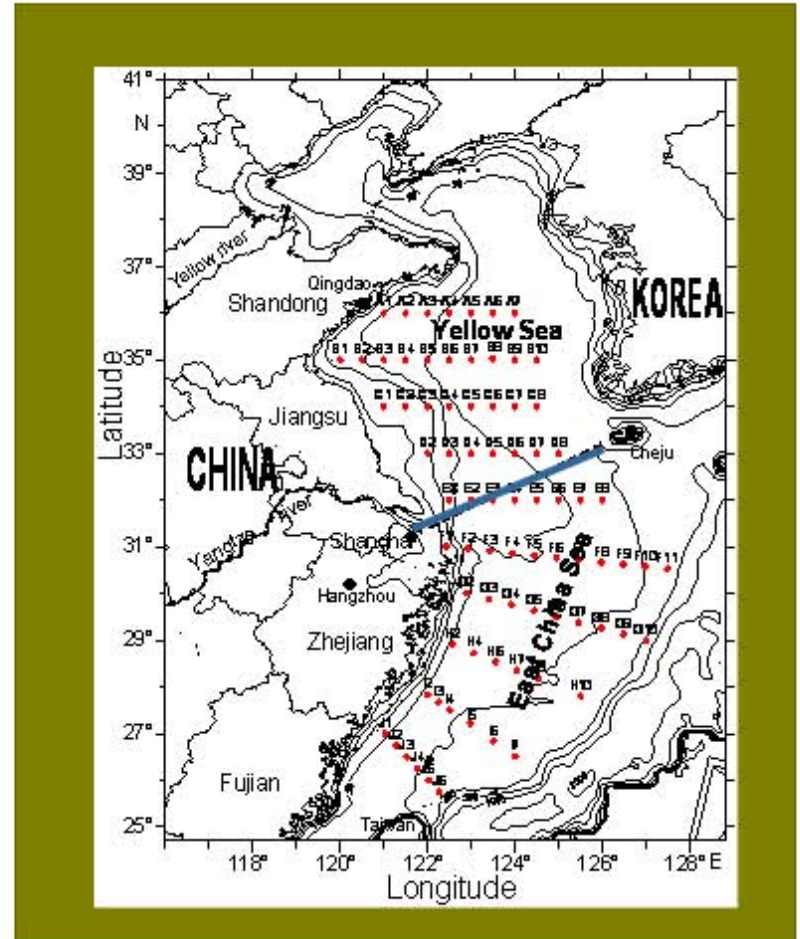


Net Macro-zooplankton Communities  
on the Continental Shelf of the Yellow  
Sea and the East China Sea

Zuo T.    Wang R.

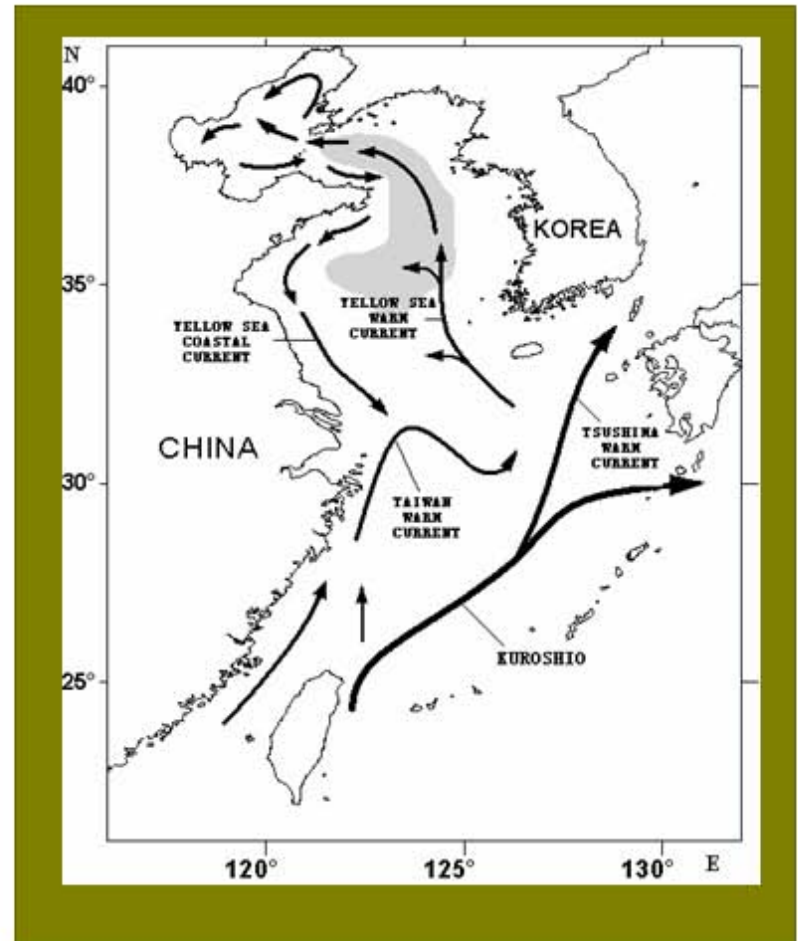
# Study Area

- The Yellow Sea (YS) and East China Sea (ECS) are marginal seas in the northwest of Pacific Ocean, bounded by the China mainland, Korea, Japan, and Taiwan Island.
- Both seas are connected topographically, but divided arbitrarily by the line from the Yangtze River mouth to Cheju Island.
- More than 70% of them are shelf area.



# Study Area

- The shelf areas are highly dynamic regions with wide varying water properties.
- Four fundamental waters: Coastal Water, Kuroshio Water, YS Water, and Mixed Water. Their properties vary seasonally with air temperature, river runoff and wind stress etc.

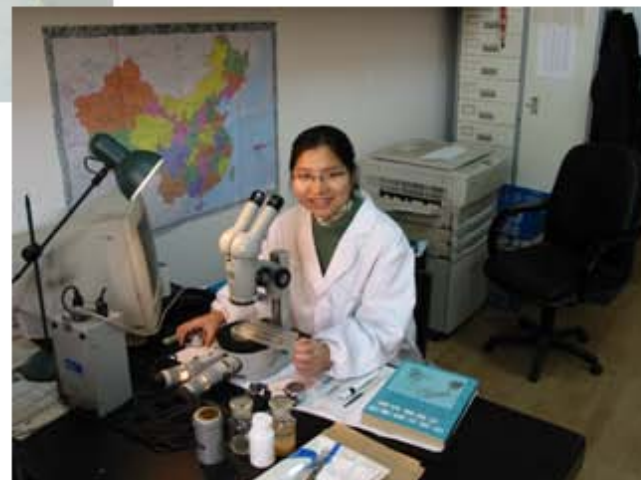


# Why we do this study ?

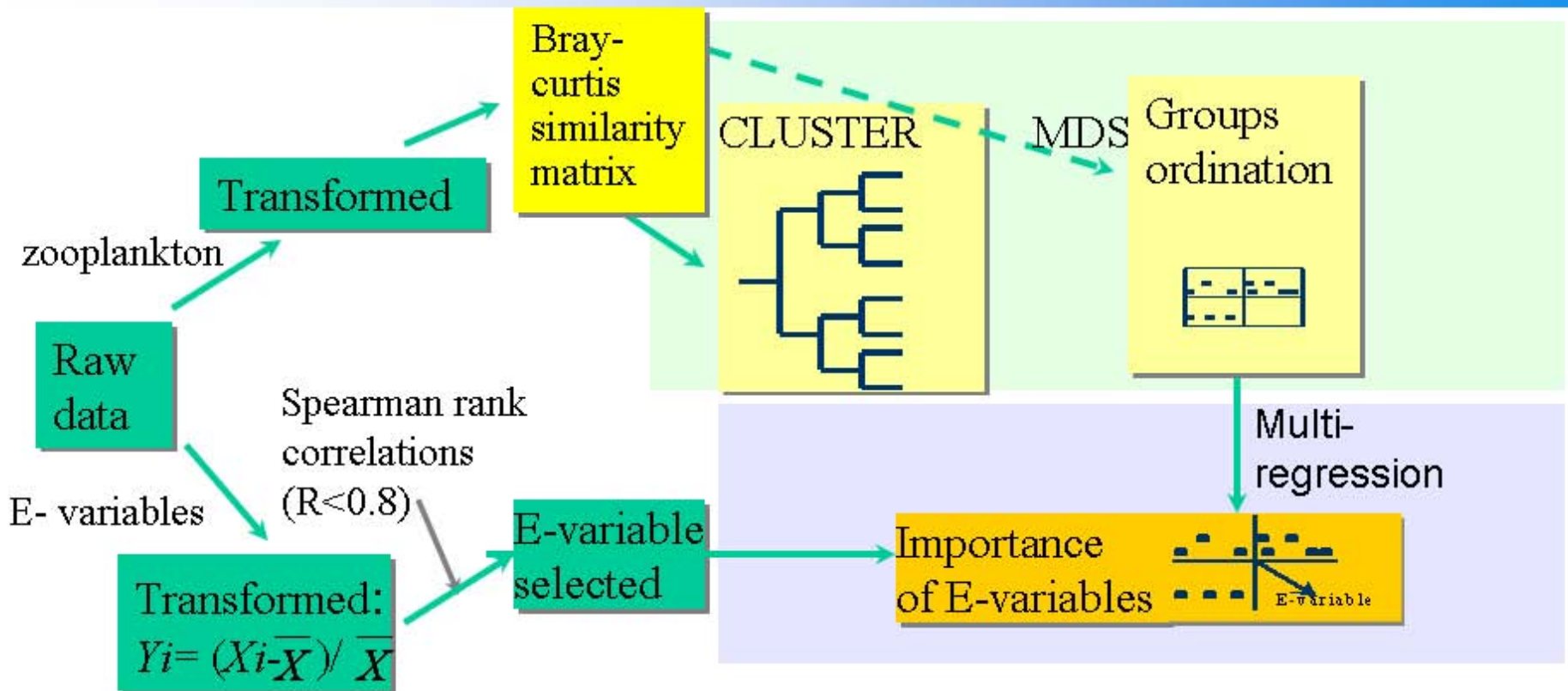
- Complicated shelf waters are believed to strongly affect or reflect by the spatial distribution patterns of zooplankton assemblage structure.
- Compared with previous works, our research improved in the following aspects:
  - Study area extended and observed stations were designed more frequently than before.
  - Statistic methods employed which proved to be effective and objective to complex plankton community data.

