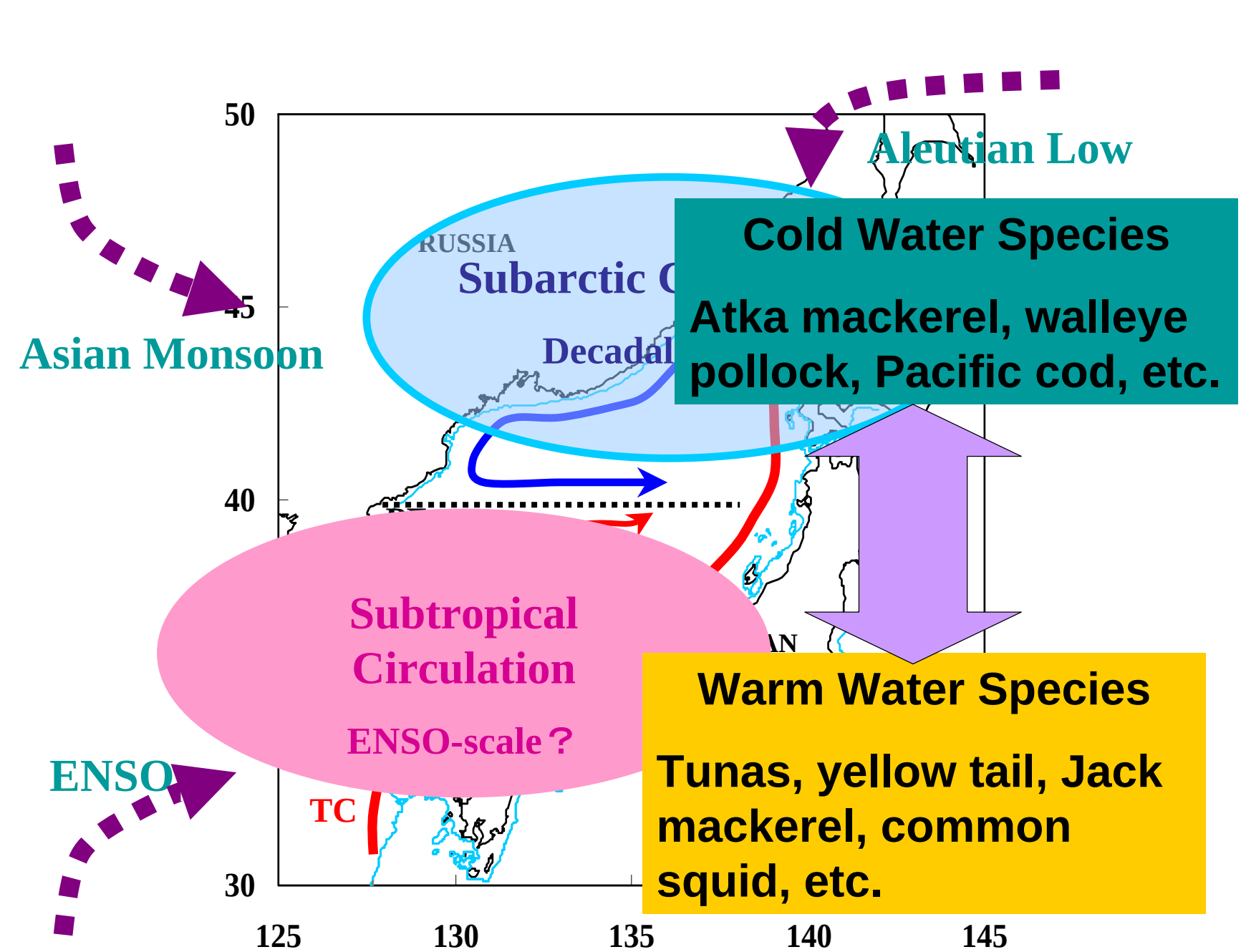
PICES 13th Annual Meeting
Honolulu, Hawaii, Oct. 19, 2004

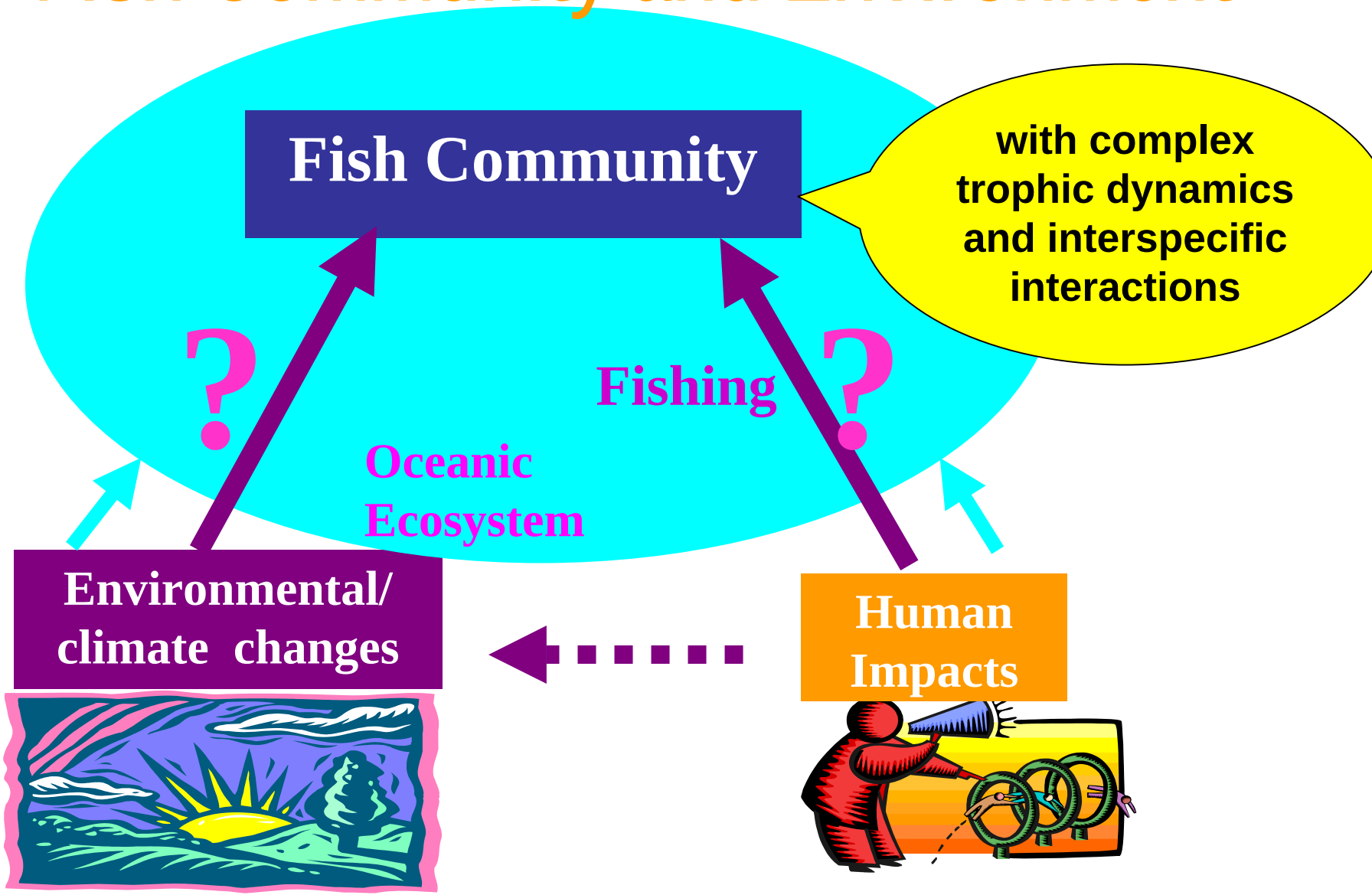
Long-term changes in fisheries production of the Japan Sea with an emphasis on the impacts of fishing and climate regime shift during the last three decades

Yongjun Tian, Hideaki Kidokoro
Japan Sea National Fisheries Research Institute,
Fisheries Research Agency (FRA), Niigata, JAPAN

last 46 years:
1958-2003


Aleutian Low
Asian Monsoon
ENSO
RUSSIA
Subarctic C
Decadal
Subtropical
Circulation
ENSO-scale？
TC
Cold Water Species
Atka mackerel, walleye pollock, Pacific cod, etc.
Warm Water Species
Tunas, yellow tail, Jack mackerel, common squid, etc.
50
45
40
30
125
130
135
140
145

Fish Community and Environment



TWO OBJECTIVES

1. To identify

in the fish

2. To un

oceanic

to the dyna

structure .

