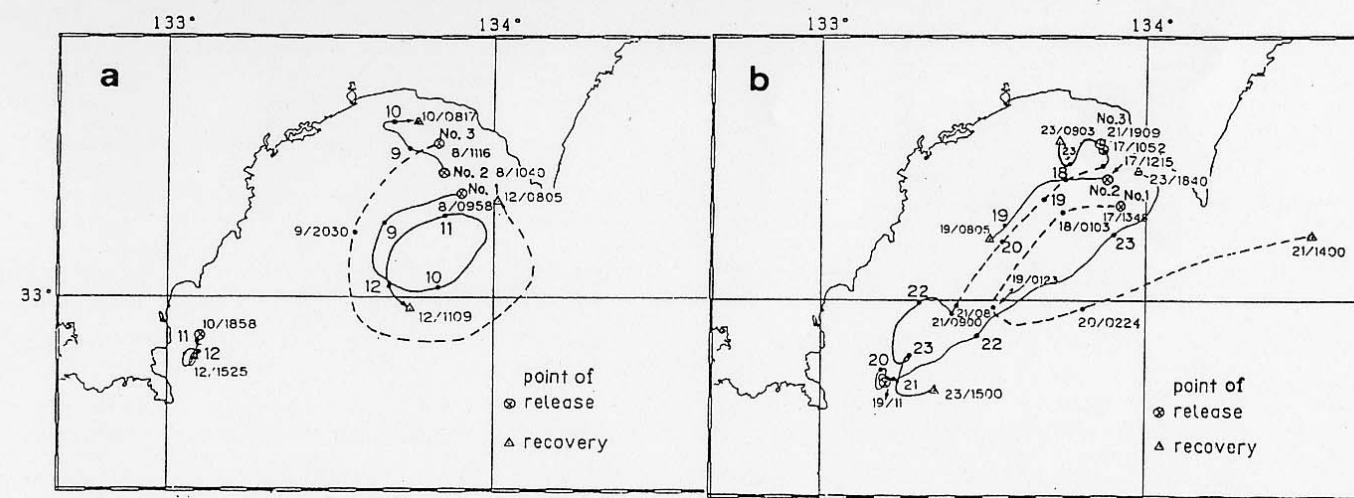
# Progression of frontal waves and coastal circulation



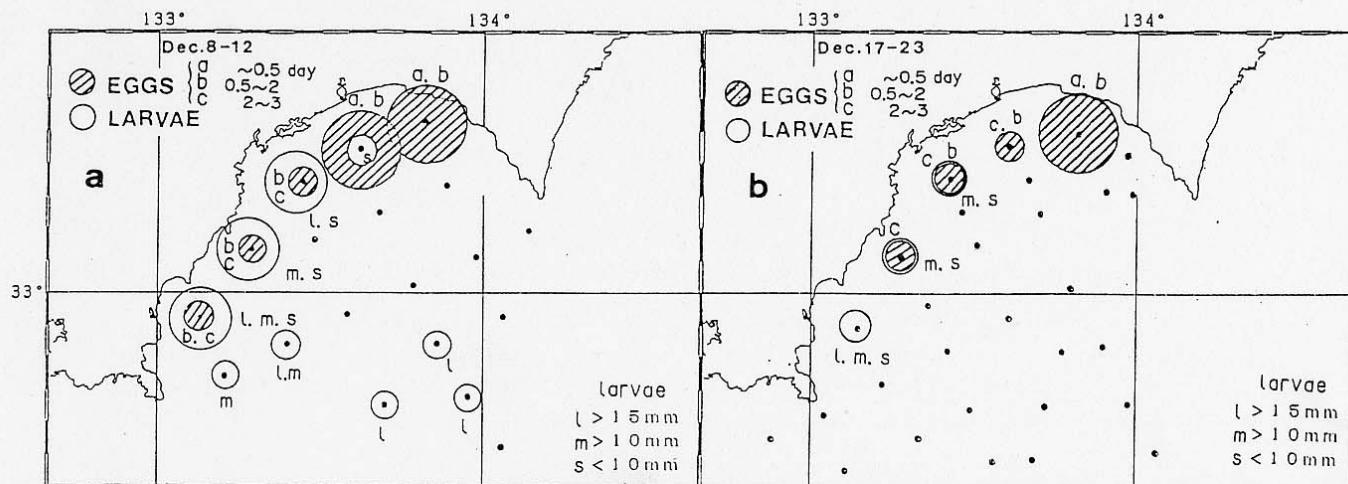


Vertical sections of the water temperature (a) and salinity (b) during the period of Dec. 8~12, and that of water temperature during Dec. 17~23 (c).

# Coastal circulation and larval distribution

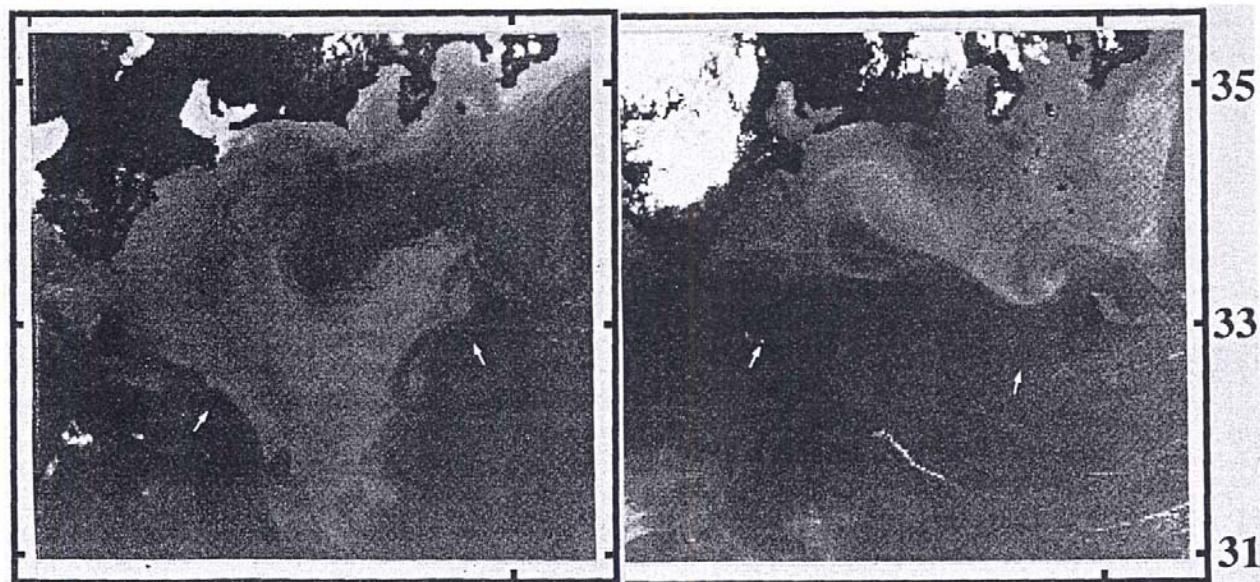
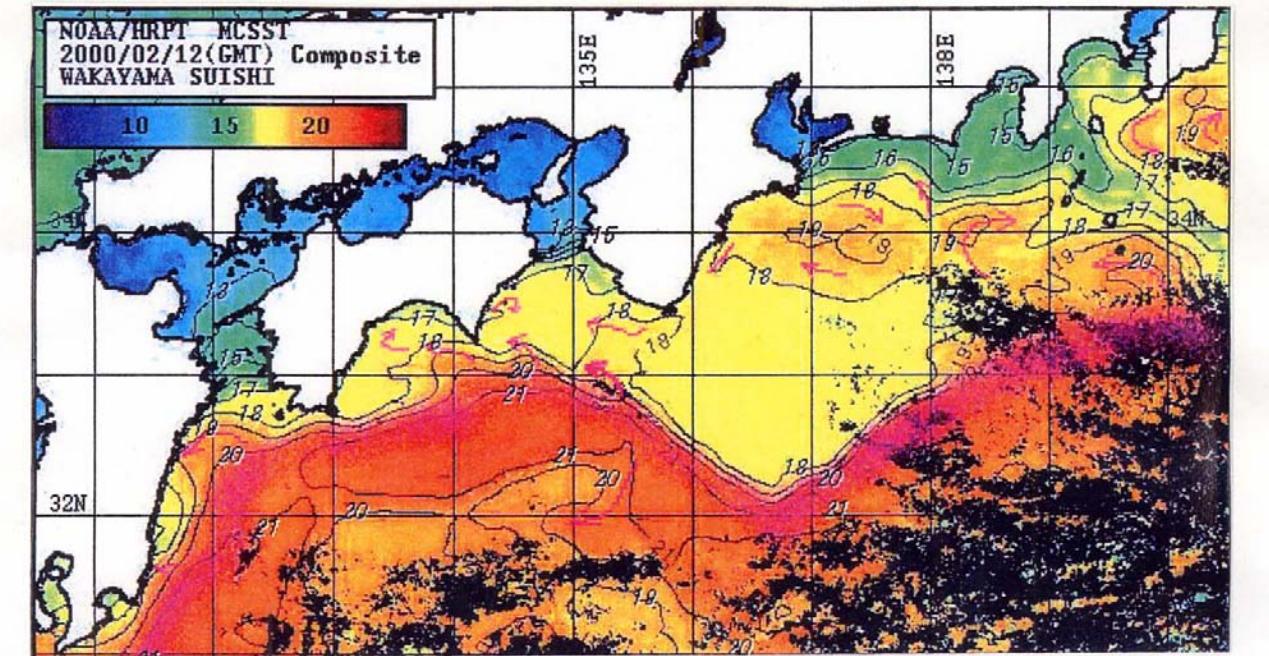