# Sampling

- R/V “*Beidou*”
- Cruises:
  - autumn, 2000  
18 Oct.-21 Nov.  
71 stations
  - spring, 2001  
14 April- 20 May  
77 stations
- Environment (CTD, Chl a, etc.)
- Net mesh size: 500  $\mu$  m



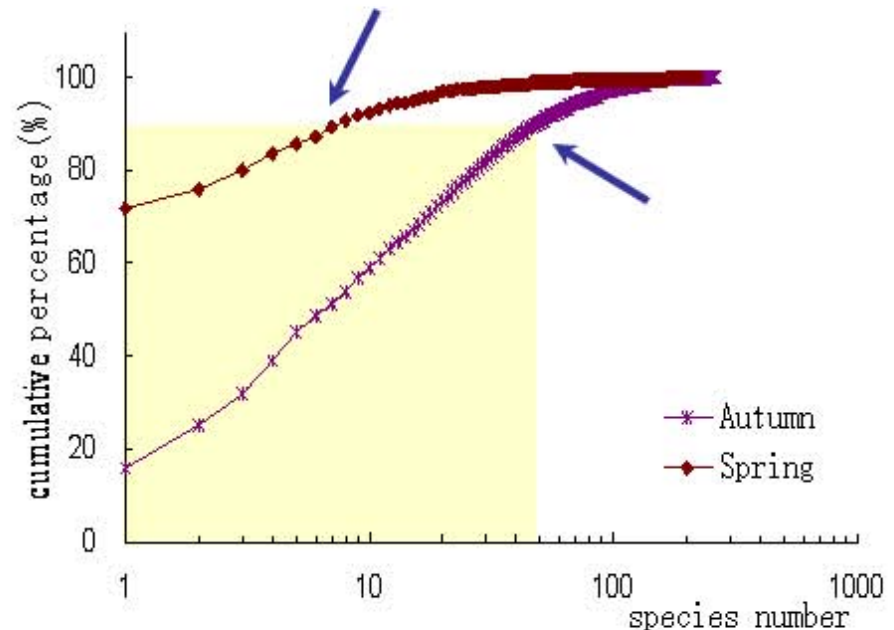
# Data processing



The procedure was followed Field et al. (1982), Data were transformed in different way in q-type and r-type cluster analysis to reduce the weights of abundant species and abundance level among large or small species

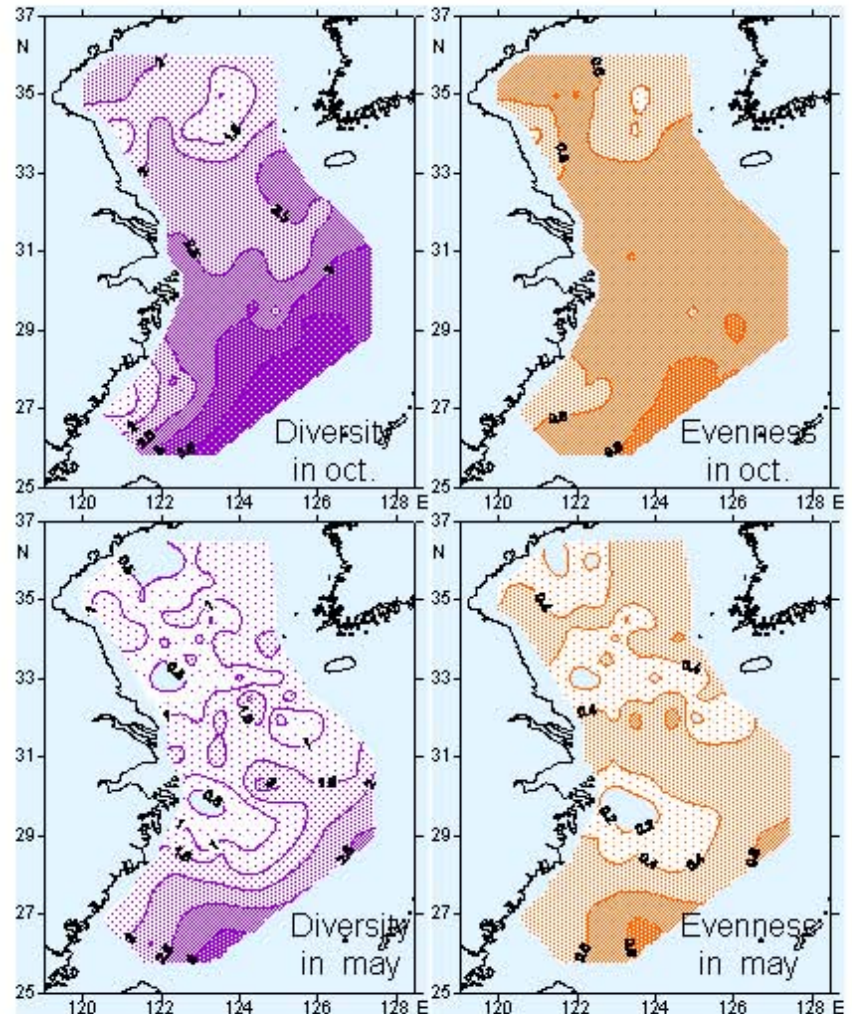
# Species compositions

- Total 210 species were identified in two cruises.
- 90 common species occurred in both cruises.
- 8 species contributed to over 90% of total abundance in May, but nearly 50 species in Oct..



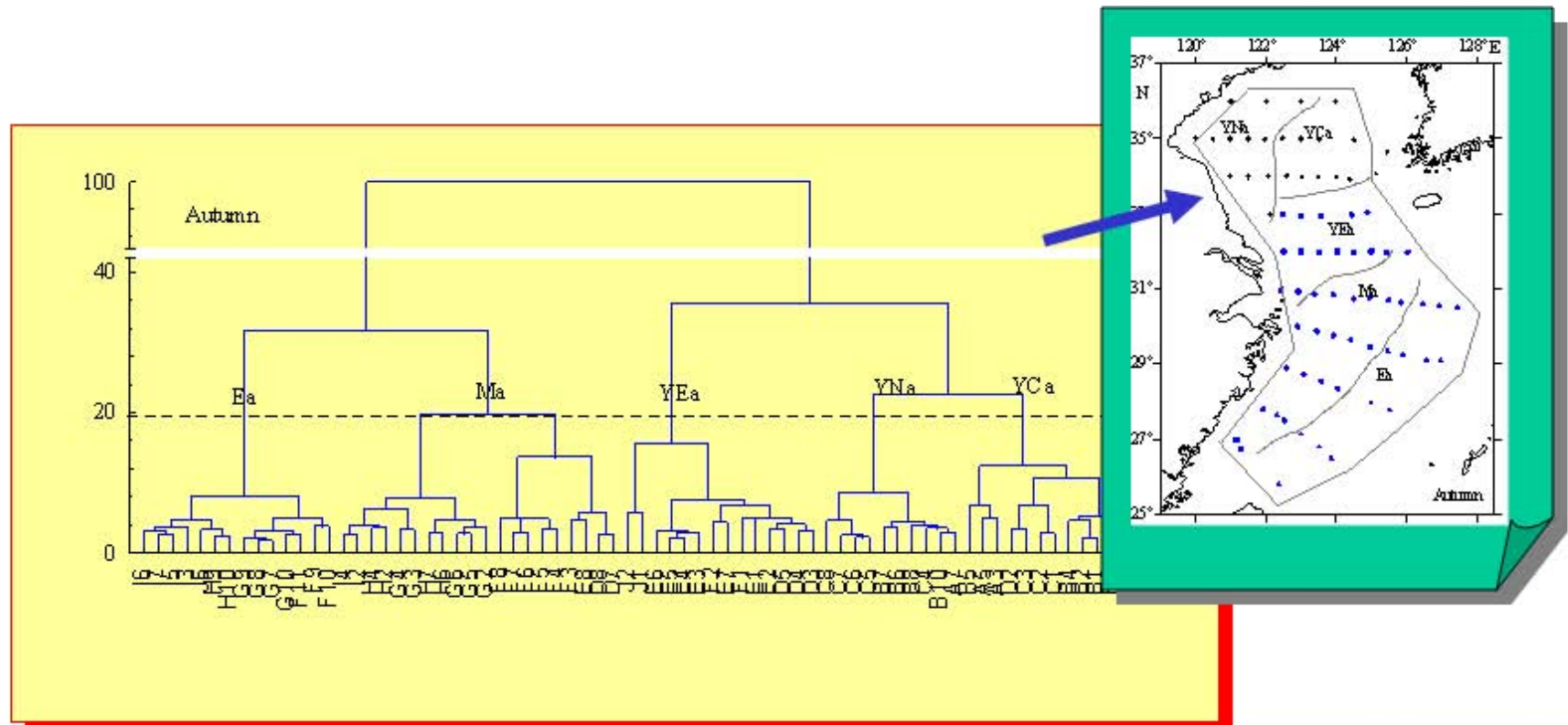
# Diversity distributions

- The Shannon diversity index  $H'$  in oct. (2.41) was higher than than in May (1.26);
- In Oct.,  $H'$  decreased from southwest to northeast.
- In May,  $H'$  distributed evenly on the shelf except the central part of YS with low value