Final Goal
To understand the function and structure of the ecosystem toward ecosystem-based fisheries management

Data Sources

1. **Catch statistics:1958-2003:**

58 species items, 91% of total catches

Fishing effort for three major fisheries (1971-2001)

2. **Oceanographic data (SST): 1950-2003**

SST for Japan Sea: 1°×1°grid data set from JMA

50 m depth water temperature: Tsushima Current

3. **Climate indices: 1950-2003**

PDO, NPI, SOI, AOI, MOI

Methods

1. Community Indices

1) Diversity Index (DI)

$$DI = 1 - \sum_{i}^{n} \frac{Y_i\ (Y_i\text{-}1)}{Y\ (Y\text{-}1)}$$

2) Mean Trophic Level (MTL)

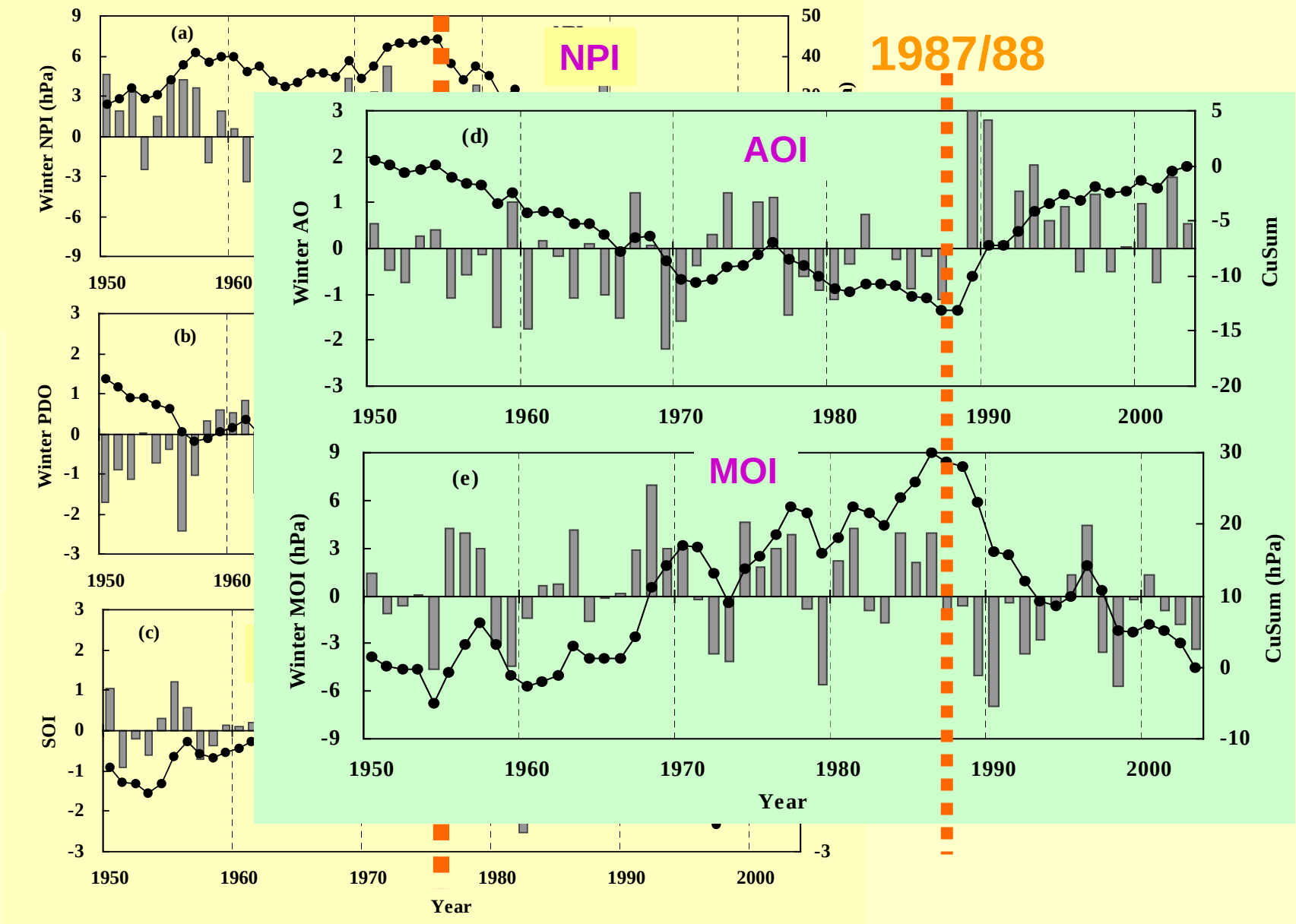
$$MTL = \sum_{i}^{n} \frac{TL_i\ Y_i}{Y}$$

3) Piscivores / Zooplanktivores ratio

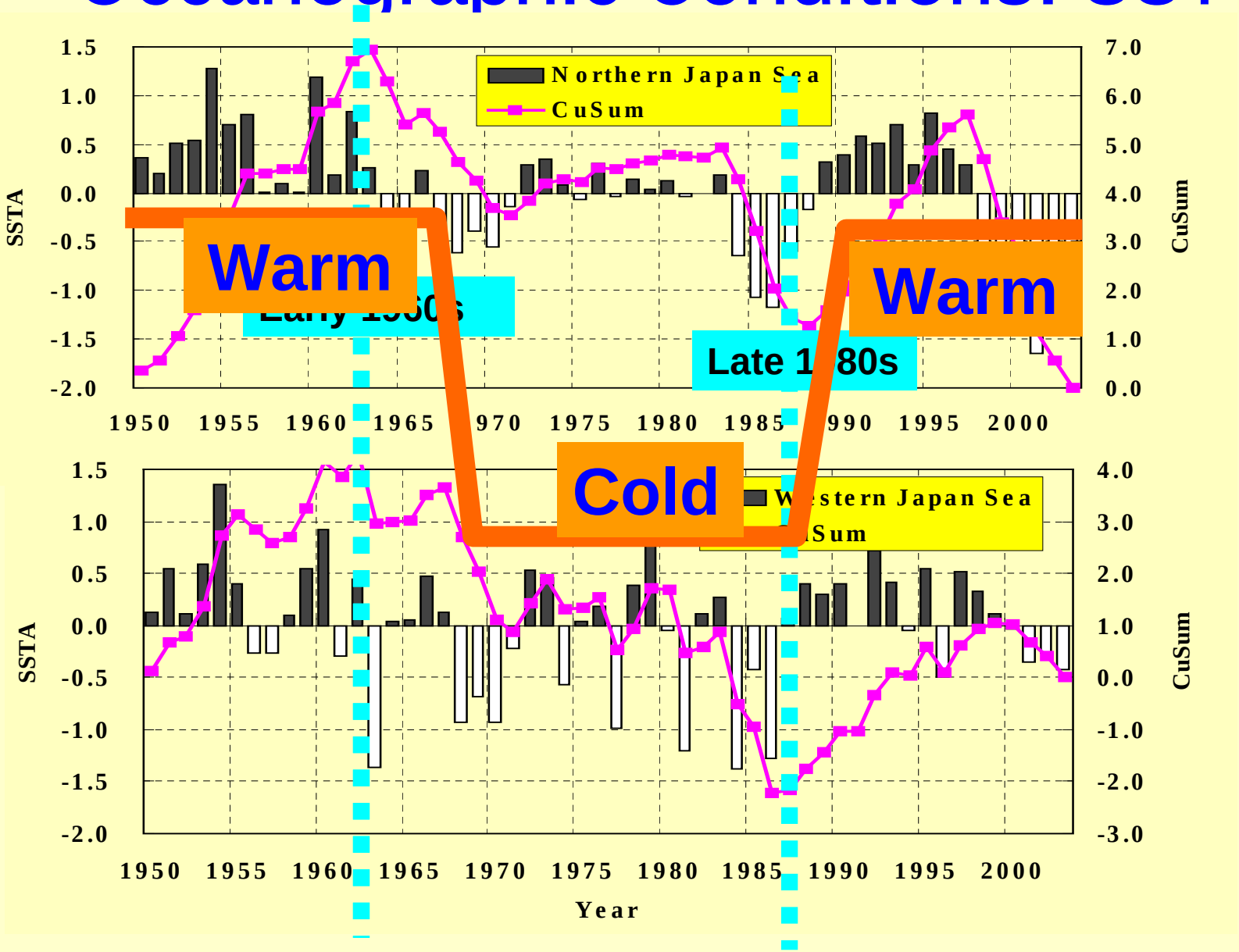
2. Principal Component Analysis (PCA)