Paths of the drifting buoys tracked during Dec. 8~12(a) and Dec. 17~23(b). Solid lines were measured by loran-C and dashed lines indicate estimated paths. Small numerals indicate day/time when drifters were released or recovered. Dots and larger numerals indicate the position at 00:00 of each day.

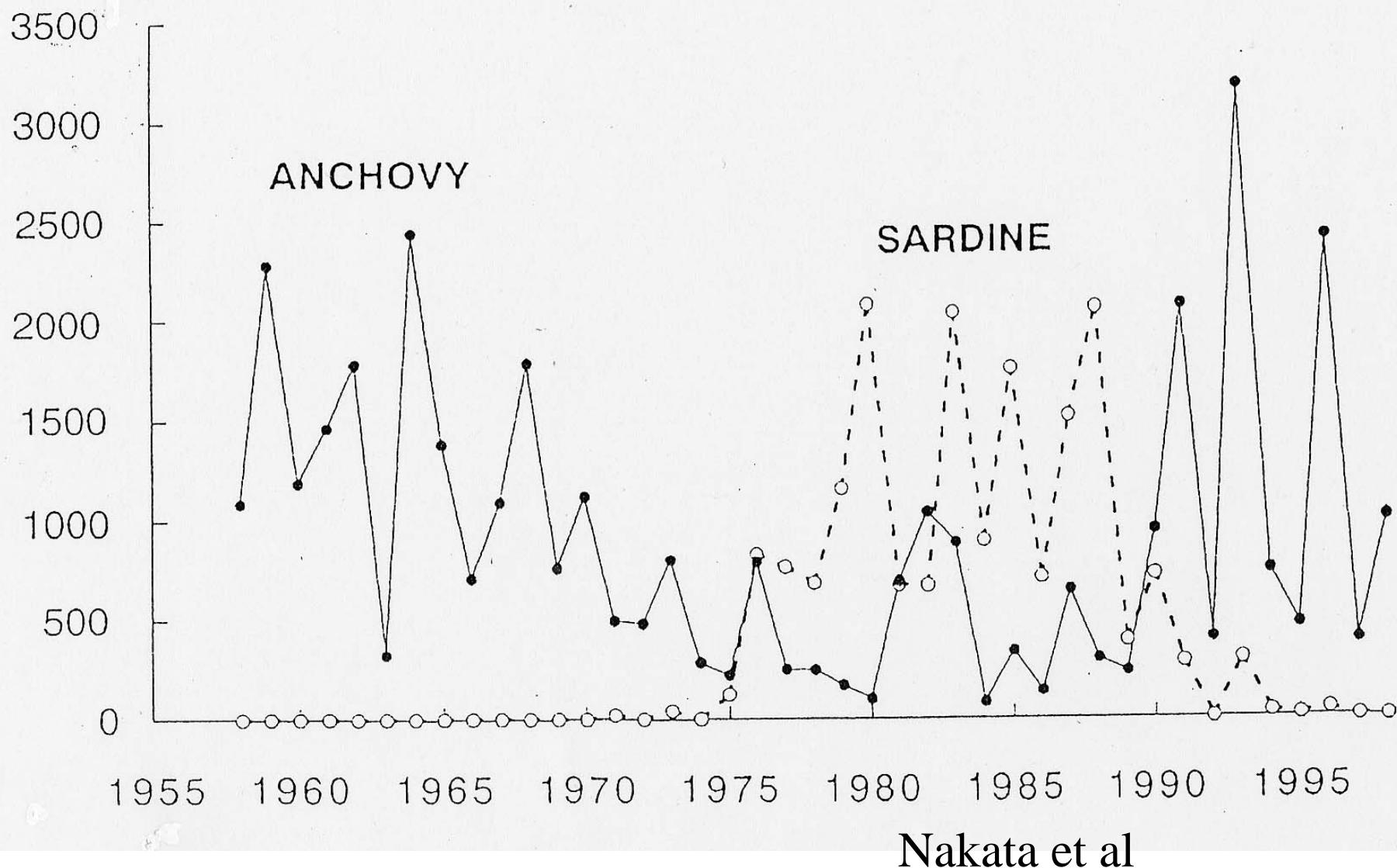


Distribution of sardine eggs and larvae of each stage, obtained Dec. 8~12 (a) and Dec. 17~23 (b). Large and small circles indicate catch amount qualitatively.