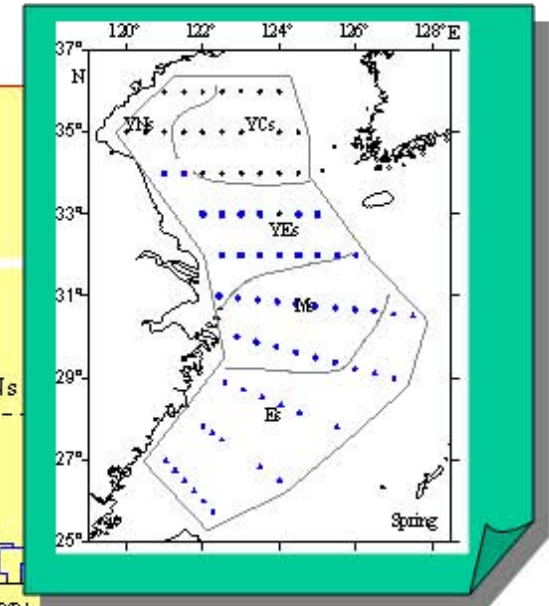
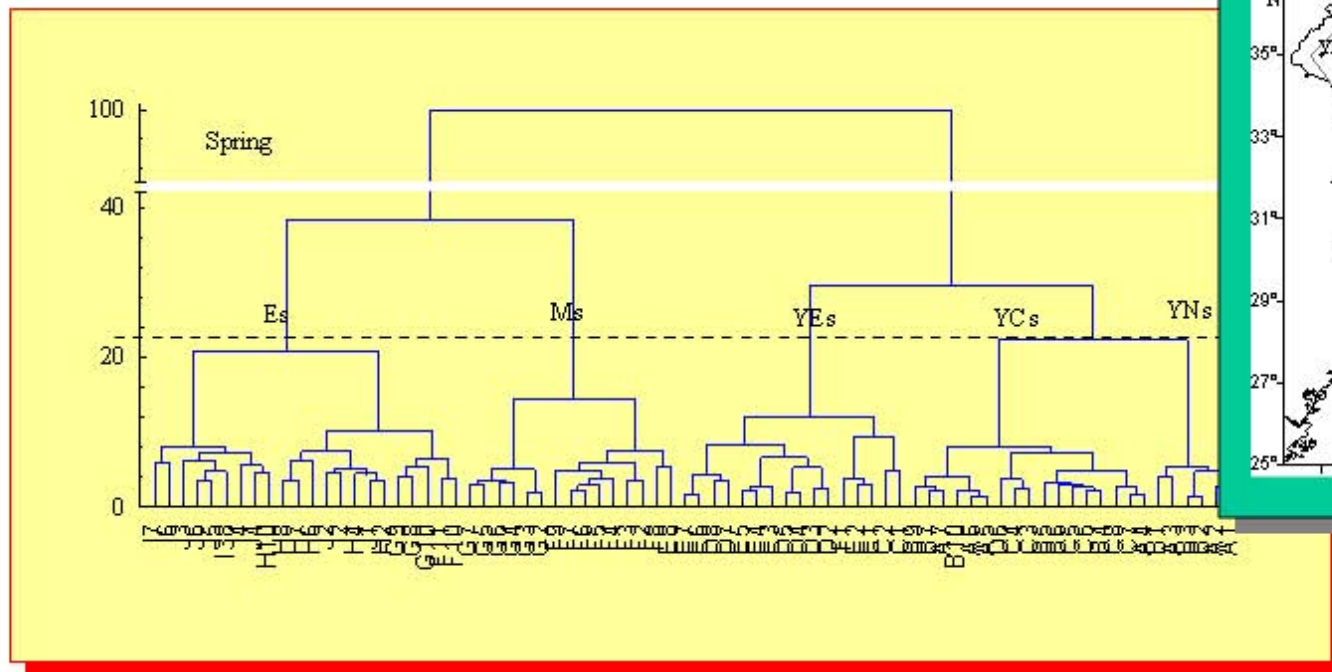


# Cluster analysis ---q type



In Oct., five station groups were divided. Stations of the same cluster group presented similar geographical distributions and water properties.

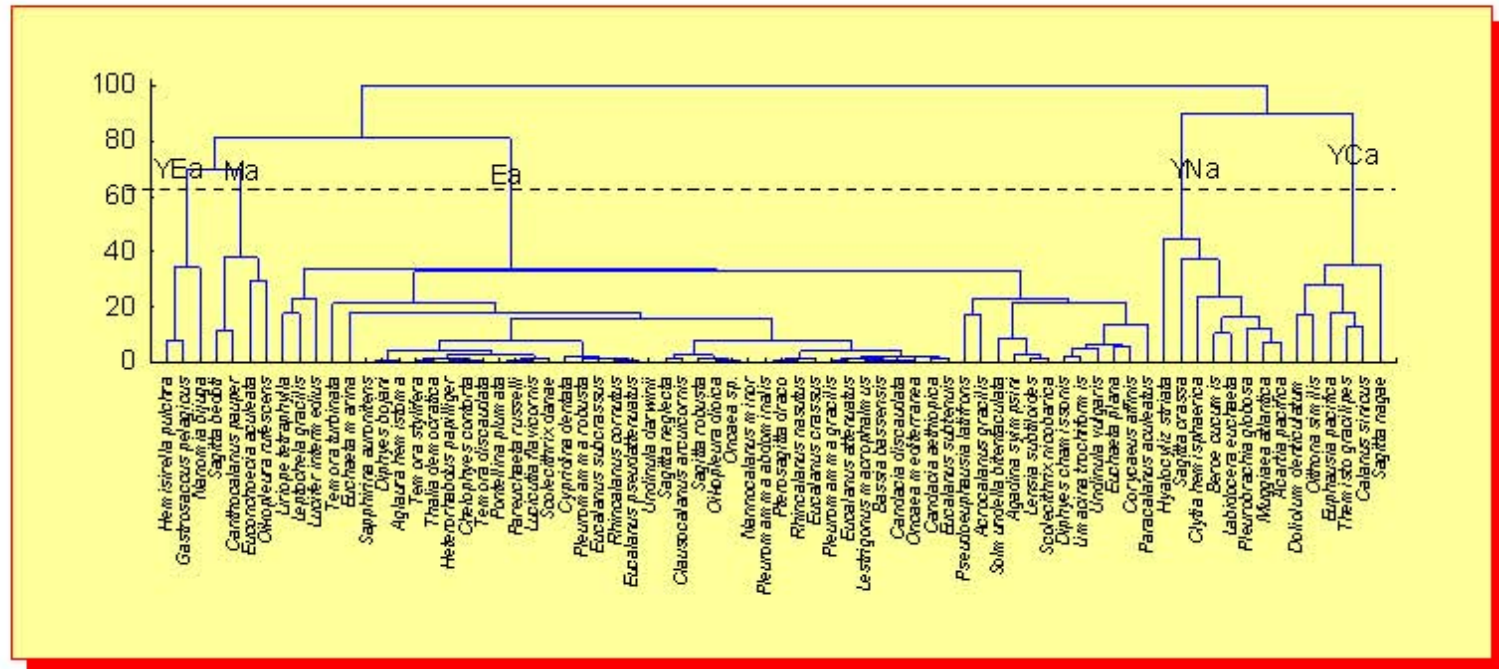
# Cluster analysis ---q type



In May, five station groups were also divided. Stations of the same cluster group also presented similar geographic distributions and water properties.

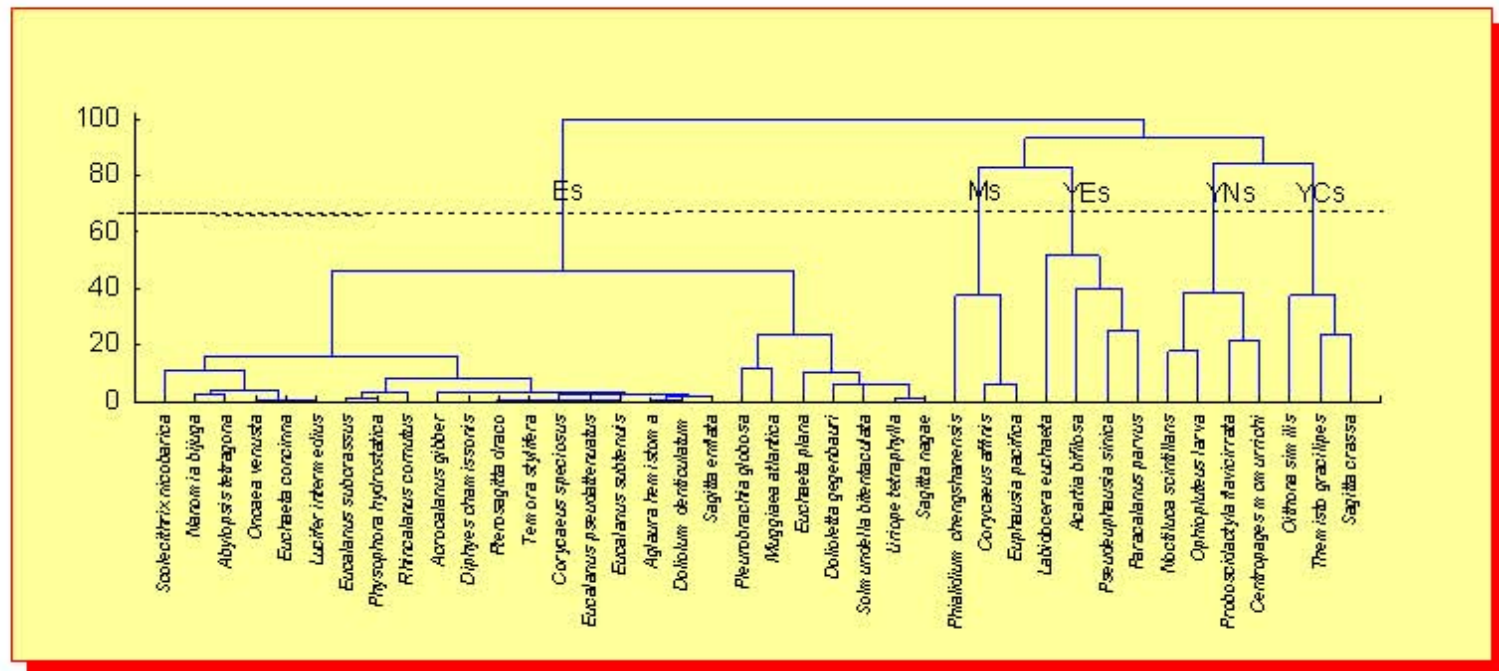
# Cluster analysis ---r type

- Oct.