To identify the common variation pattern between various time series

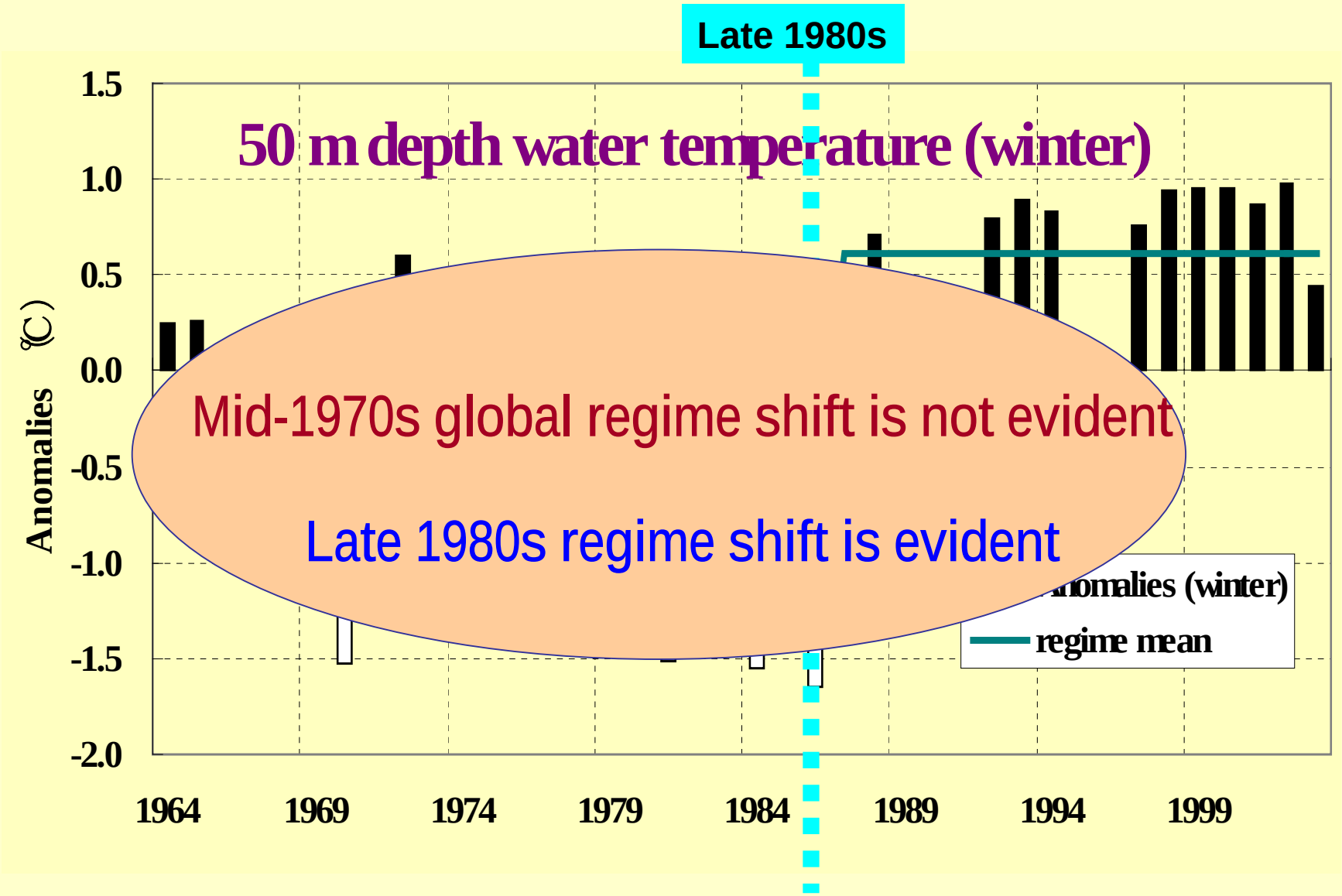
Five Climate Indices



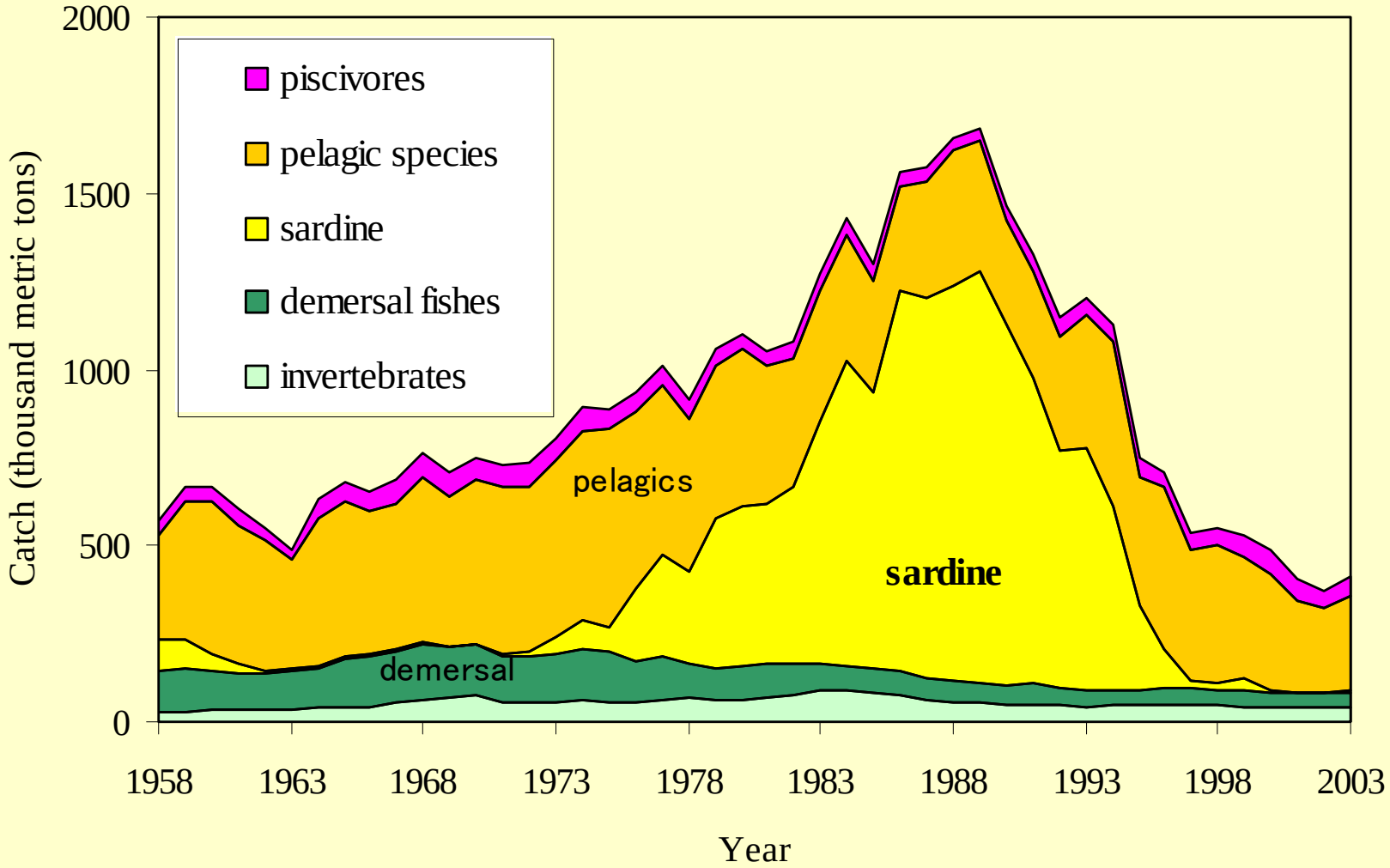
Oceanographic Conditions: SST