# SST distribution along the Kuroshio

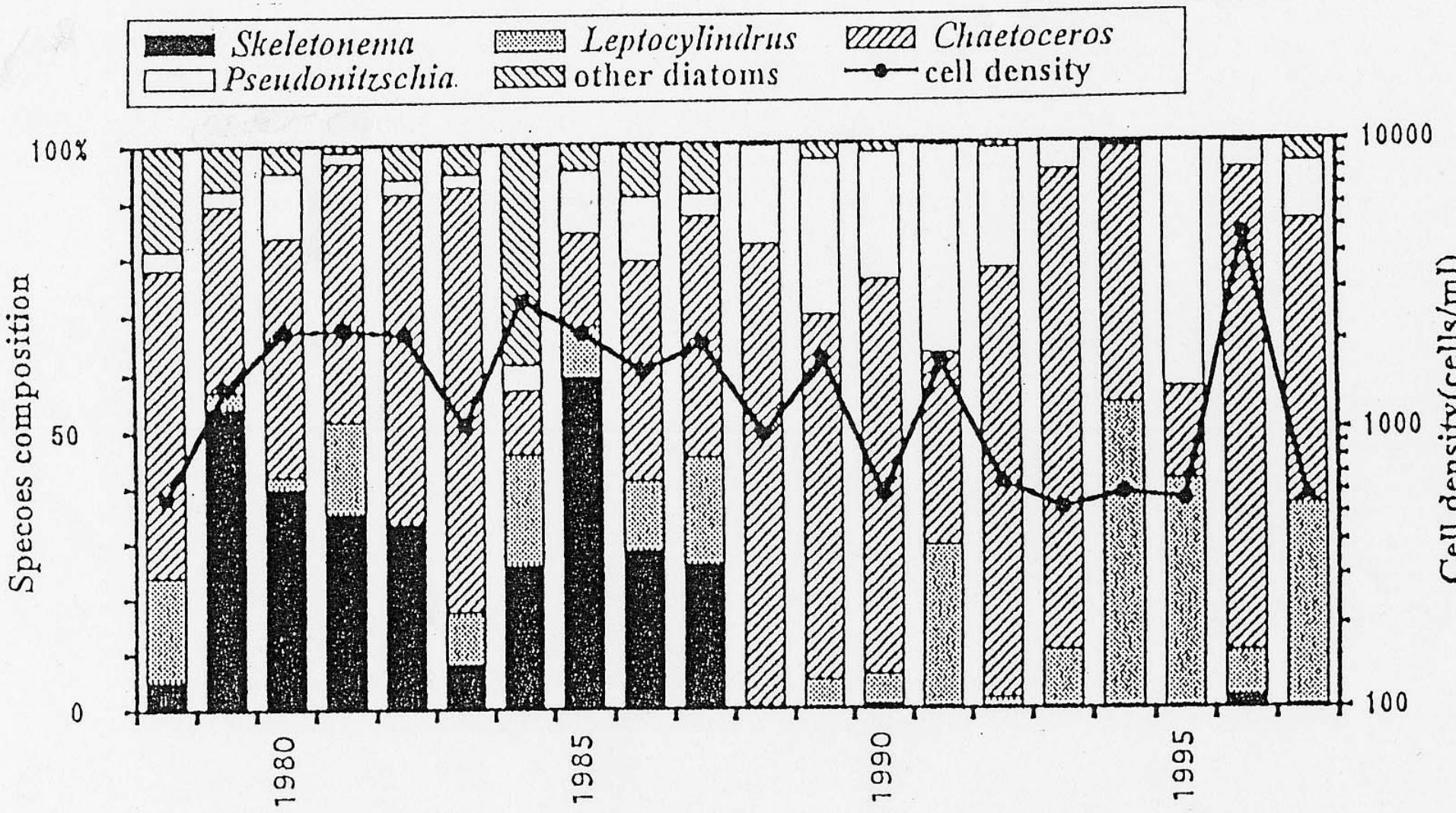


# Year-to-year variation of shirasu juvenile catch



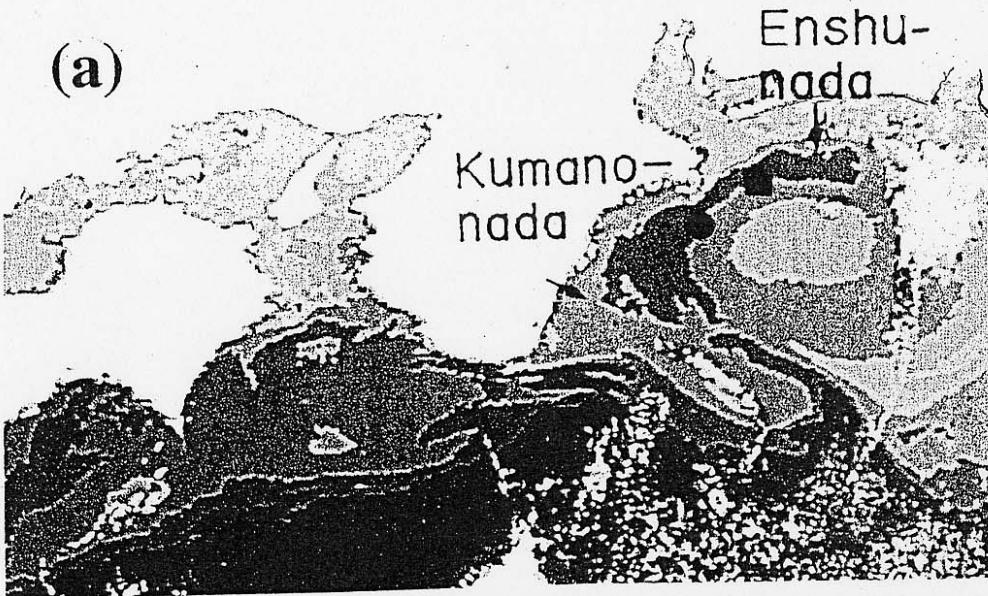
Nakata et al

# Temporal variation of phytoplankton



# Migration route and fishing ground of skip jack tuna

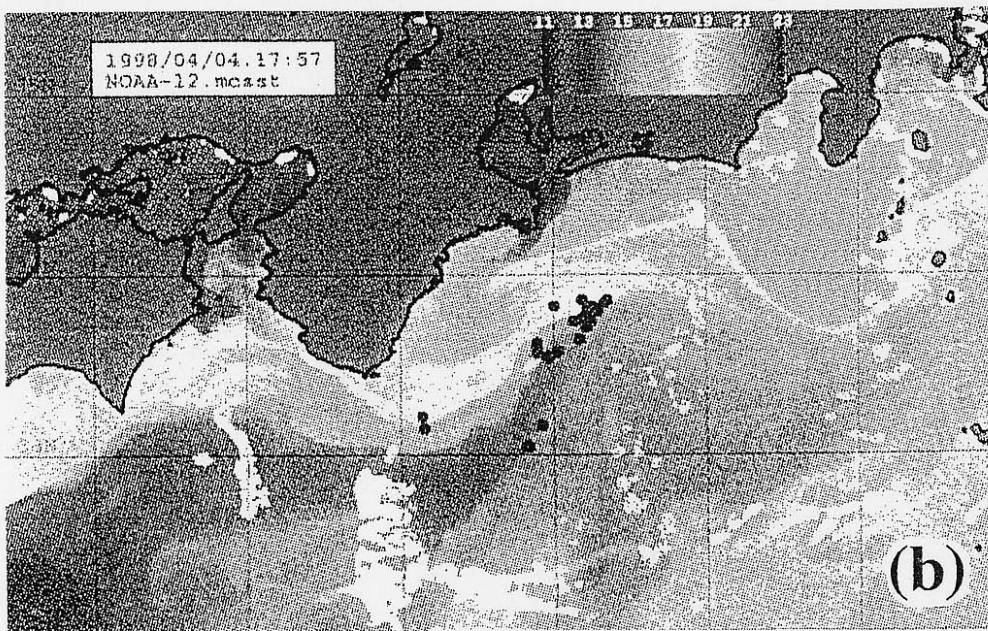
(a)