# Cluster analysis ---r type

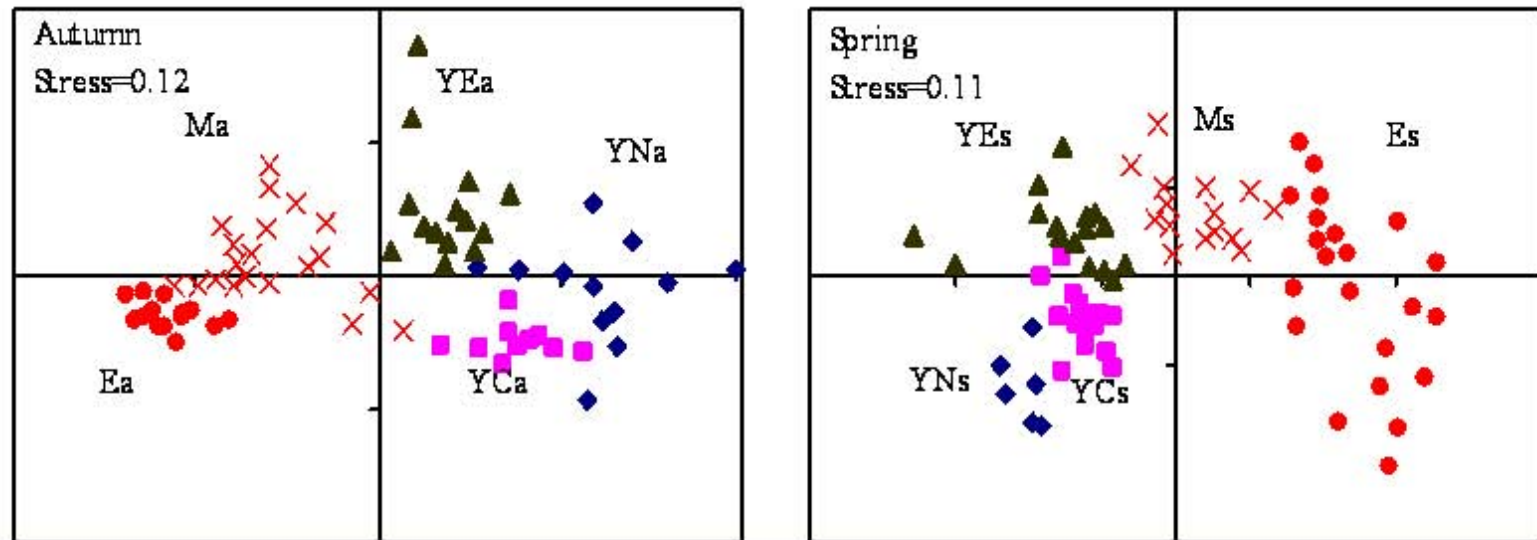
- May



# Cluster analysis ---*r* type

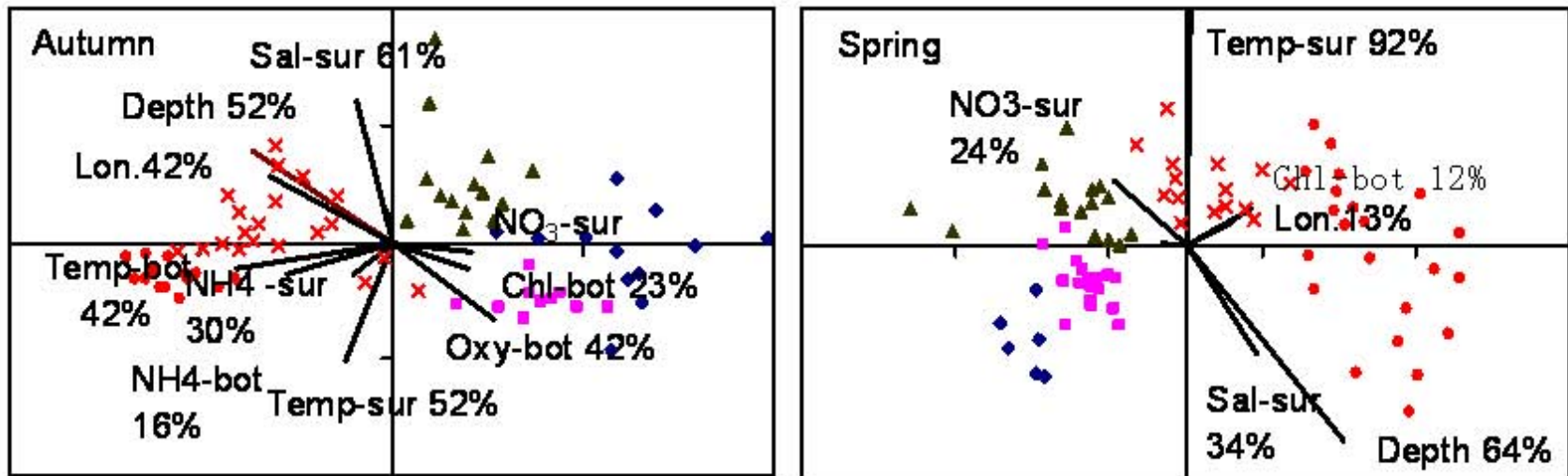
In two cruises, species with similar restriction to any station group were associated closely into one cluster.

# Non-metric multidimensional scaling analysis



The stations were ordinated by NMDS and showed in different symbols according to the cluster group they belong to. From the plot, results of NMDS showed good correspondence with q-type cluster analysis. Stations of the same cluster groups assembled closely in 2-dimensional space.

# Multiple- regression analysis



May: surface temperature

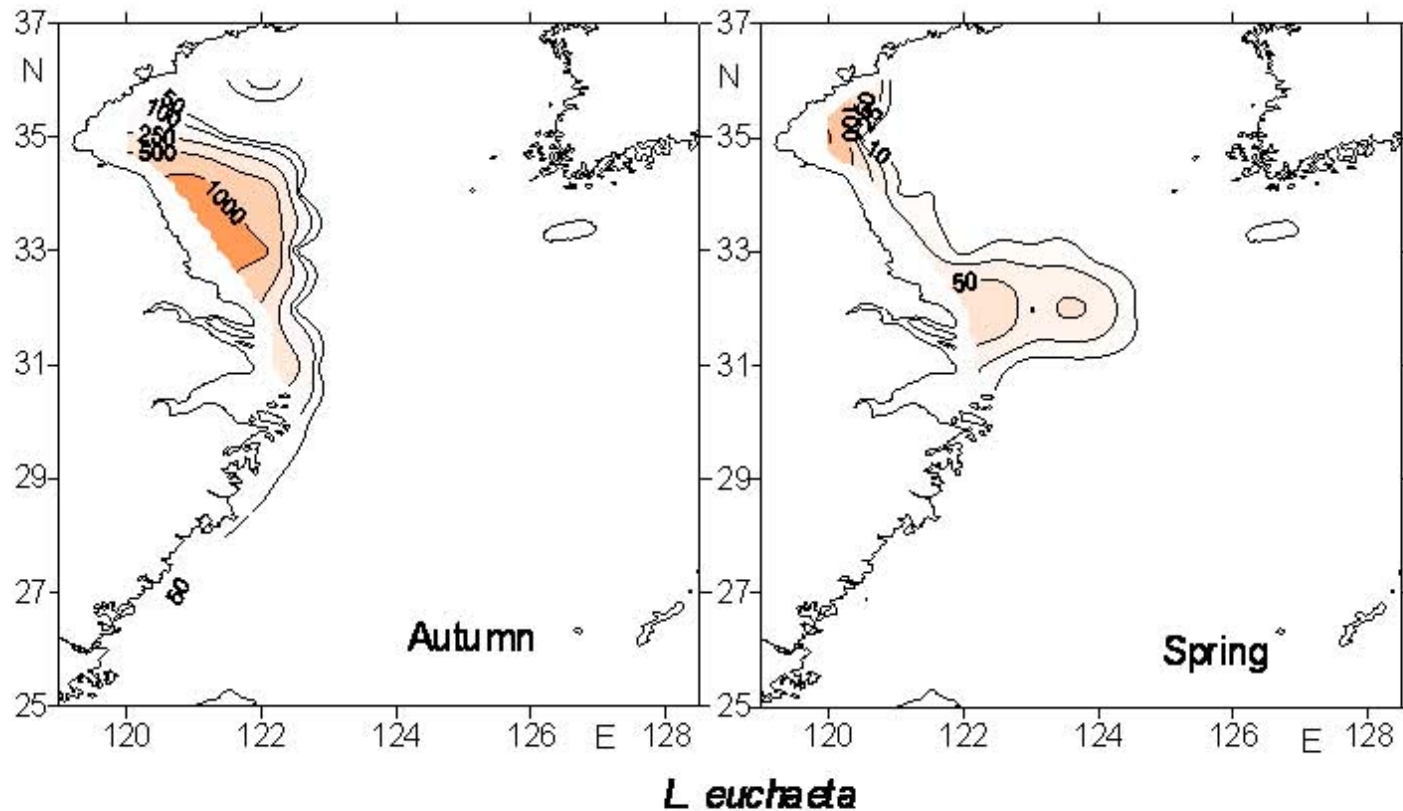
Oct.: surface salinity

# Representative species distribution

- From r-type cluster results, some representative species were selected to indicate special station groups:
  - *Labidocera euchaeta* for YNs and YNa
  - *Rhincalanus rostrifrons* for Es and Ea
  - *Euphausia pacifica* for YEa
  - Other abundant species

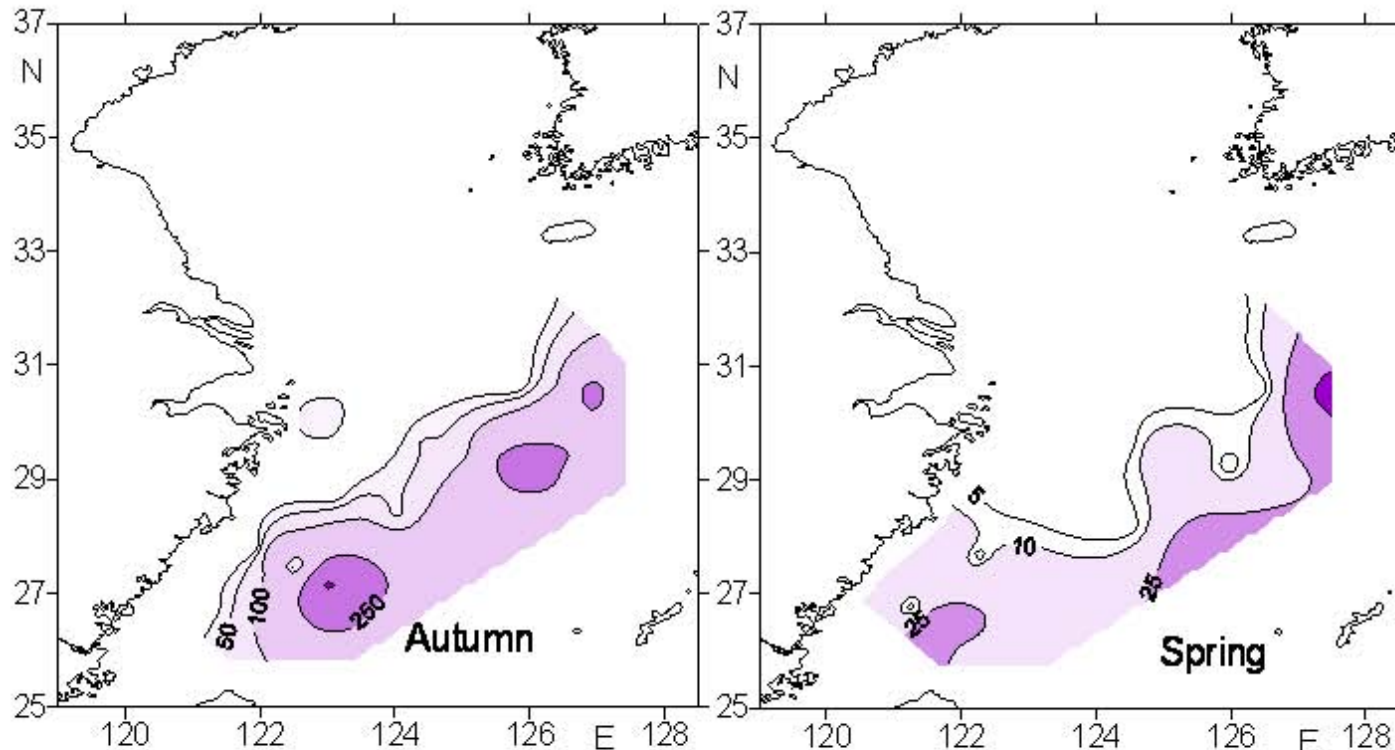


# Representative species distribution



- neritic species , often distributes near the coastal area, and mainly confined landward with low saline YS waters.