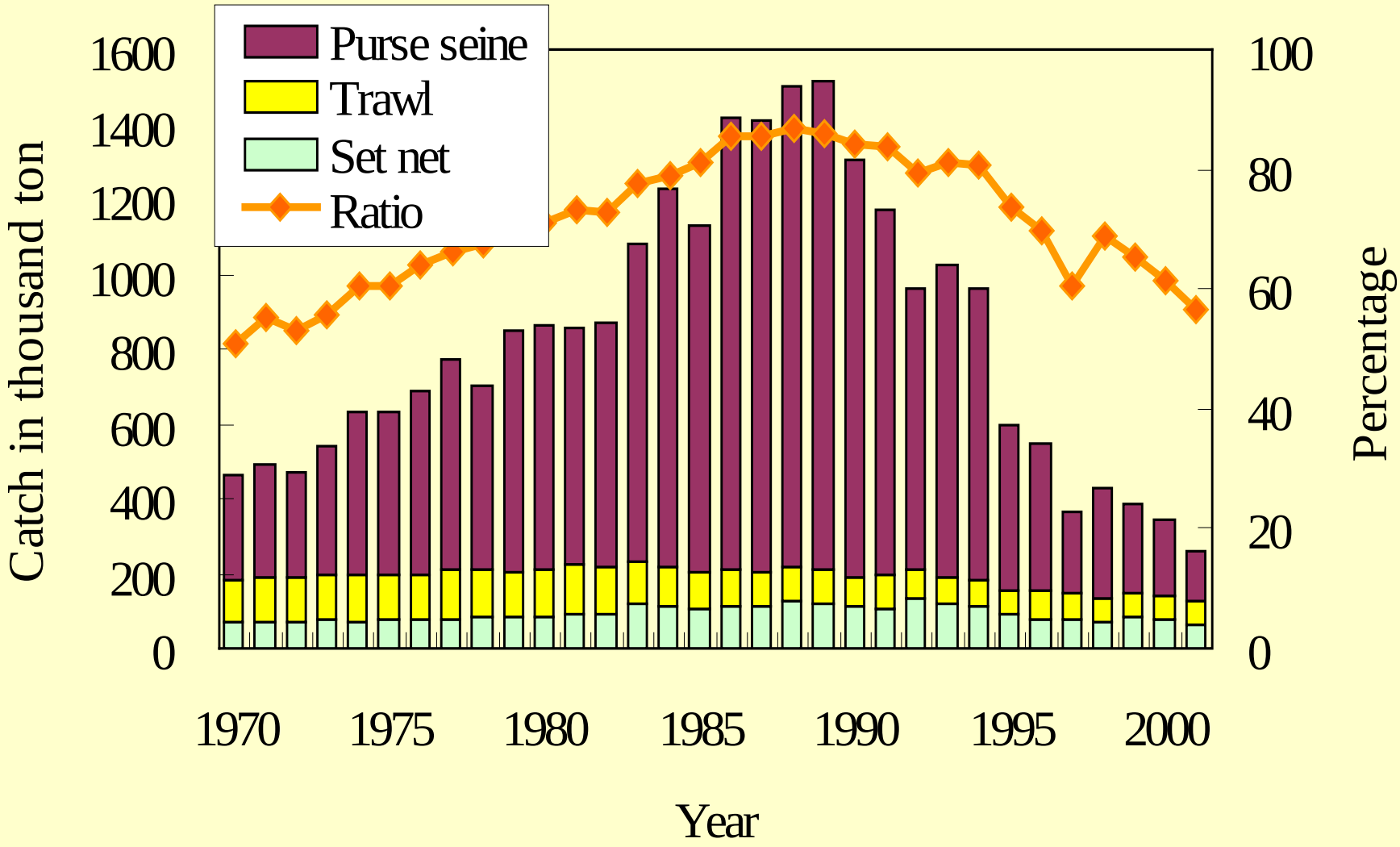
Indicator of Tsushima Warm Current



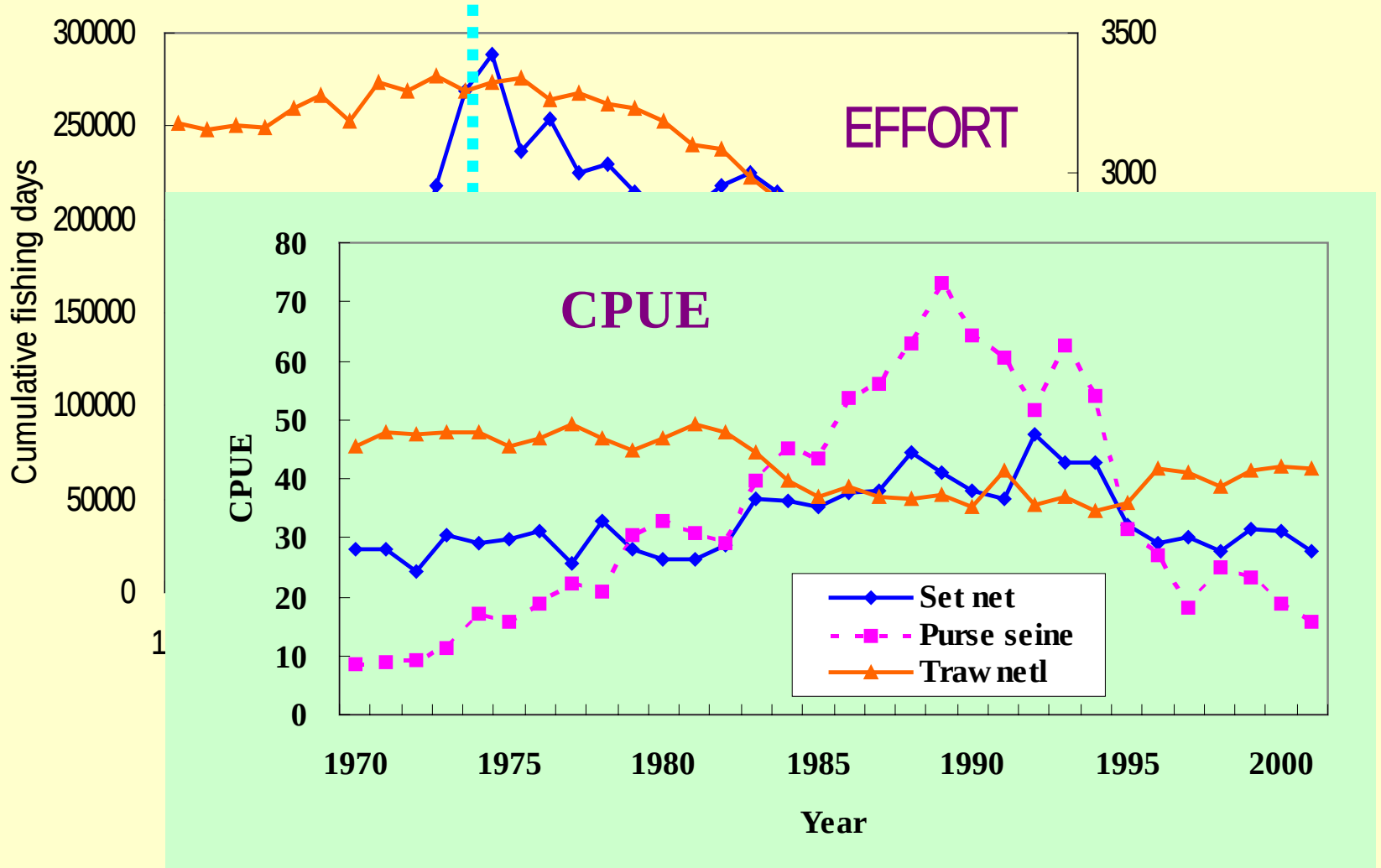
Catches Trend of 58 Species Items in the Japan Sea during 1958-2003