Enshu-  
nada

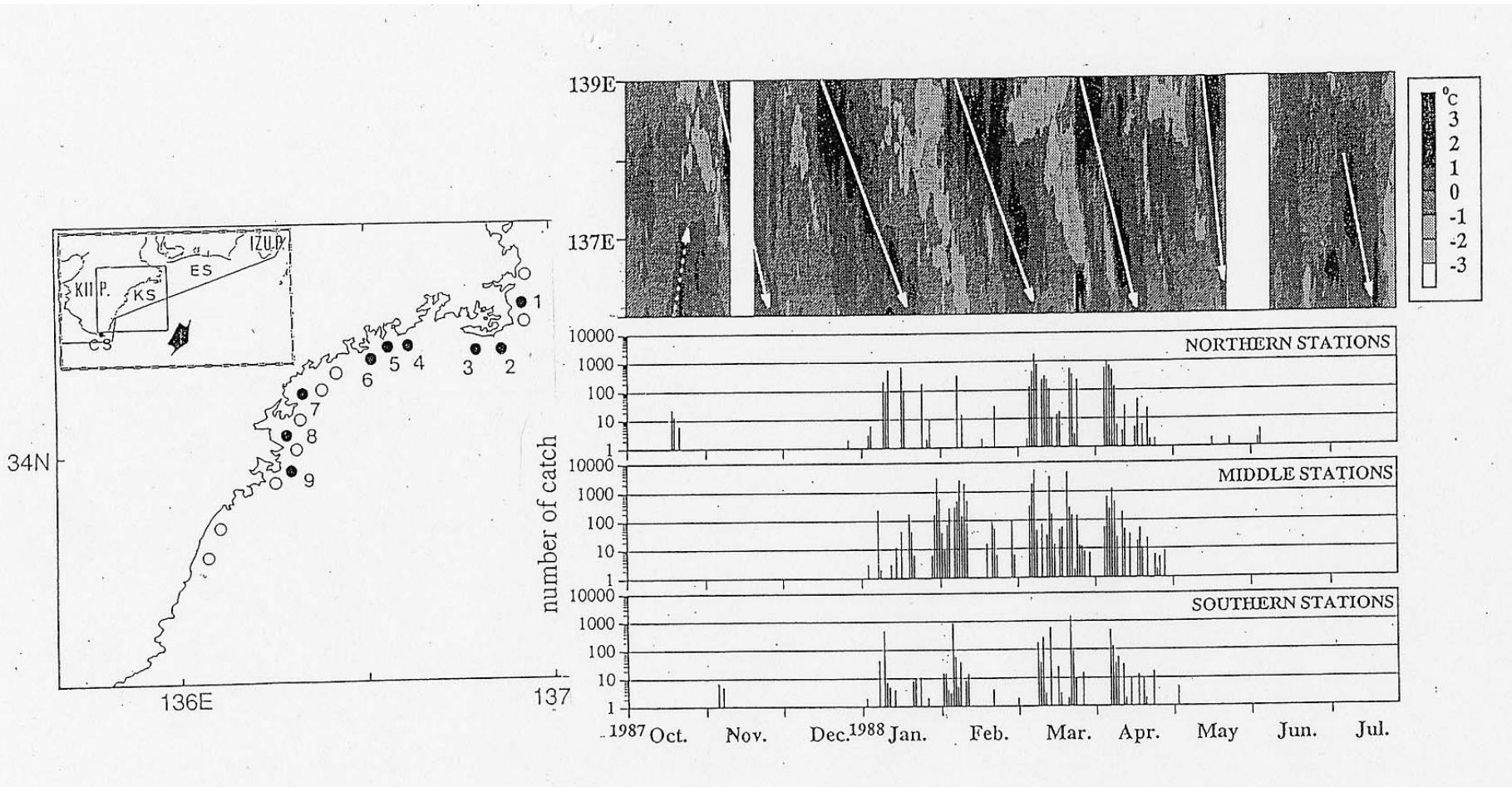
Kumano-  
nada

(b)

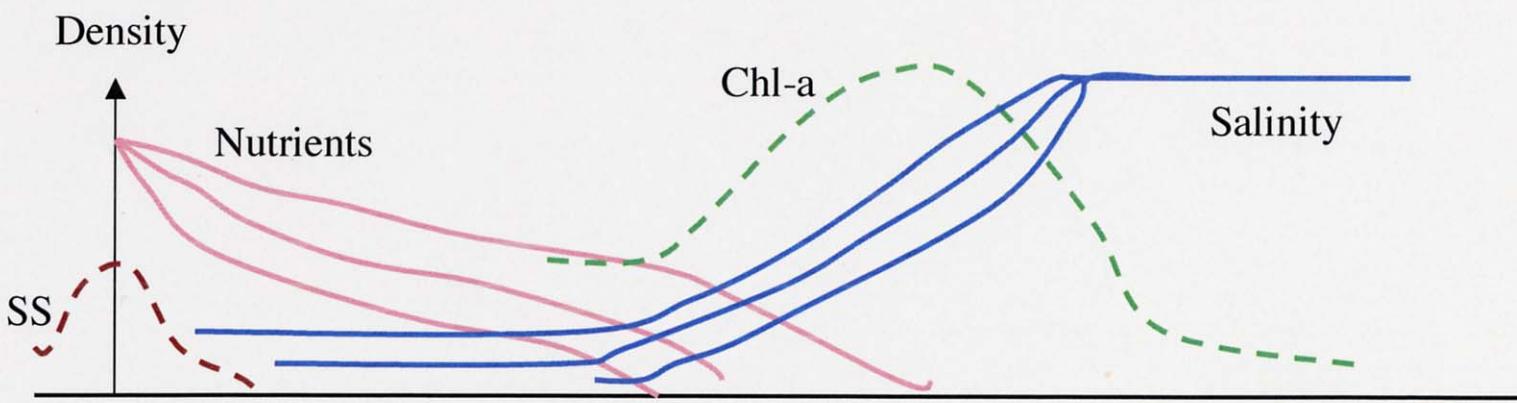
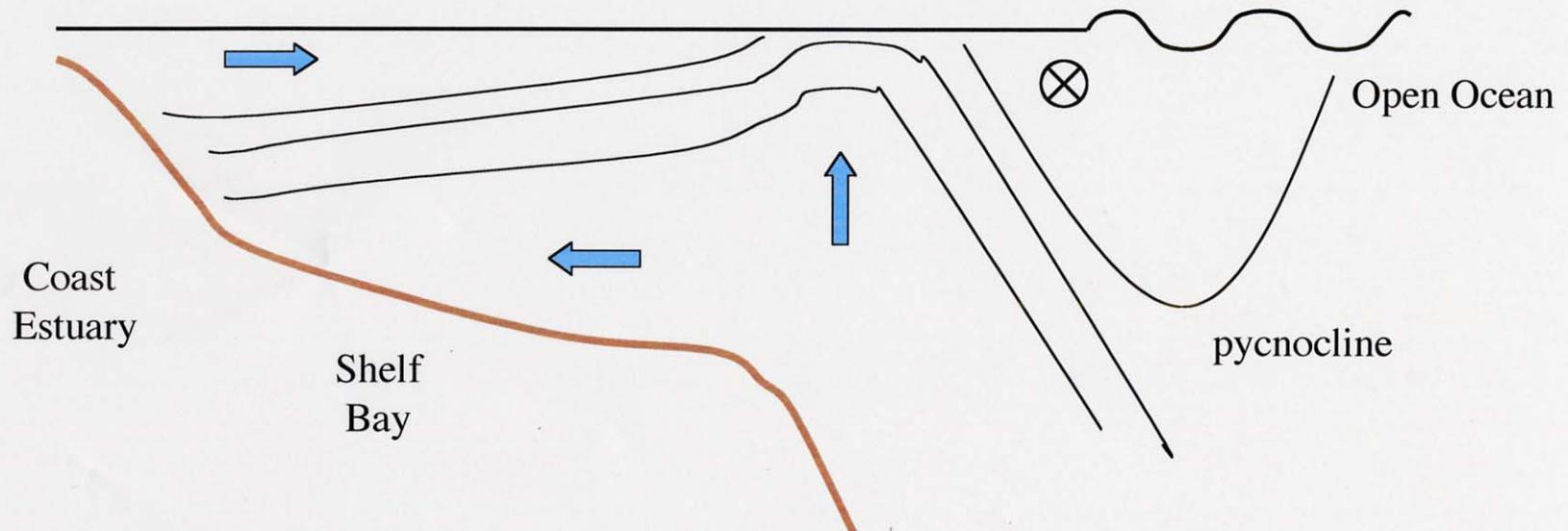