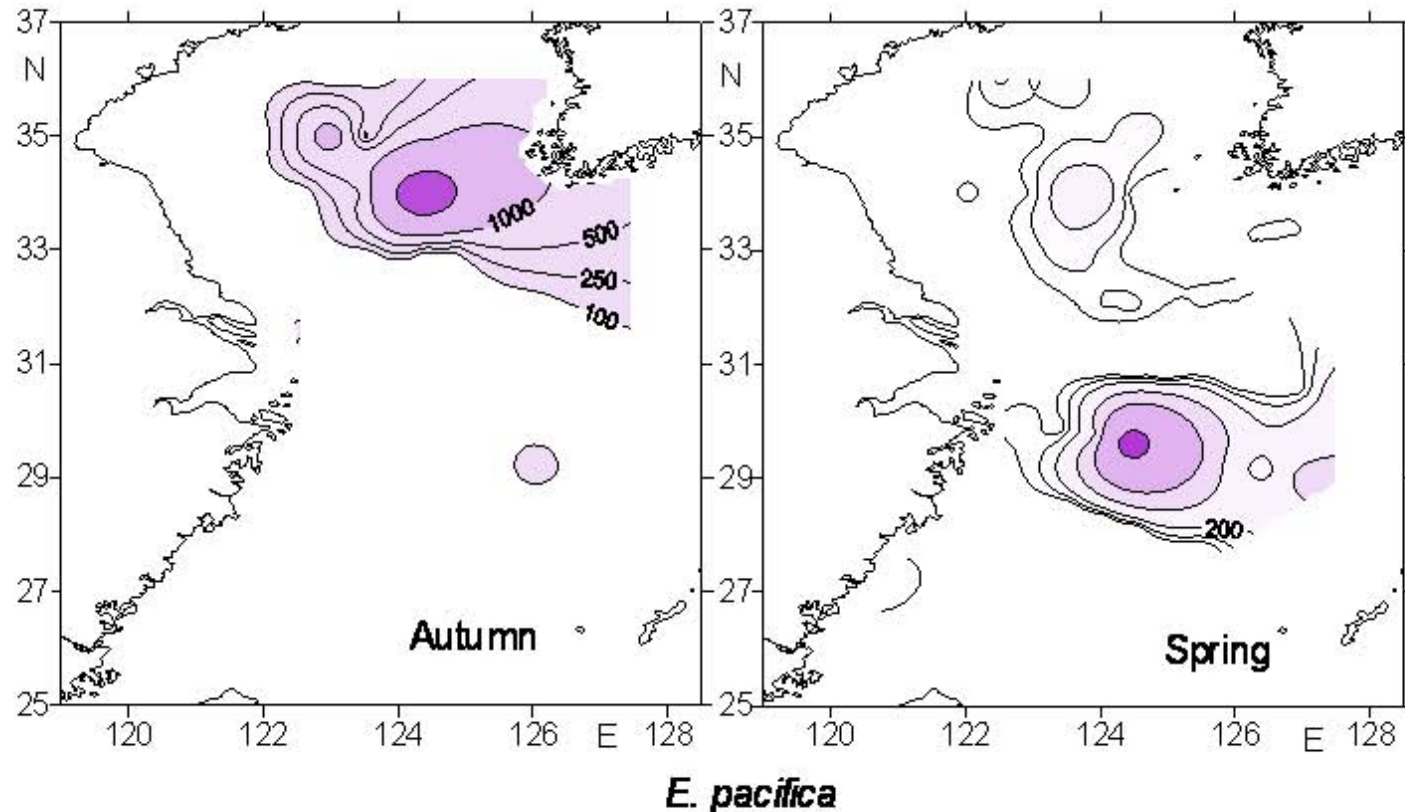
# Representative species distribution



## *Rhincalanus rostrifrons*

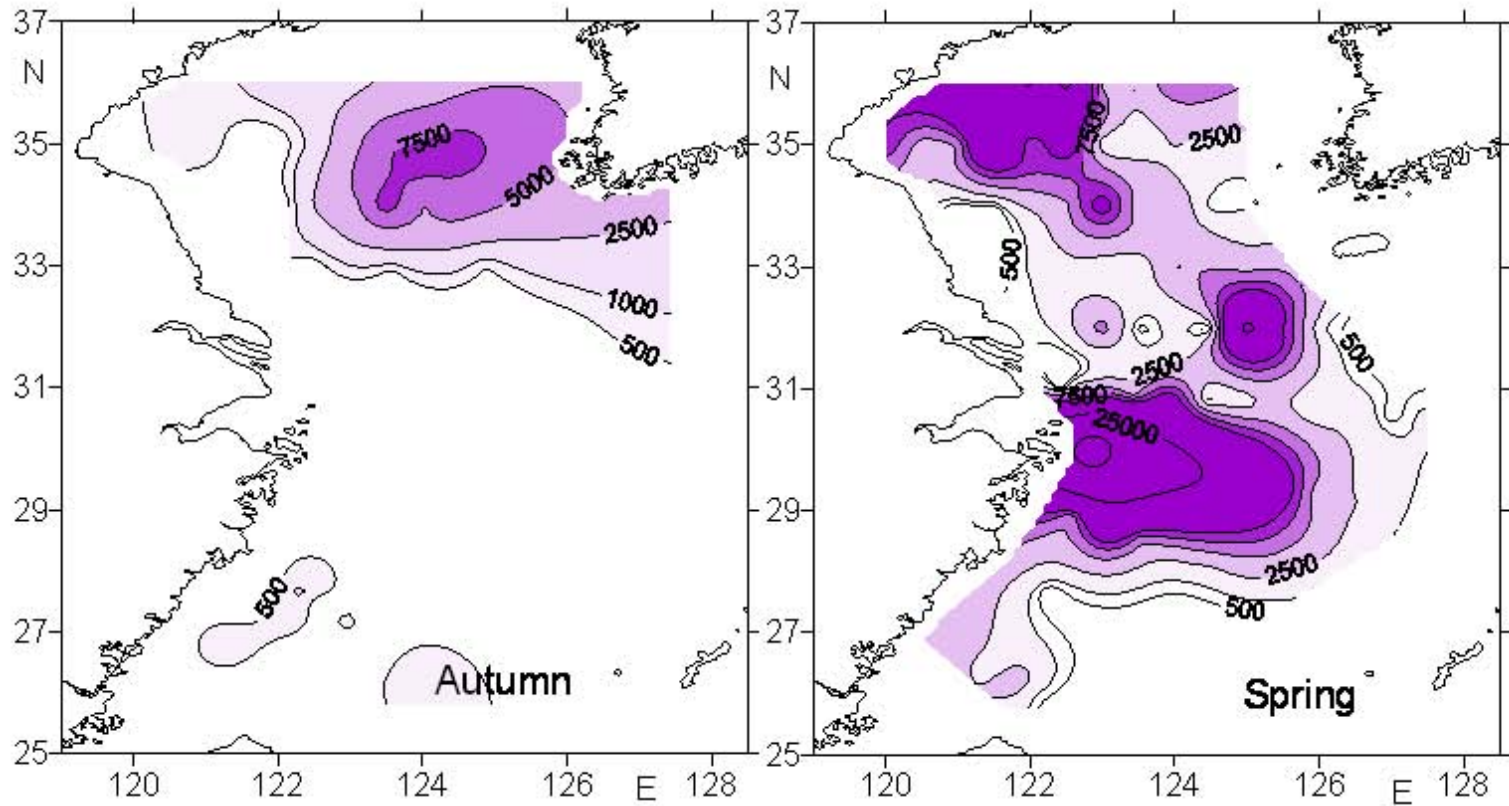
- a typical indicator of the boundary of Kuroshio intrusion to the shelf

# Representative species distribution



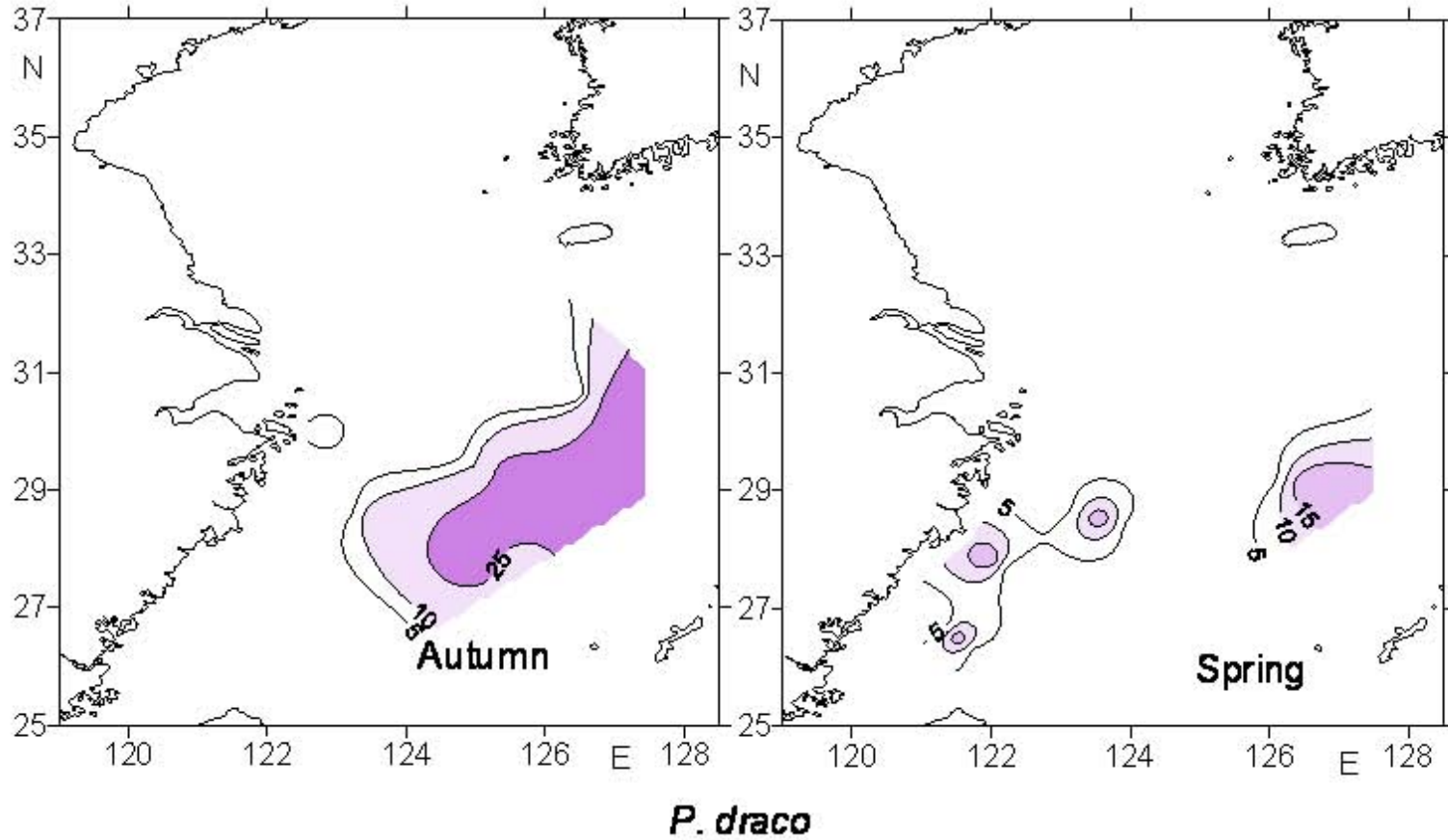
- *E. pacifica* confined its density in the YS Cold Water in oct., it can indicate the center of YSCW which occurred in summer and spring.