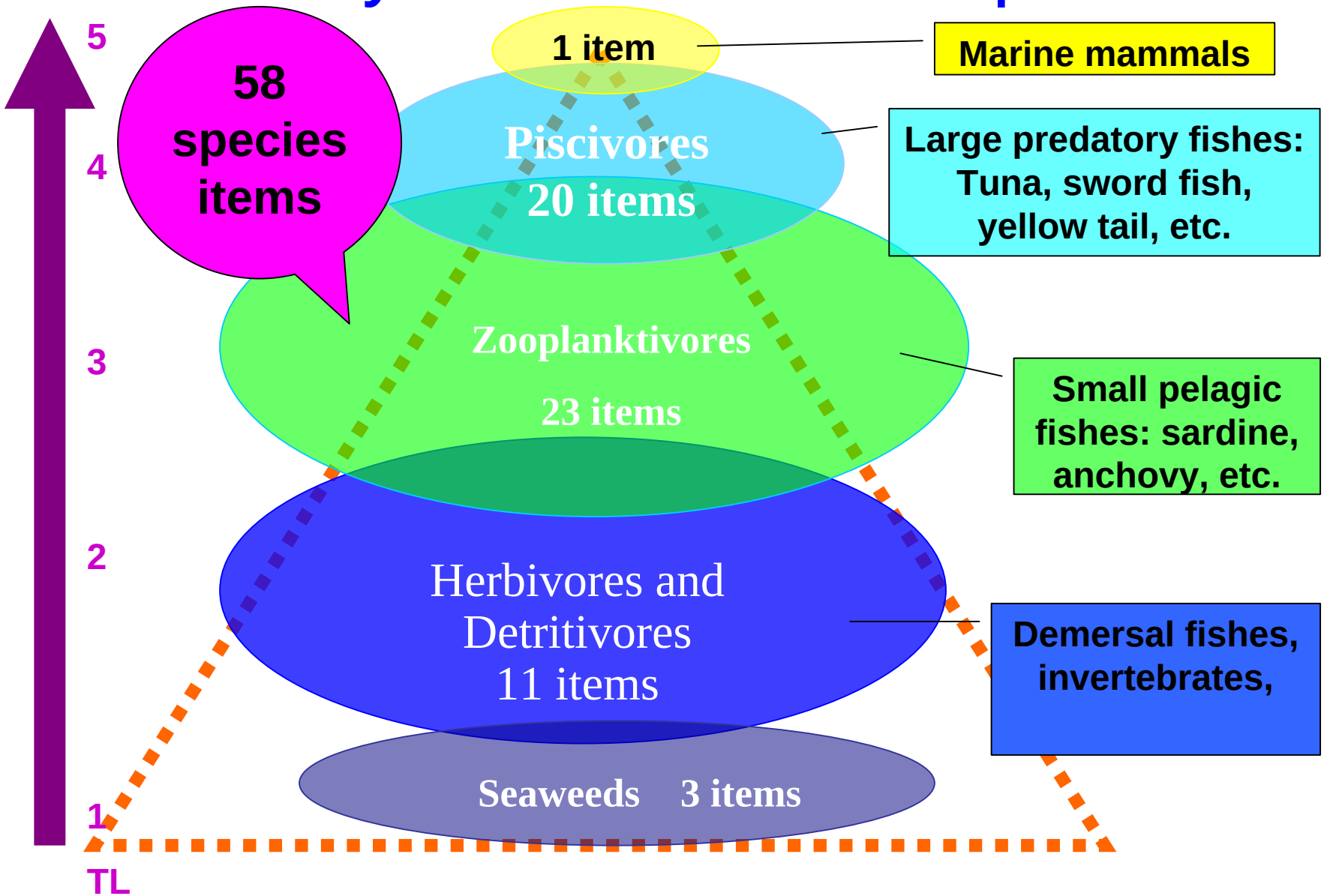
Three major fisheries in the Japan Sea



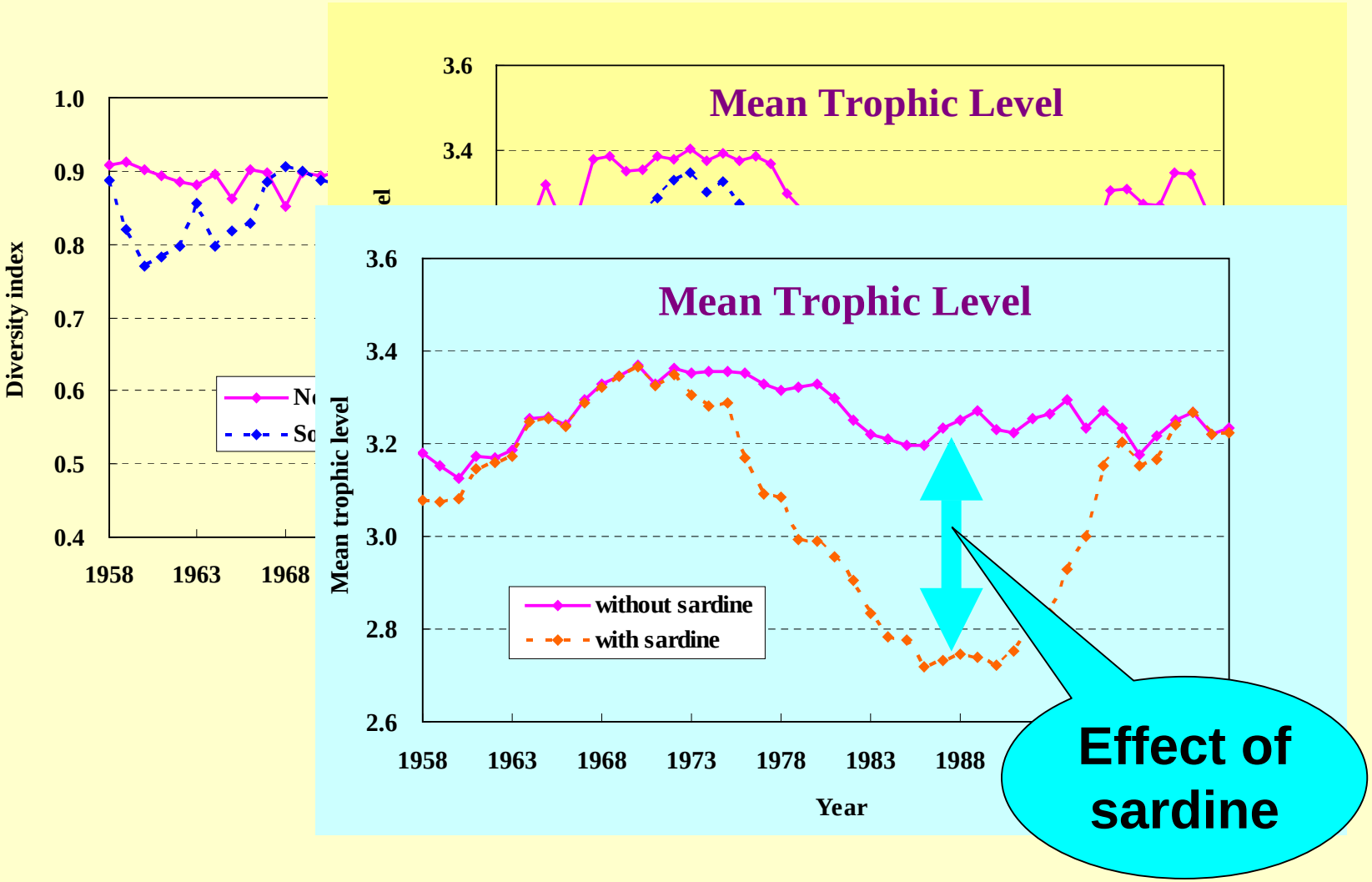
Fishing Effort and CPUE: 1970-2001



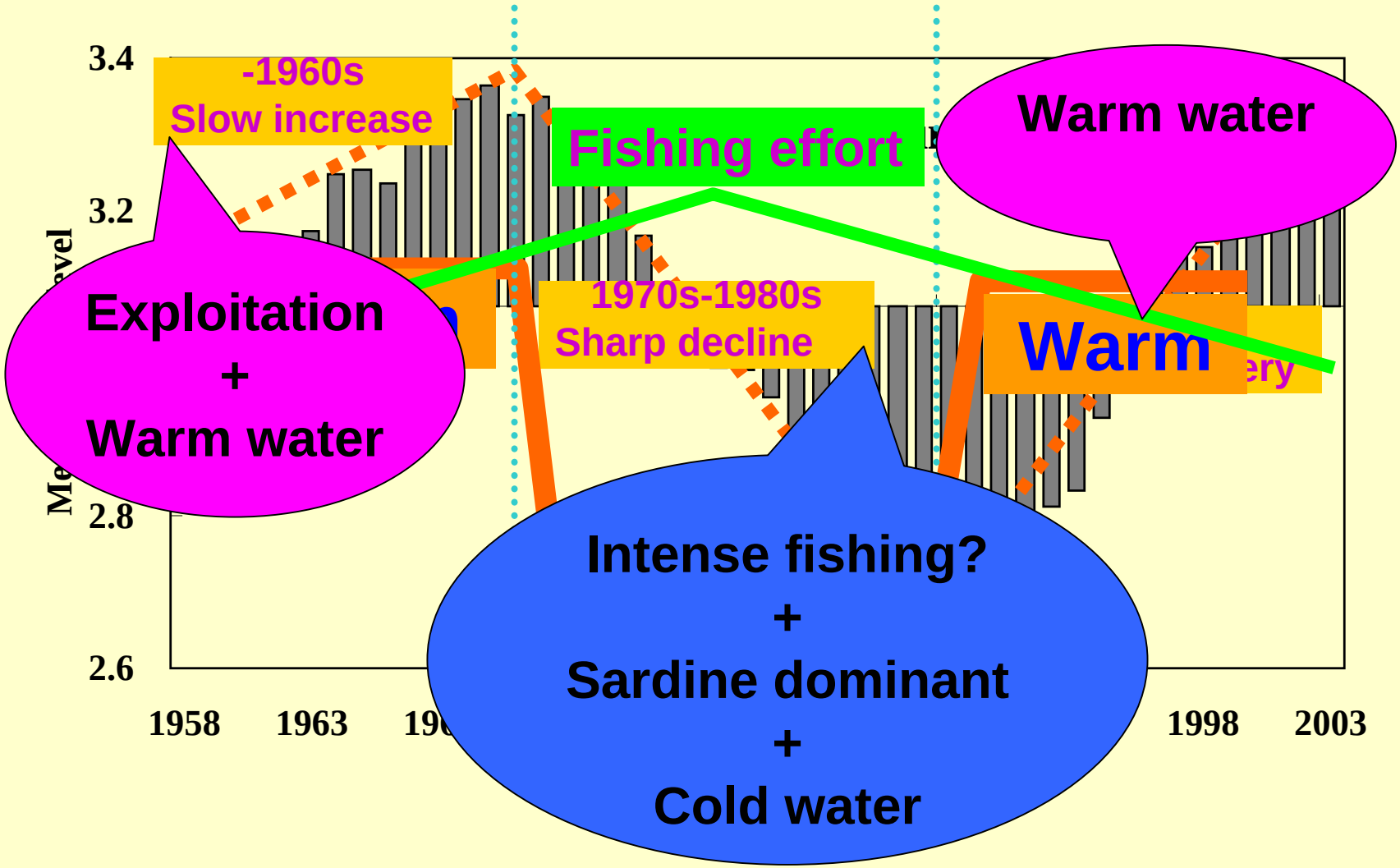