1998/04/04 17:57  
NOAA-12.mczst

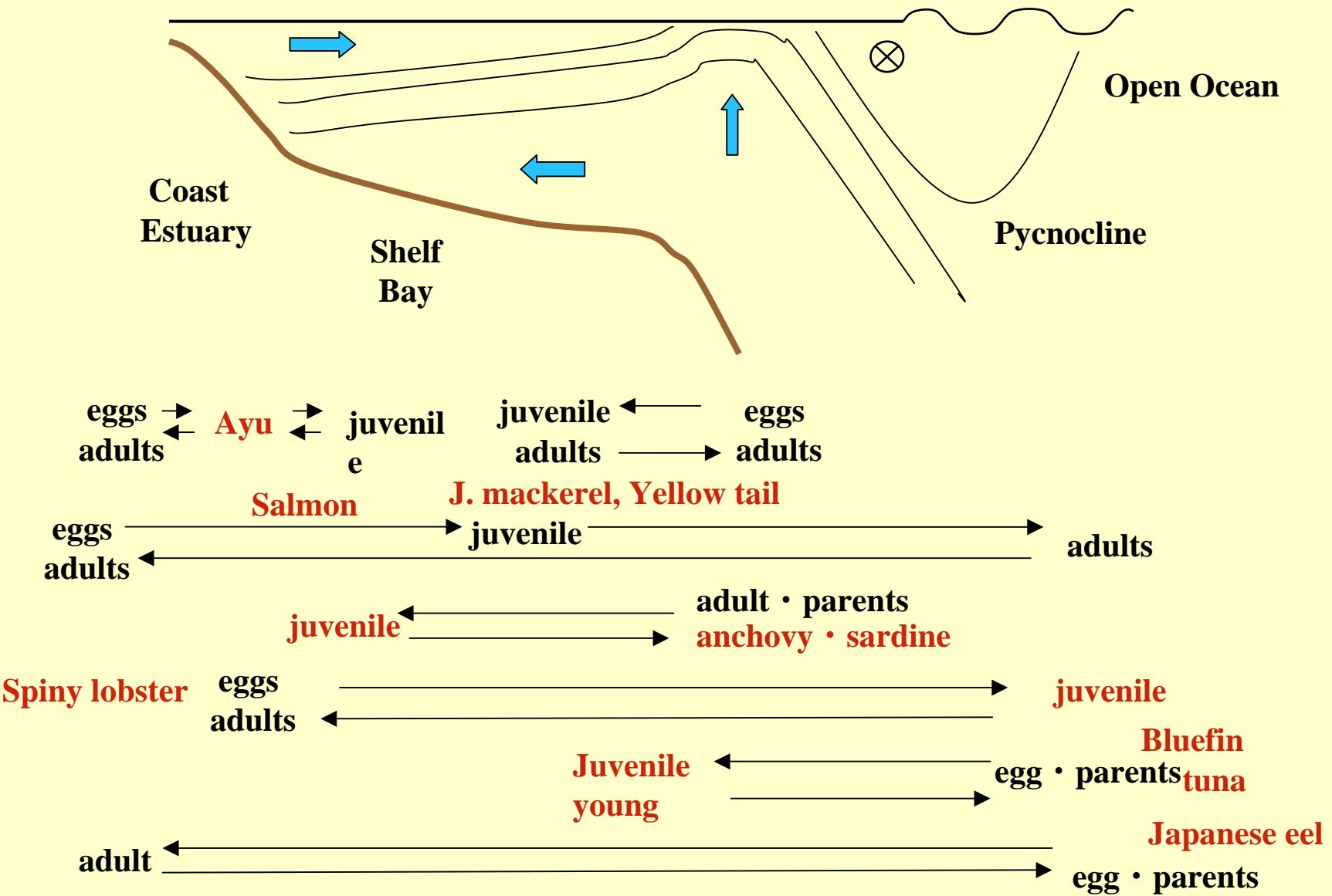
# Day-to-day variation of yellow tail catch

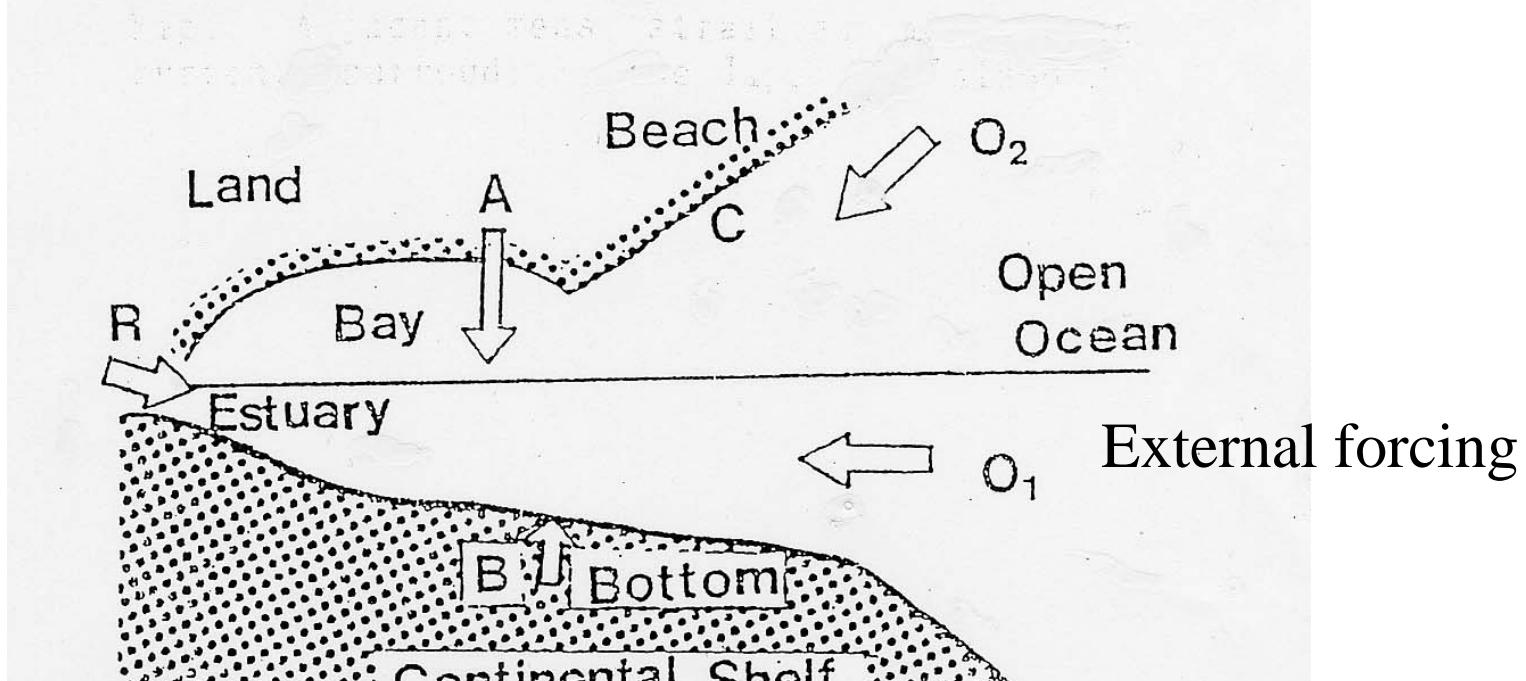
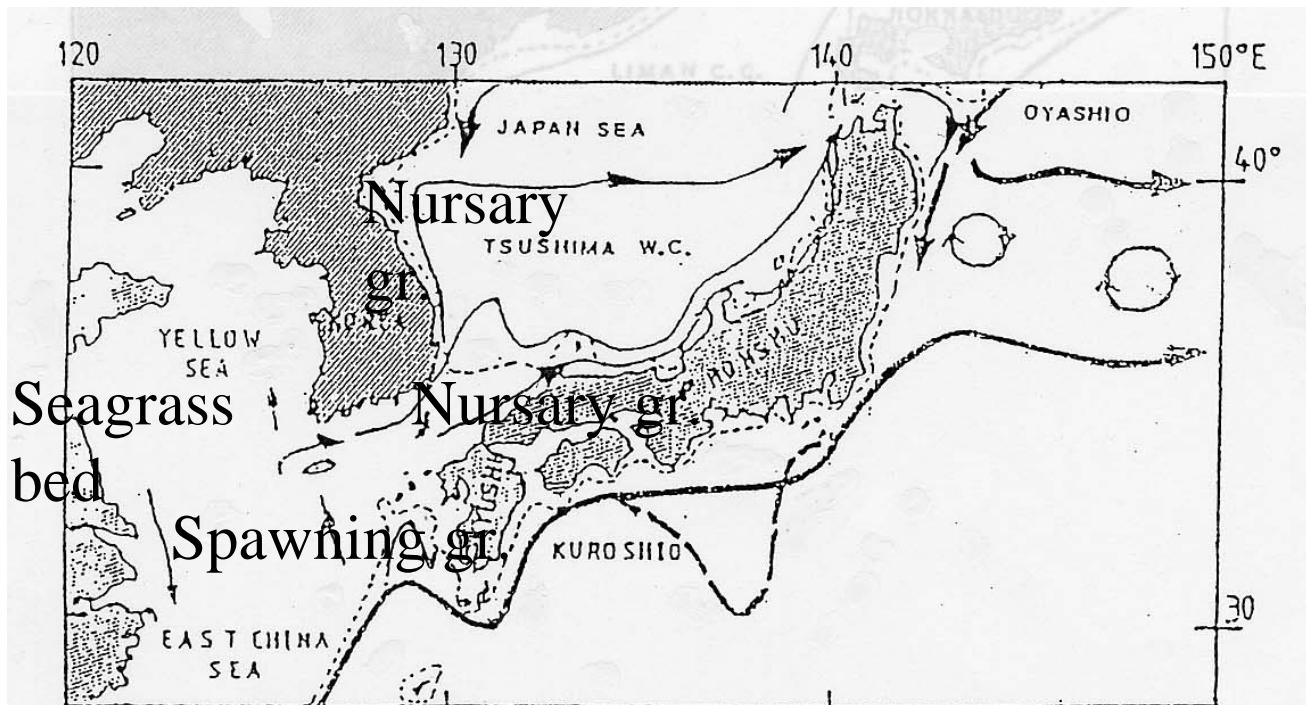