# Other species distribution



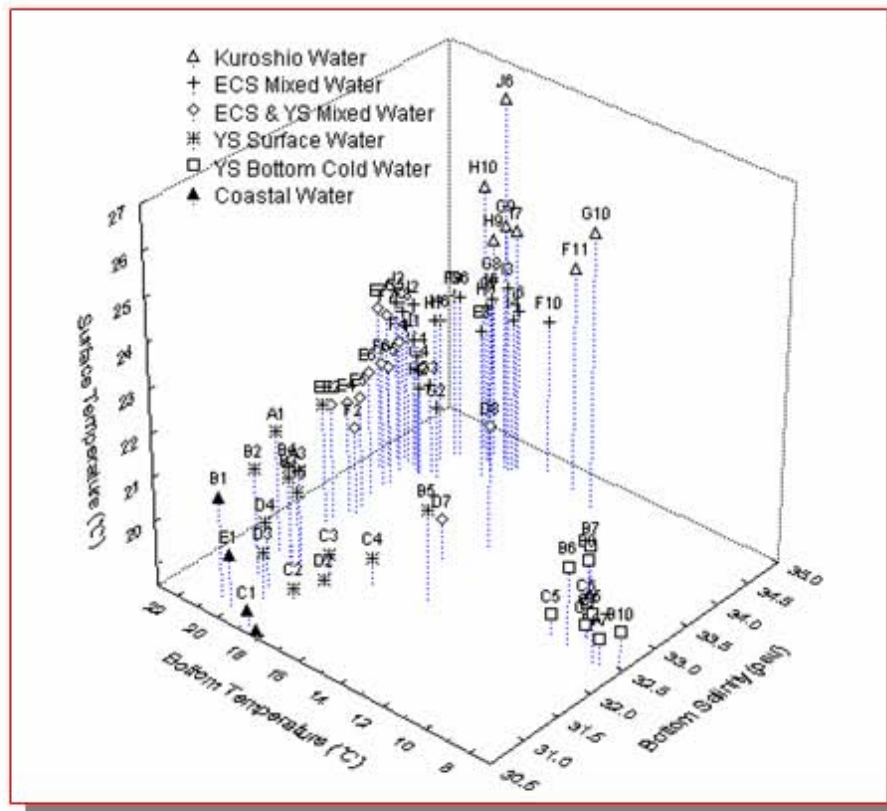
*C. sinicus*

# Other species distribution



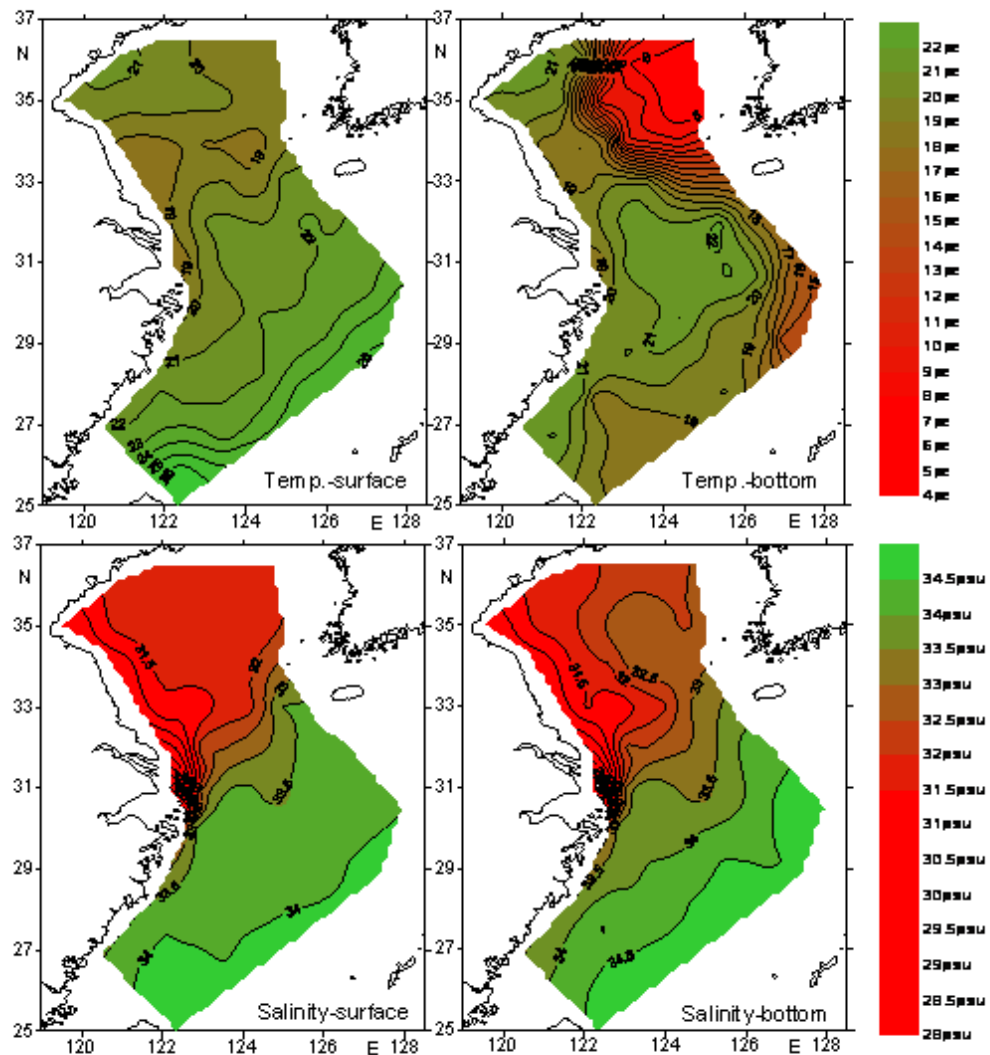
# Discussion

- According to the Liu et al.(1992) and Hur et al.(1999), stations with distinctive water masses can be defined:



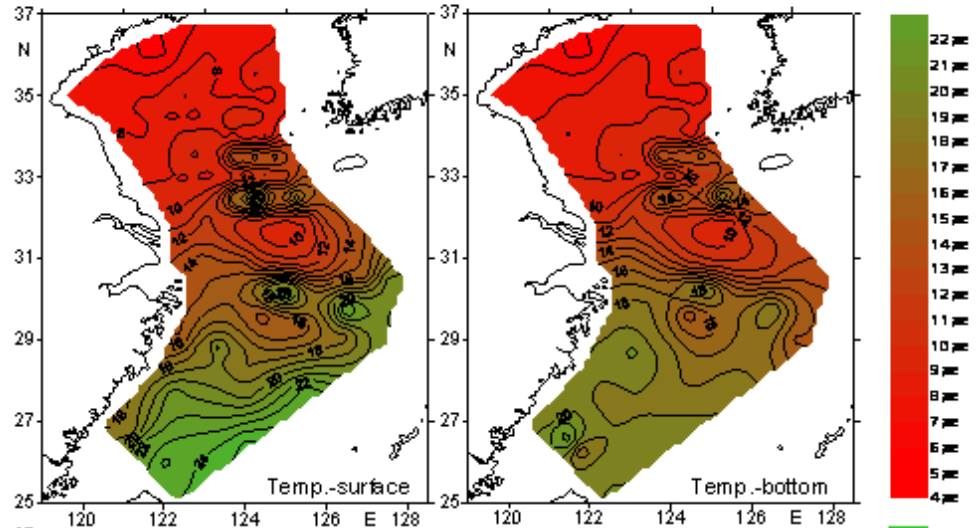
■ Oct.