Community Structure in the Japan Sea



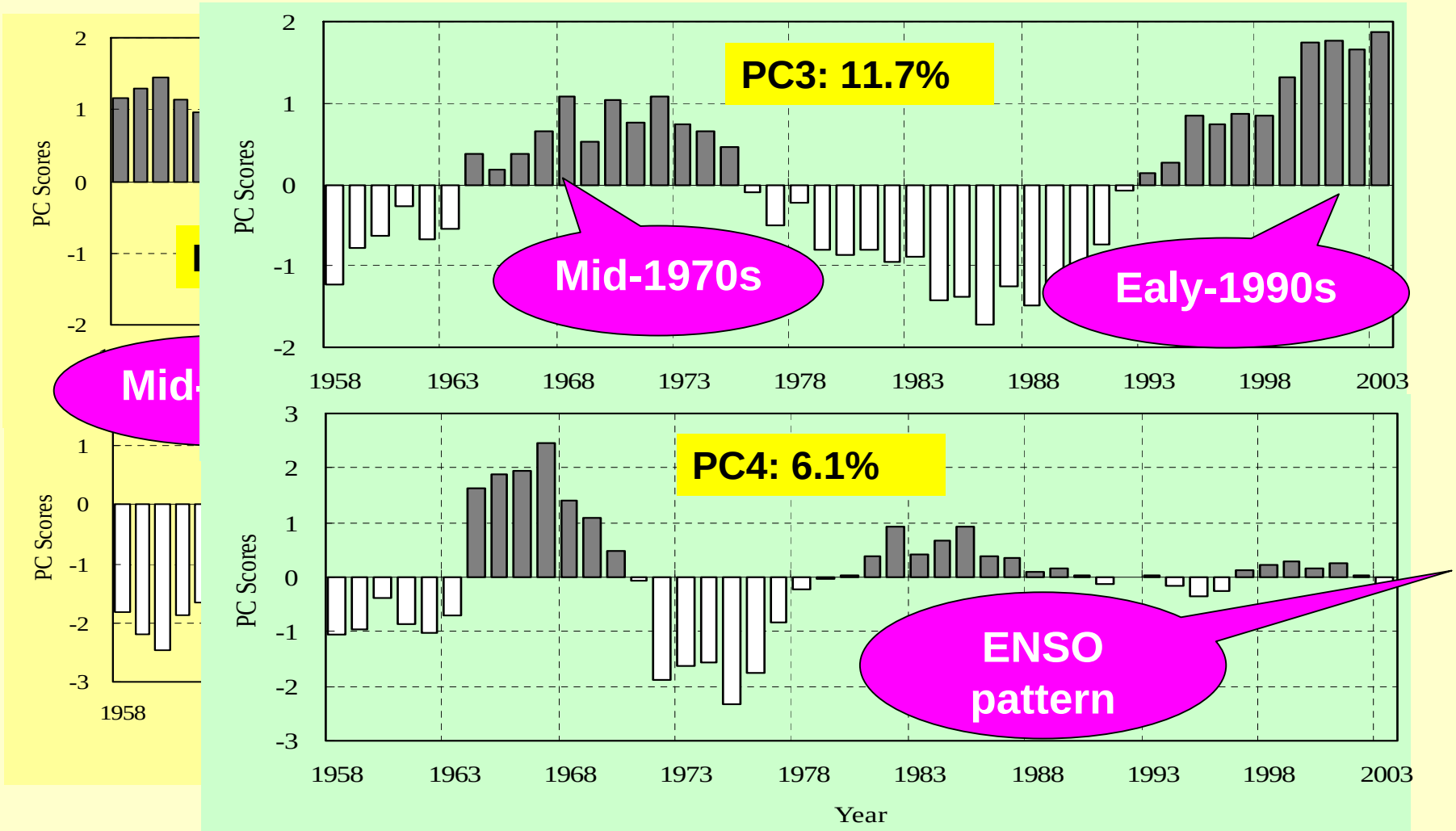
Changes in Community Indices



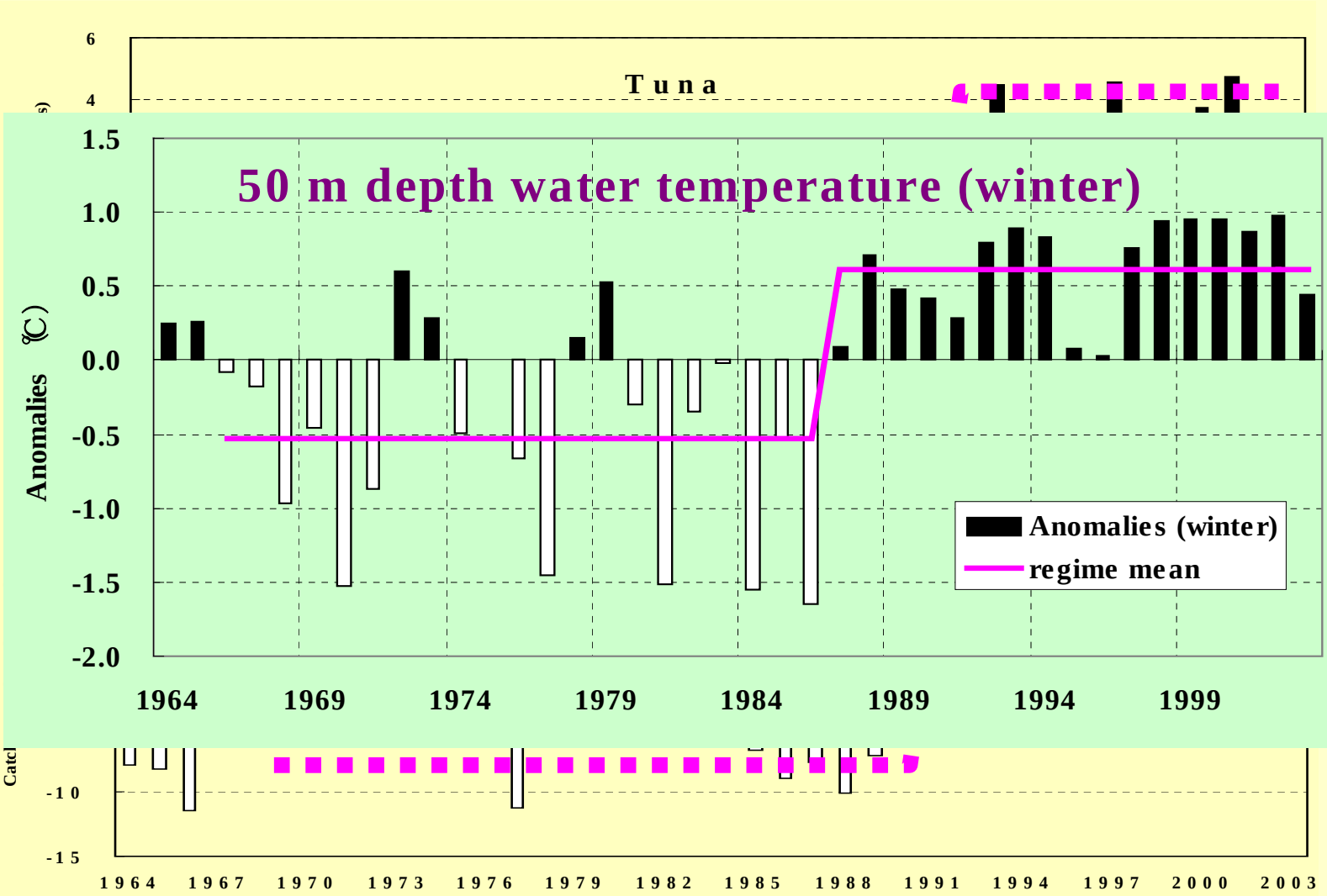