# Distribution of properties between coast and open ocean



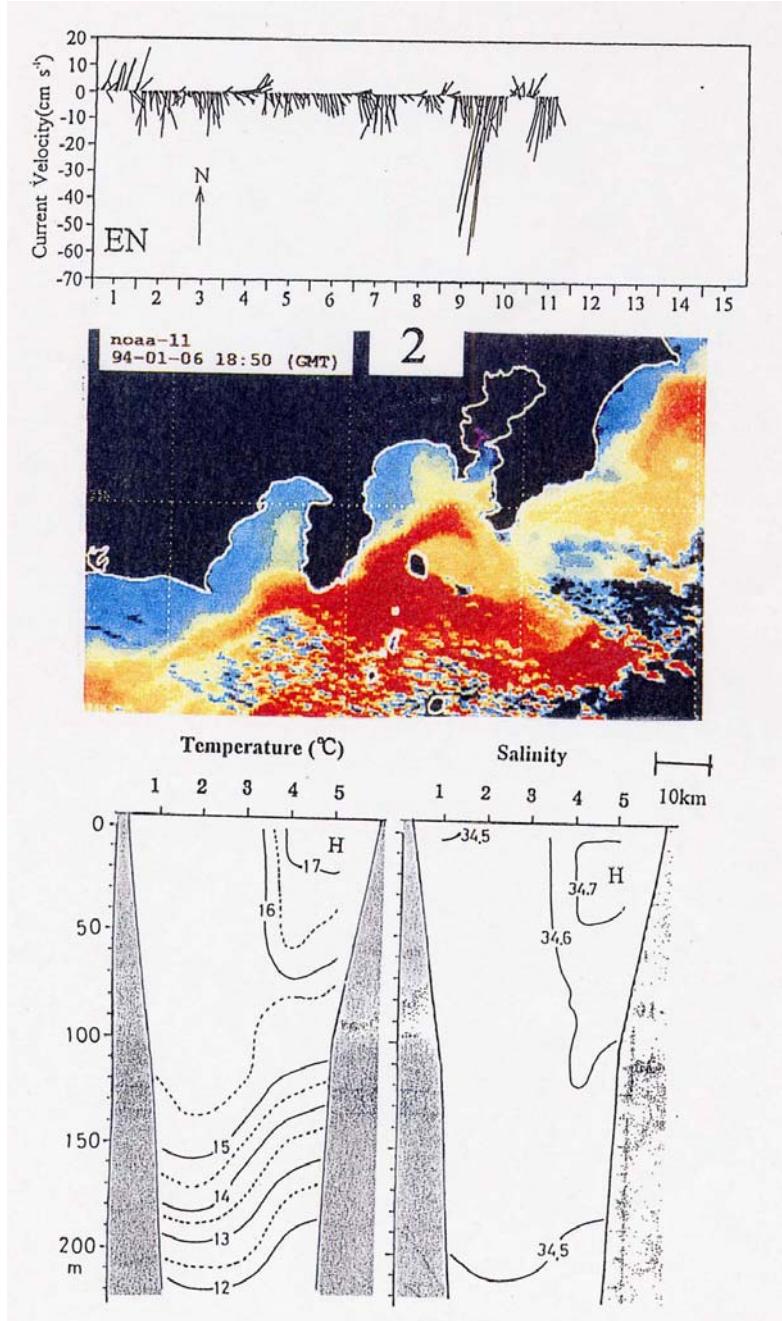
# Passive and active migration of fishes among rivers, coastal water and open ocean





# Conclusion

1. CBL of ocean gyres differ between E and W, and N and S. In the subarctic, CB density currents with low salinity water are important. In the subtropical region, upwelling associated with local and remote wind system, becomes dominant.
2. Cross-shore water exchange along the Kuroshio depends on 1) distance of the KR axis from the coast associated with meander, 2) frontal waves interacting with the coastal boundary geometry. Locally, coastal intrusions of warm/cold water are influential.
3. These cross-shore water exchange affect on the retention time of coastal water and their interannual-interdecadal variation. Furthermore, intensity of the intrusion of the offshore KR water onto the shelves or bays, affects on the species dominance of phytoplankton, zooplankton and small pelagic fish.
4. Role of drifting seaweeds on coastal-offshore linkage of biota.