➤ Temperature

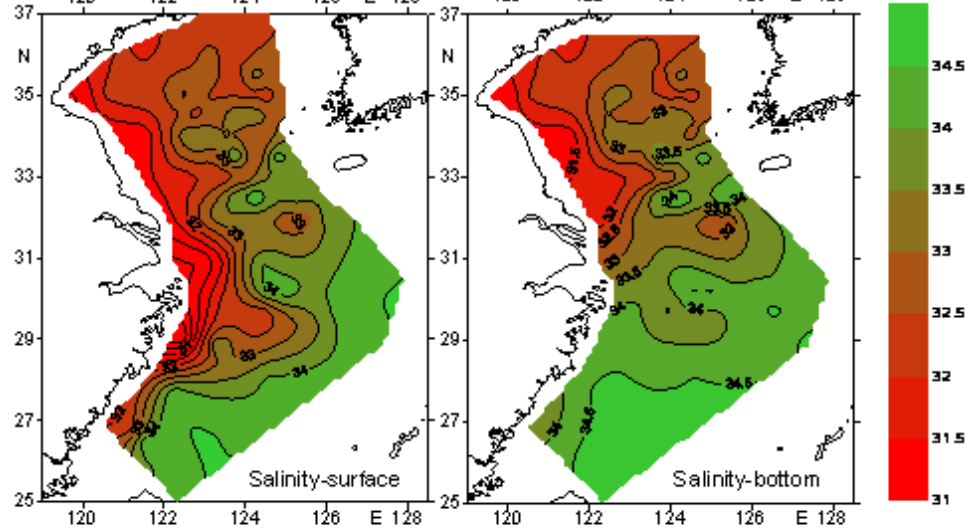


➤ Salinity

■ **May**  
▶ **Temperature**



▶ **Salinity**





# Discussion

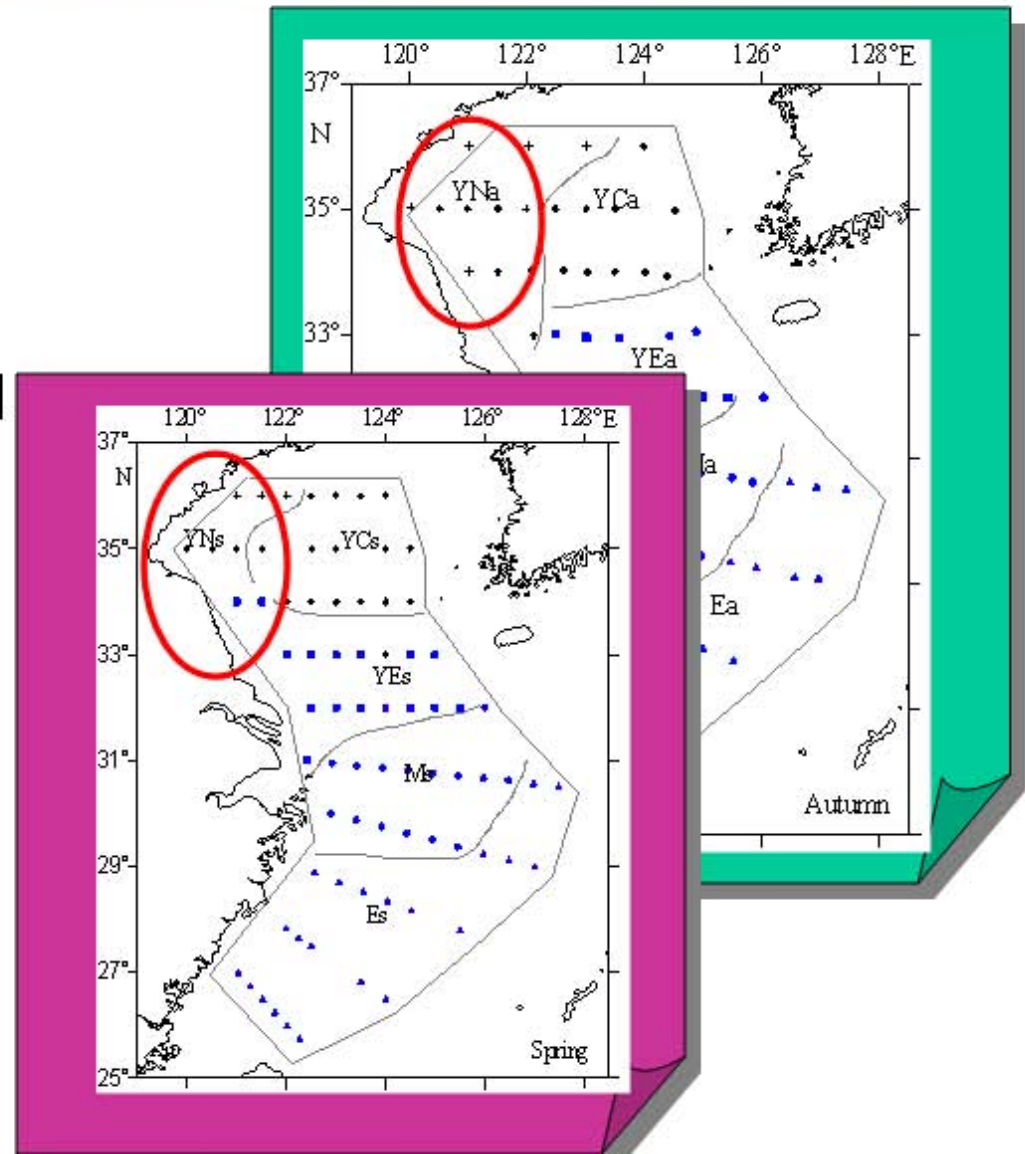
- Difference of zooplankton species composition between two cruises
  - In Oct., with the Kuroshio Current strong intrusion, the north boundary of the tropical species distribution can extent to 31N, while most of the temperate species retreated to north of the Yangtze River mouth in order to avoid the hurt of high salinity / warm waters from Kuroshio.
  - In May, with YS coastal water and river runoff intensifying their extension southeastward, temperate species became the most abundant and moved southward. Kuroshio waters shrink along the edge of the shelf, fewer tropical species distributed on the shelf area.

# Discussion

- Community division
  - ❖ Zooplankton cluster groups in the study showed a clear relationship with waters, and they also had a good correspondence with previous plankton faunal studies on the shelf region

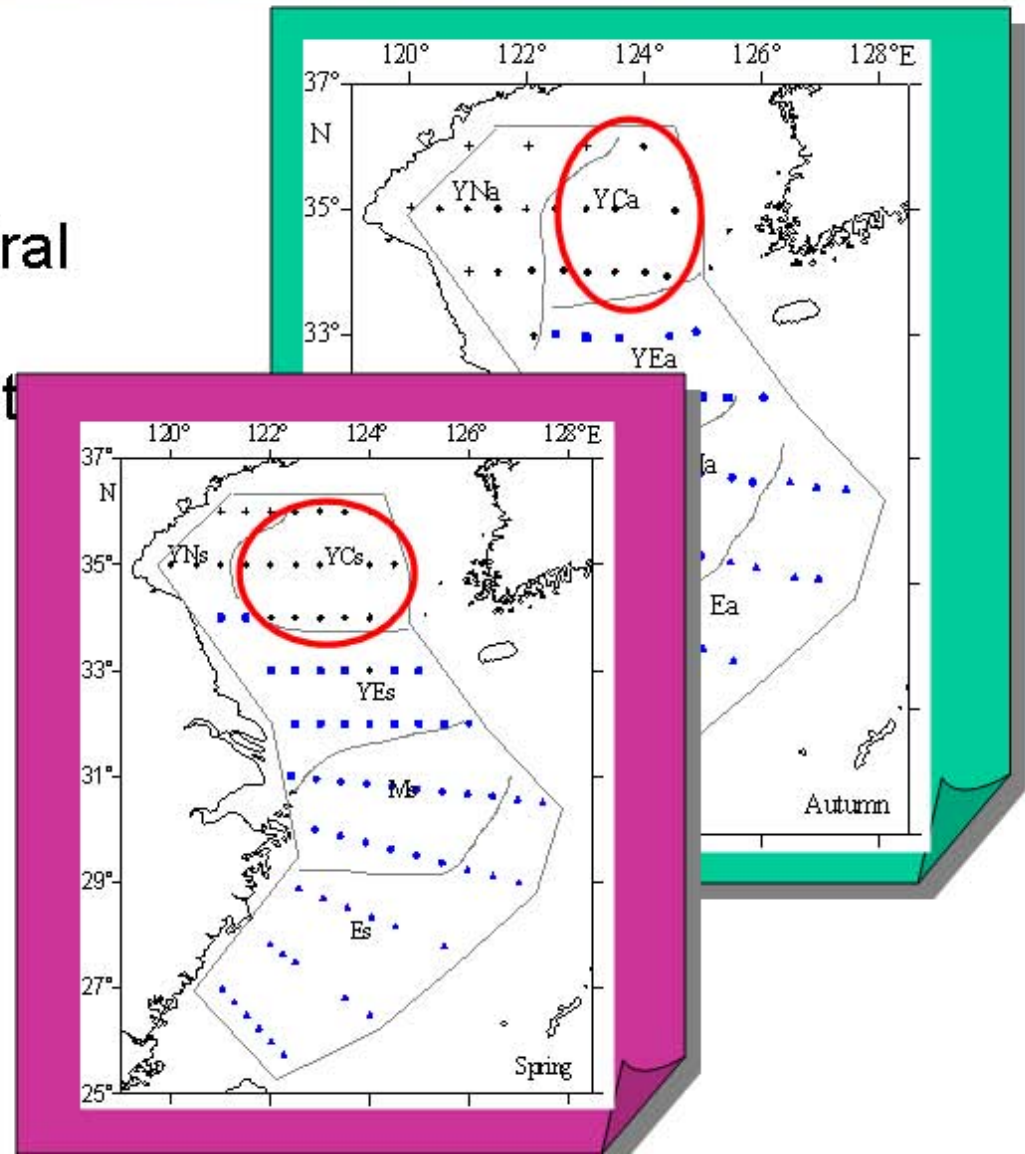
# Discussion

Groups YNa and YNs, just coincided with YS Neritic Community, were mainly confined landward with YS Surface Water and Coastal Water, and had neritic species occurring frequently.