Impacts on Community



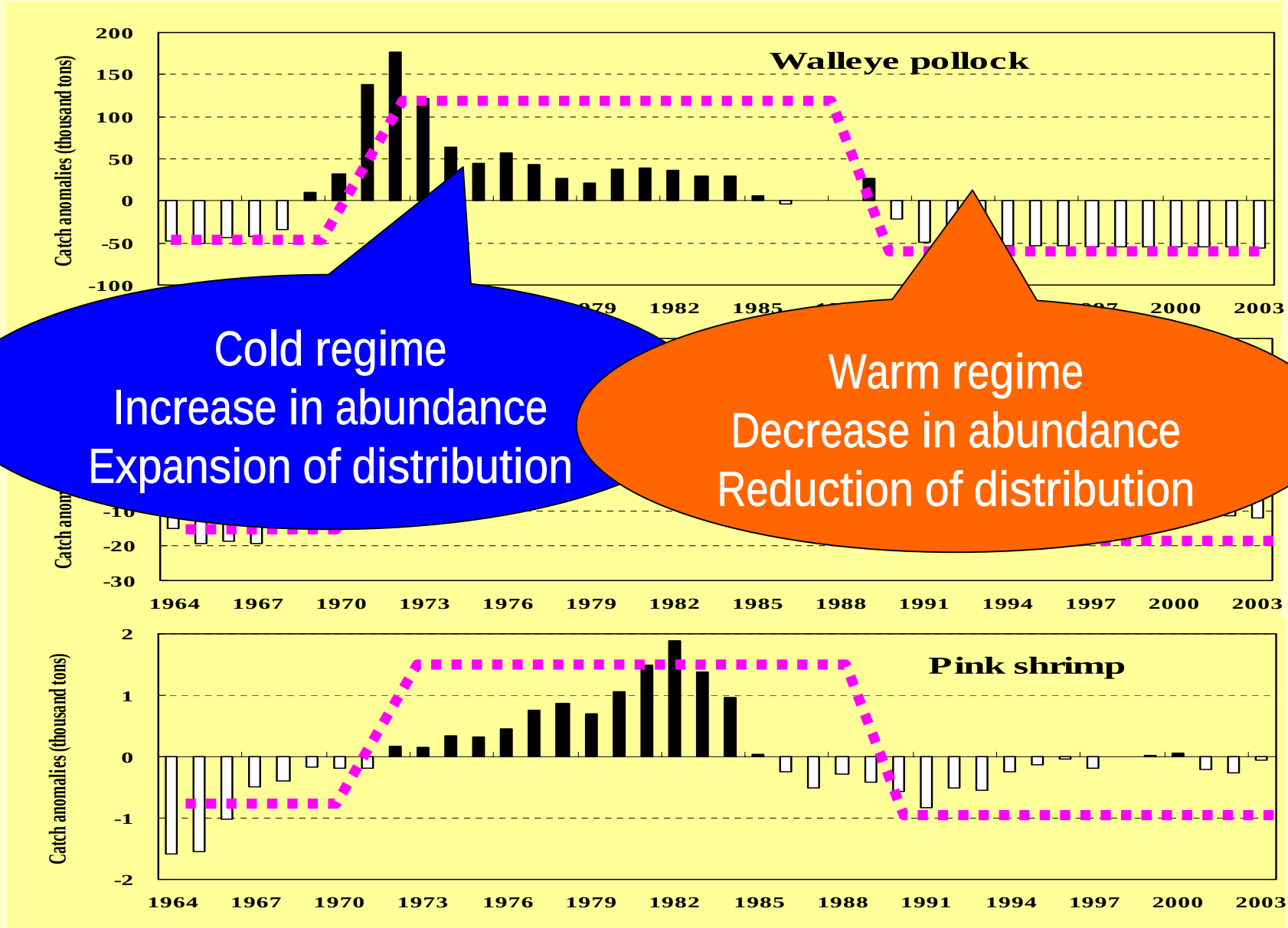
The First Four Principal Components



Large Predatory Warm Water Species

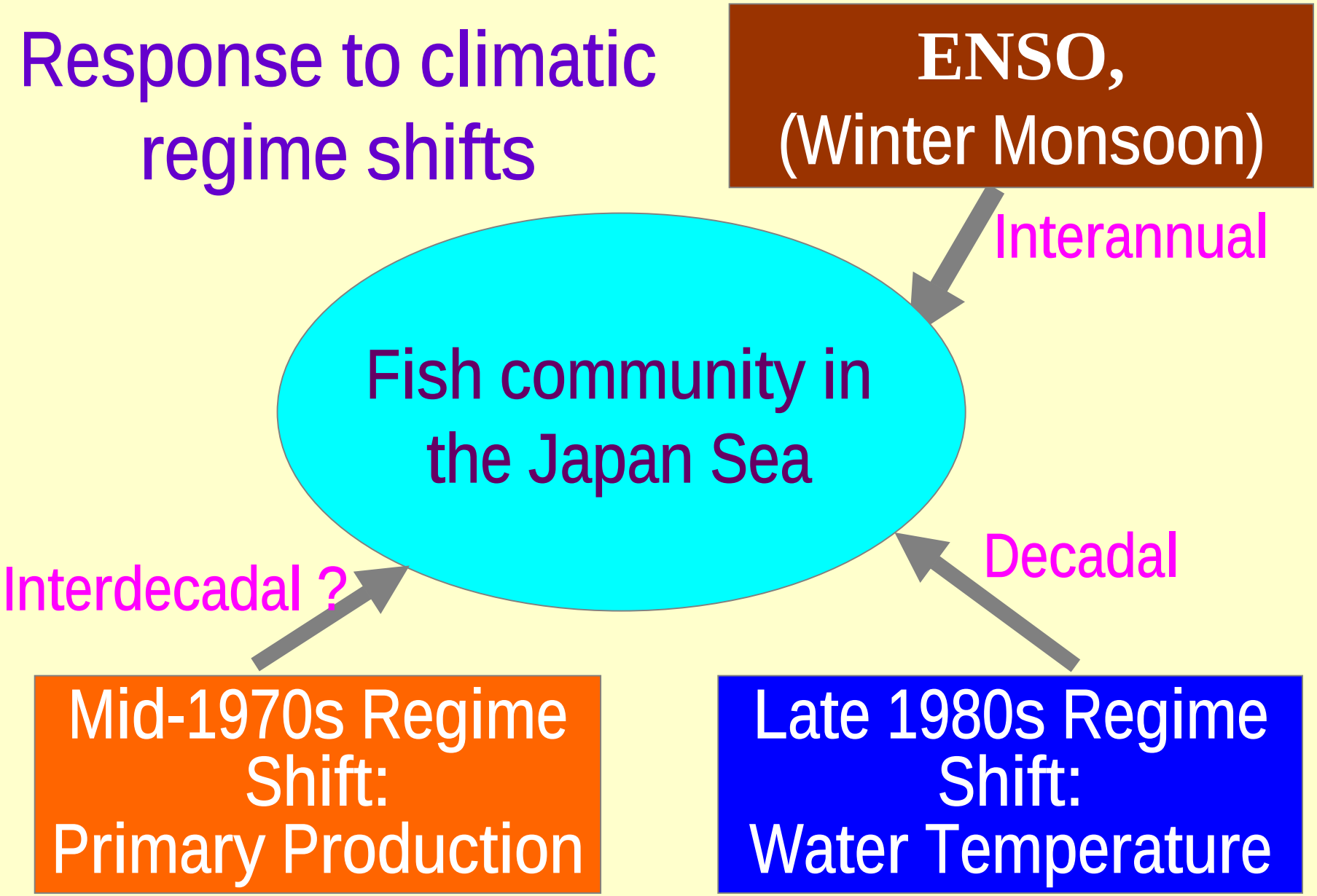