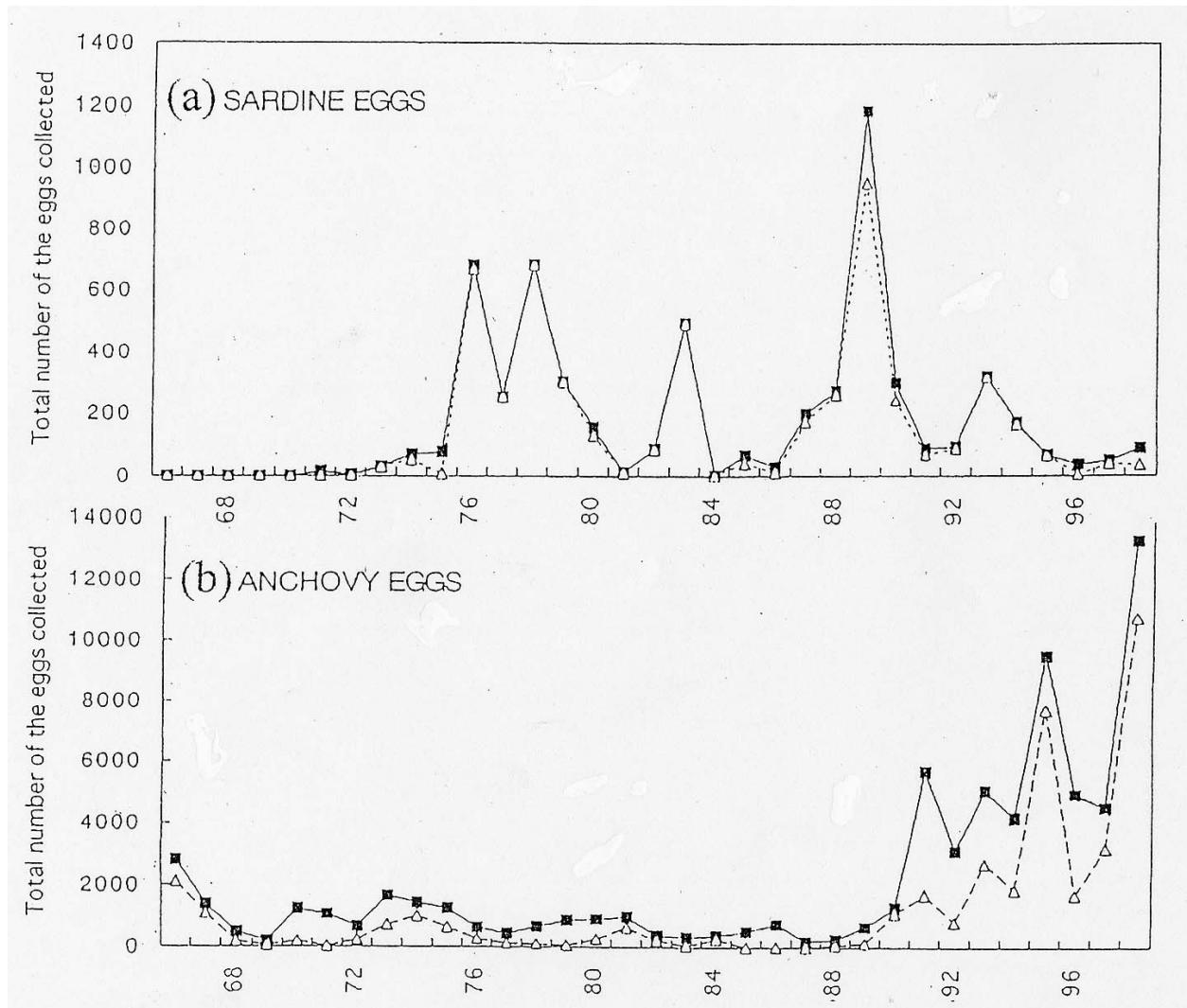


# Kyucho event

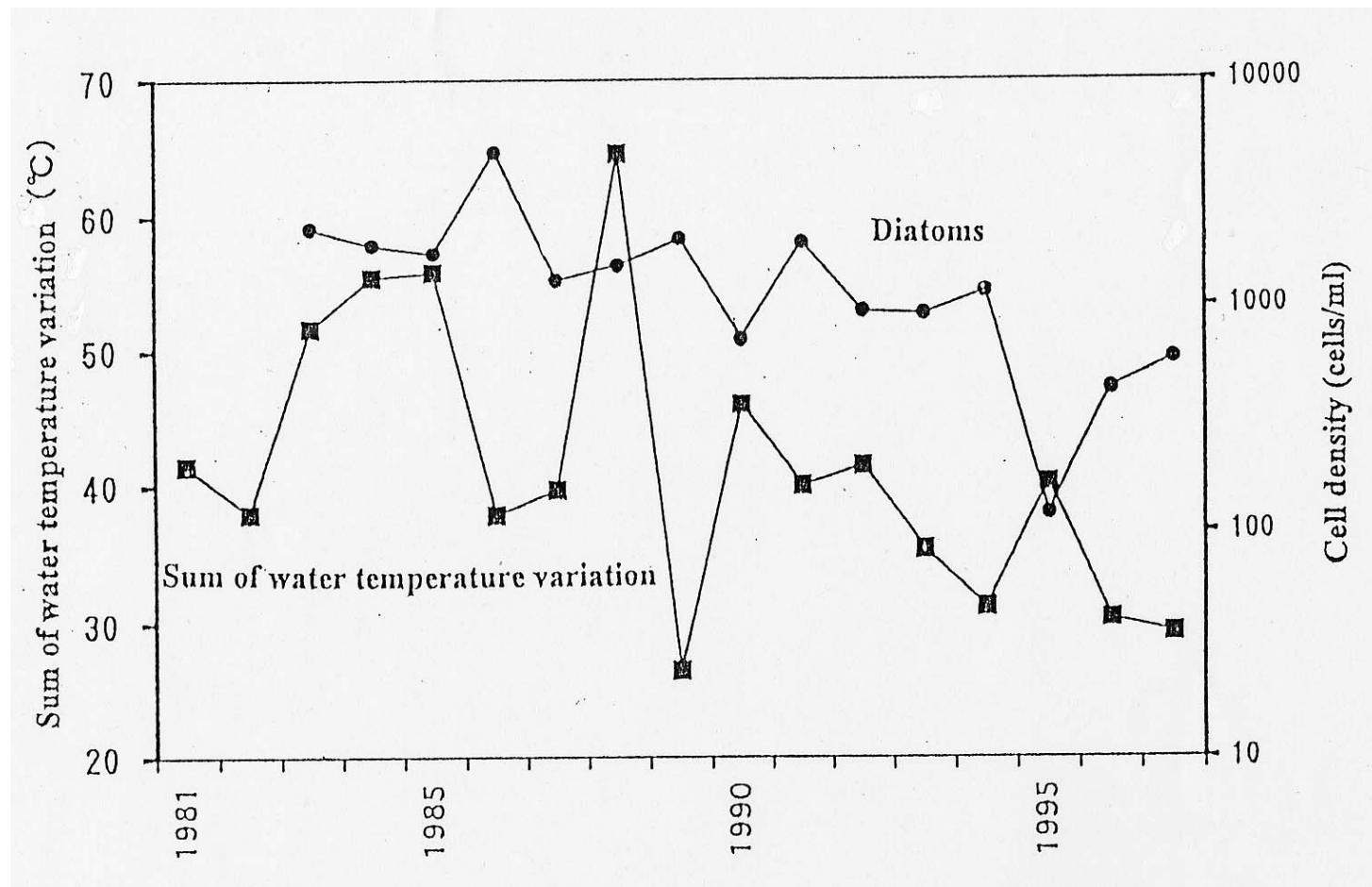
Temporal and spatial structures

Ishidoya et al.