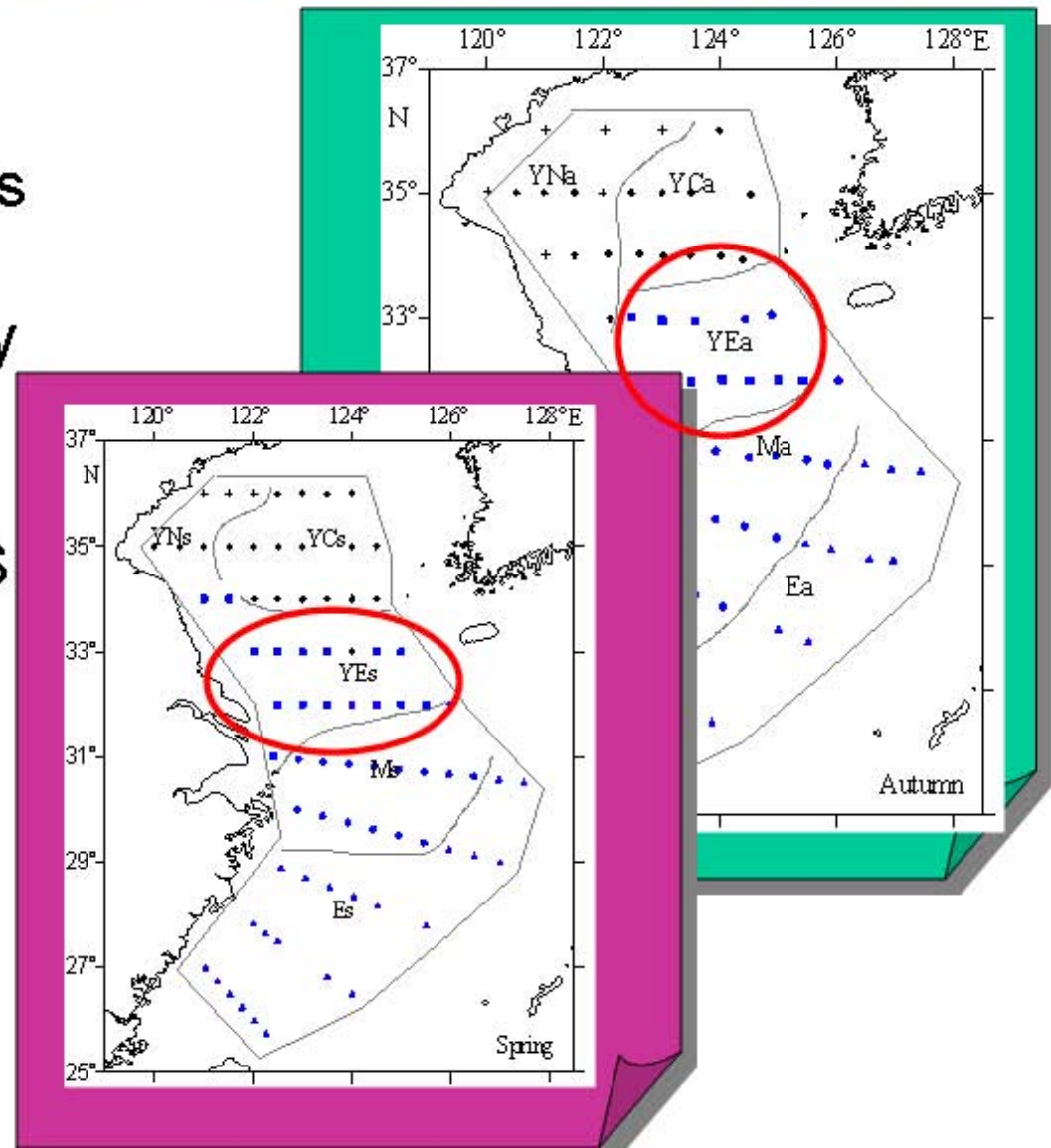
# Discussion

- Groups YCa and YCs, consistent with YS Central Community, lay in the central part of the YS with YS Cold Water. Warm temperate species had their density in them.

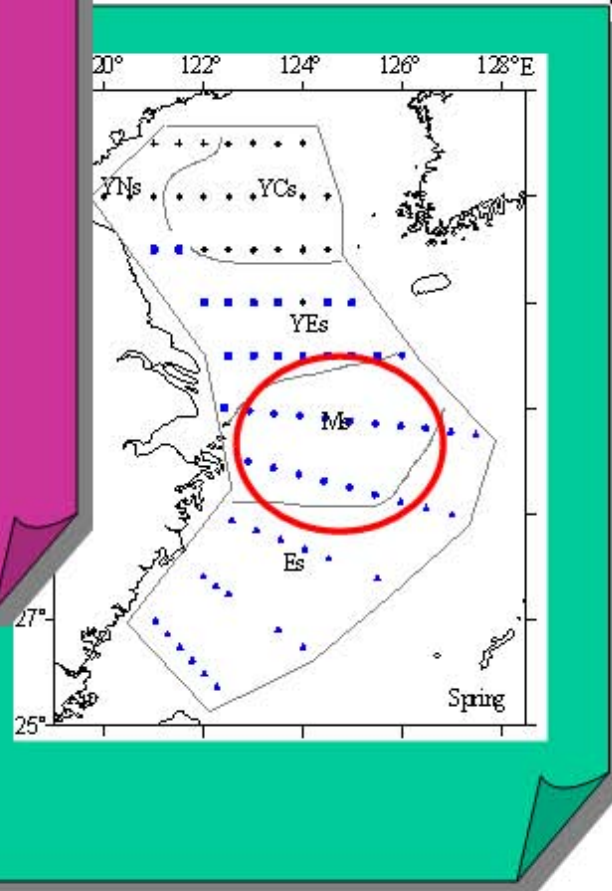
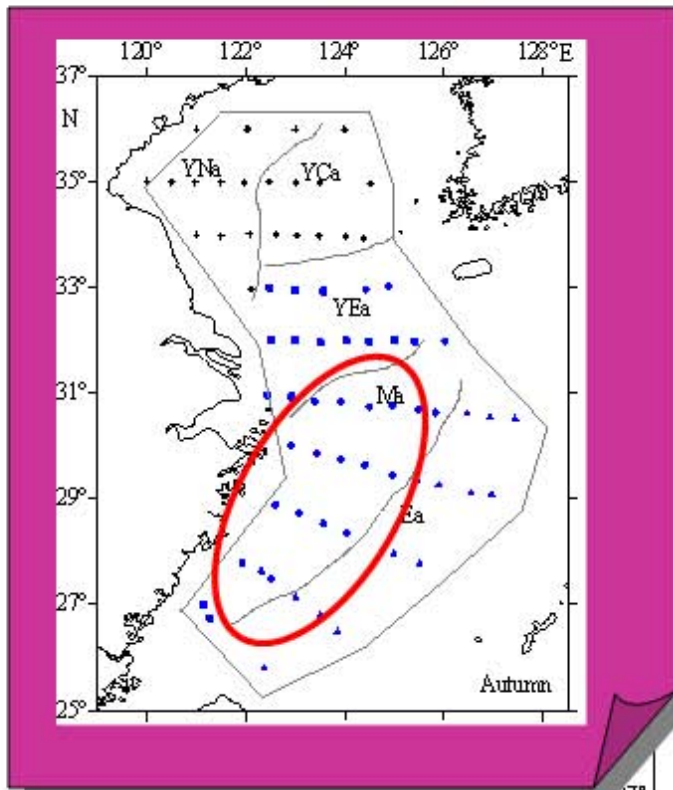


# Discussion

- Groups YEa and YEs belonged to Mixed Water Community by Chen et al. (1985), distributed in the transition zone of YS and ECS, and had few special species.

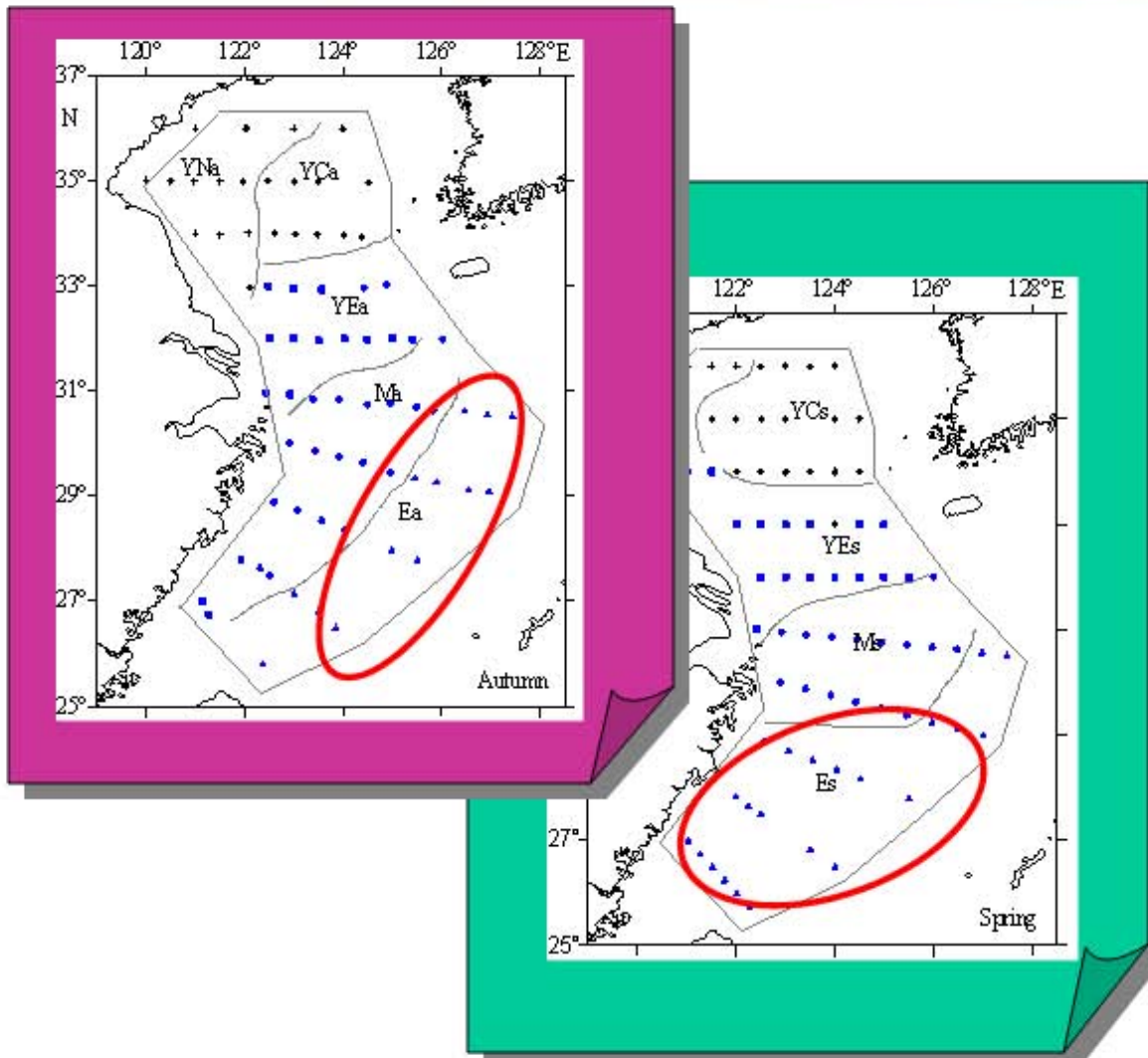


# Discussion



- Group Ma and Ms, similar with the ECS Shelf Mixed Water Community, occupied the main shelf area of ECS with ECS Mixed Water, but had few restricted species.

# Discussion



- Ea and Es, coincided with ECS Offshore Mixed Water Community which had highest temperature and salinity influenced mostly by Kuroshio intrusion on the shelf slope edge.

# Discussion

- YS Neritic Community, YS Central Community, ECS Shelf Mixed Water Community were stable. They appeared annually in the relevant water masses.
- Mixed Water Community and ECS Offshore Mixed Water Community were relatively unstable which varied seasonally with the Yangtze River runoff and Kuroshio Current intrusion.



A photograph of a dense forest of evergreen trees, heavily covered in snow. The trees are packed closely together, and their branches are thick with white snow. The sky is a pale, overcast blue, providing a soft, diffused light to the scene. The overall atmosphere is quiet and serene.

Thank you !