# Temporal variation of egg quantities

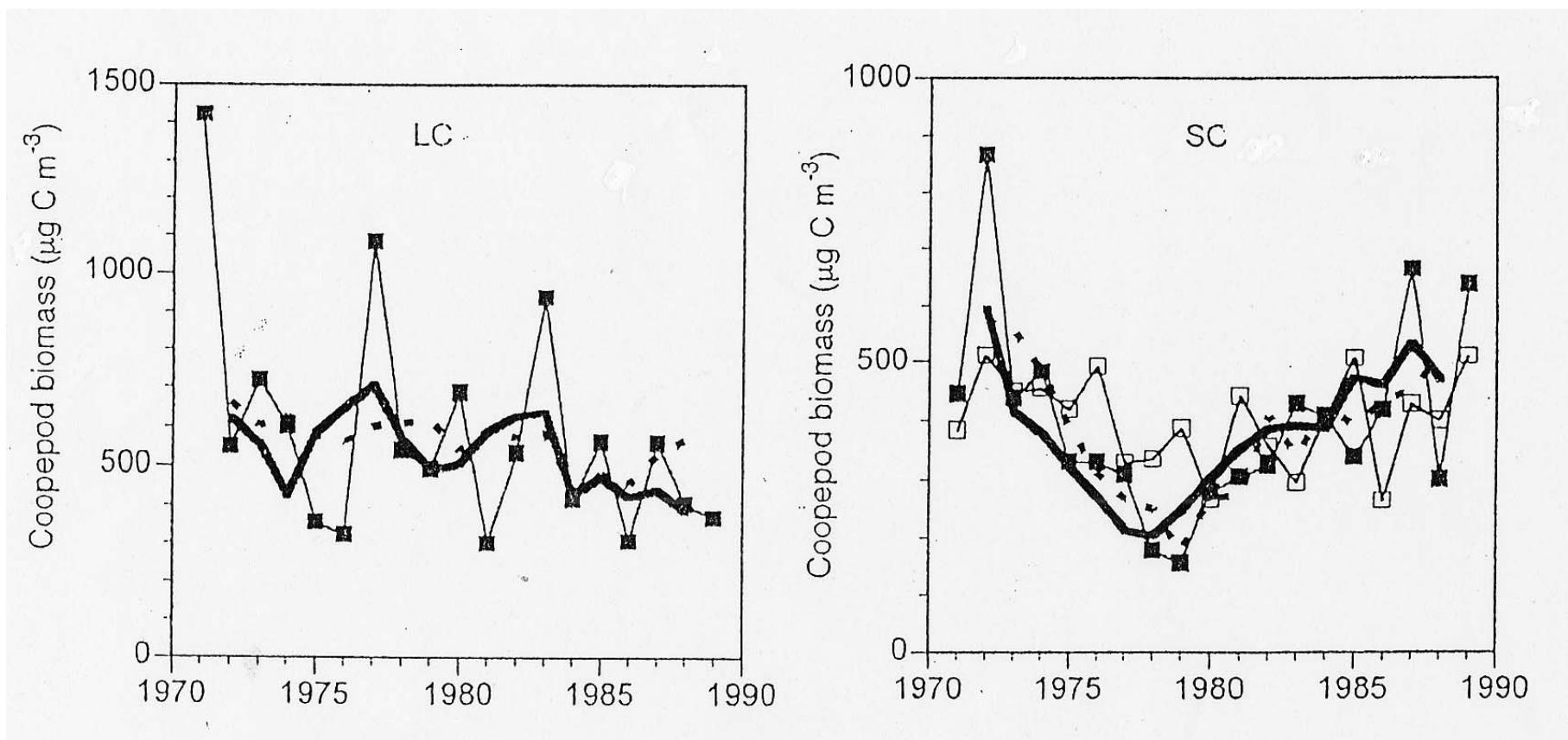


# Relation between diatom density and water temperature

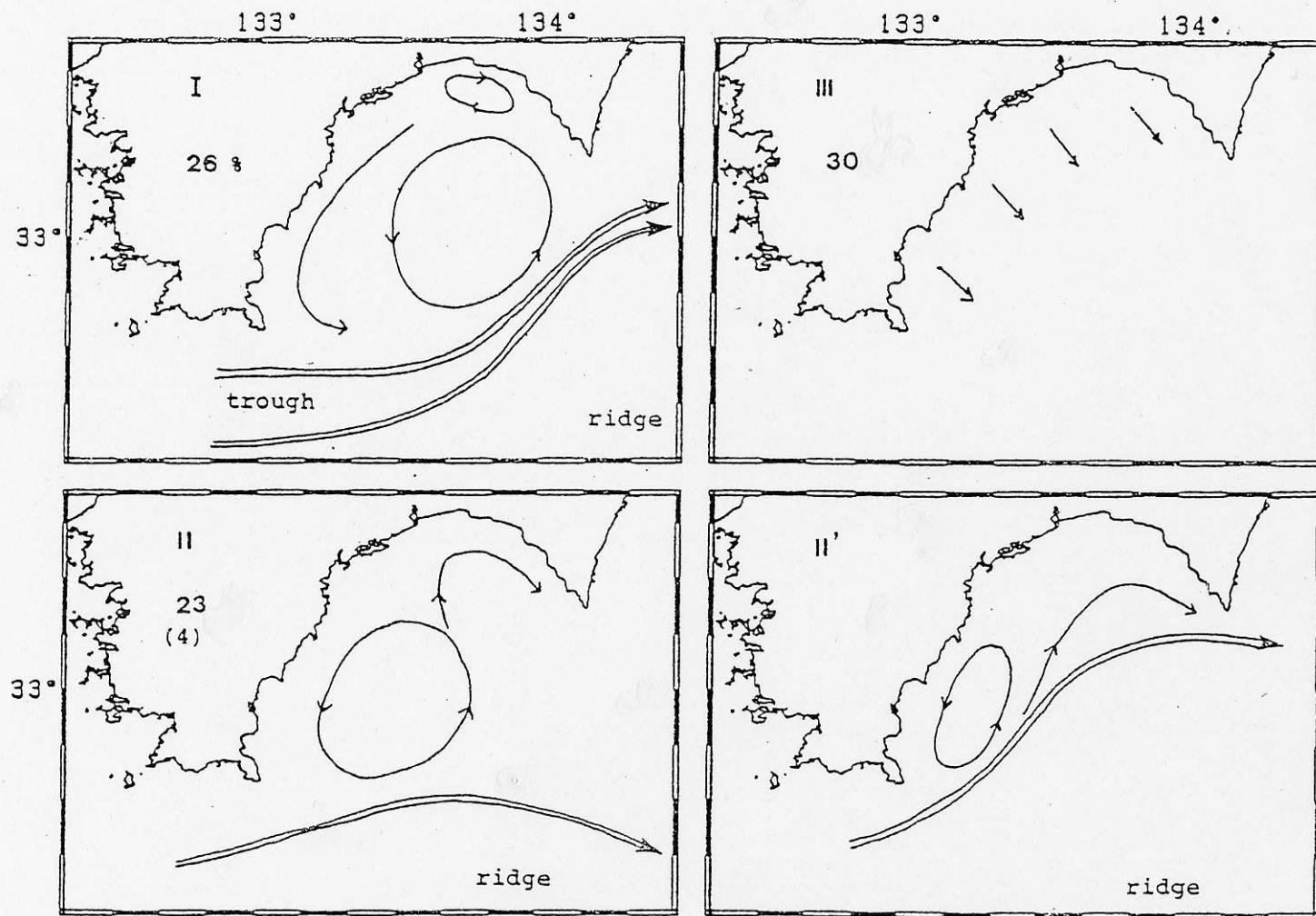


Yoo et al. (2002)

# Temporal variation of zooplankton biomass



Nakata et al.



Circulation patterns and their occurrence frequency in Tosa Bay.  
Modification of those by Fujimoto (1987).