Demersal Cold Water Species



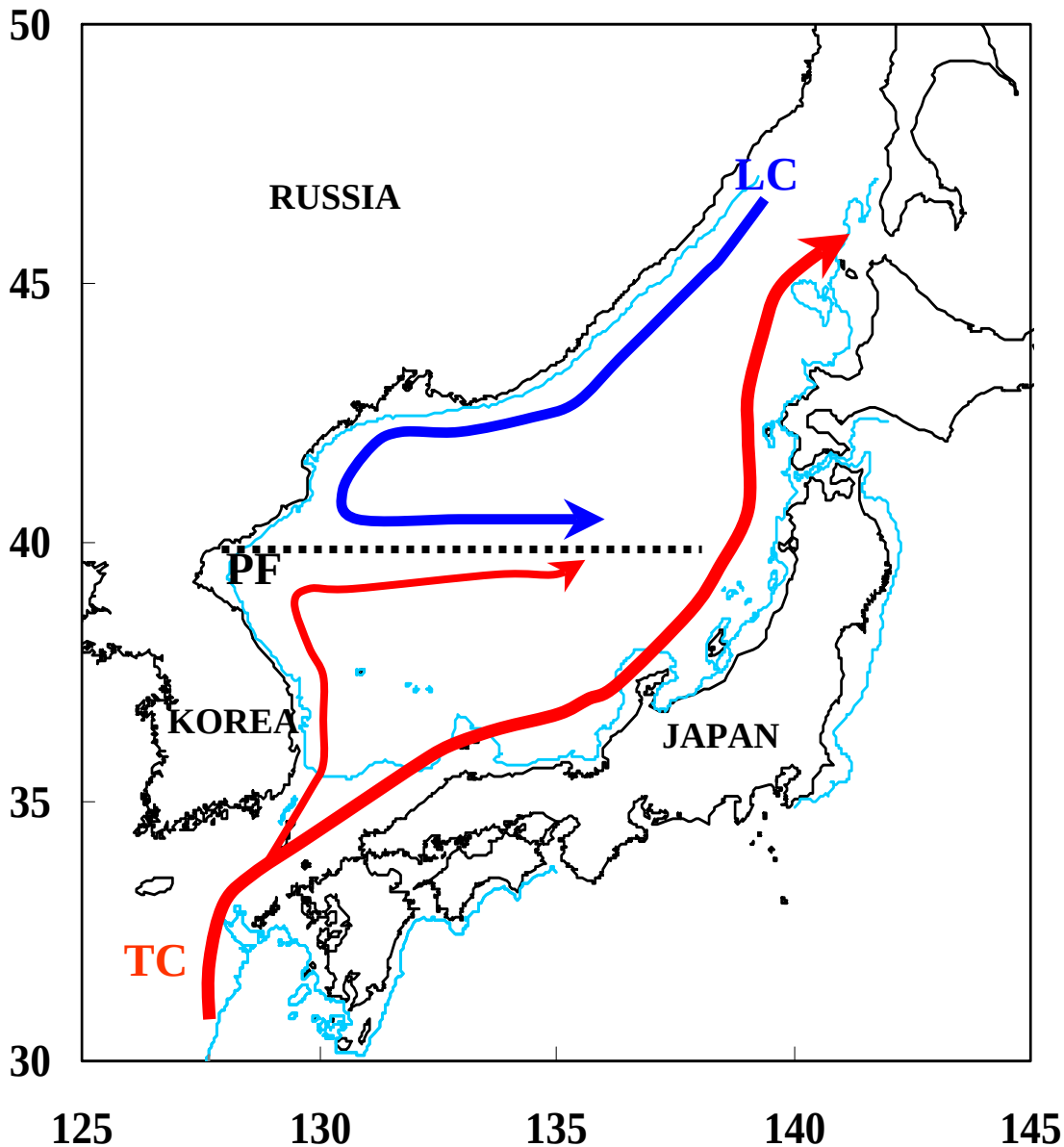
Cold regime
Increase in abundance
Expansion of distribution

Warm regime
Decrease in abundance
Reduction of distribution

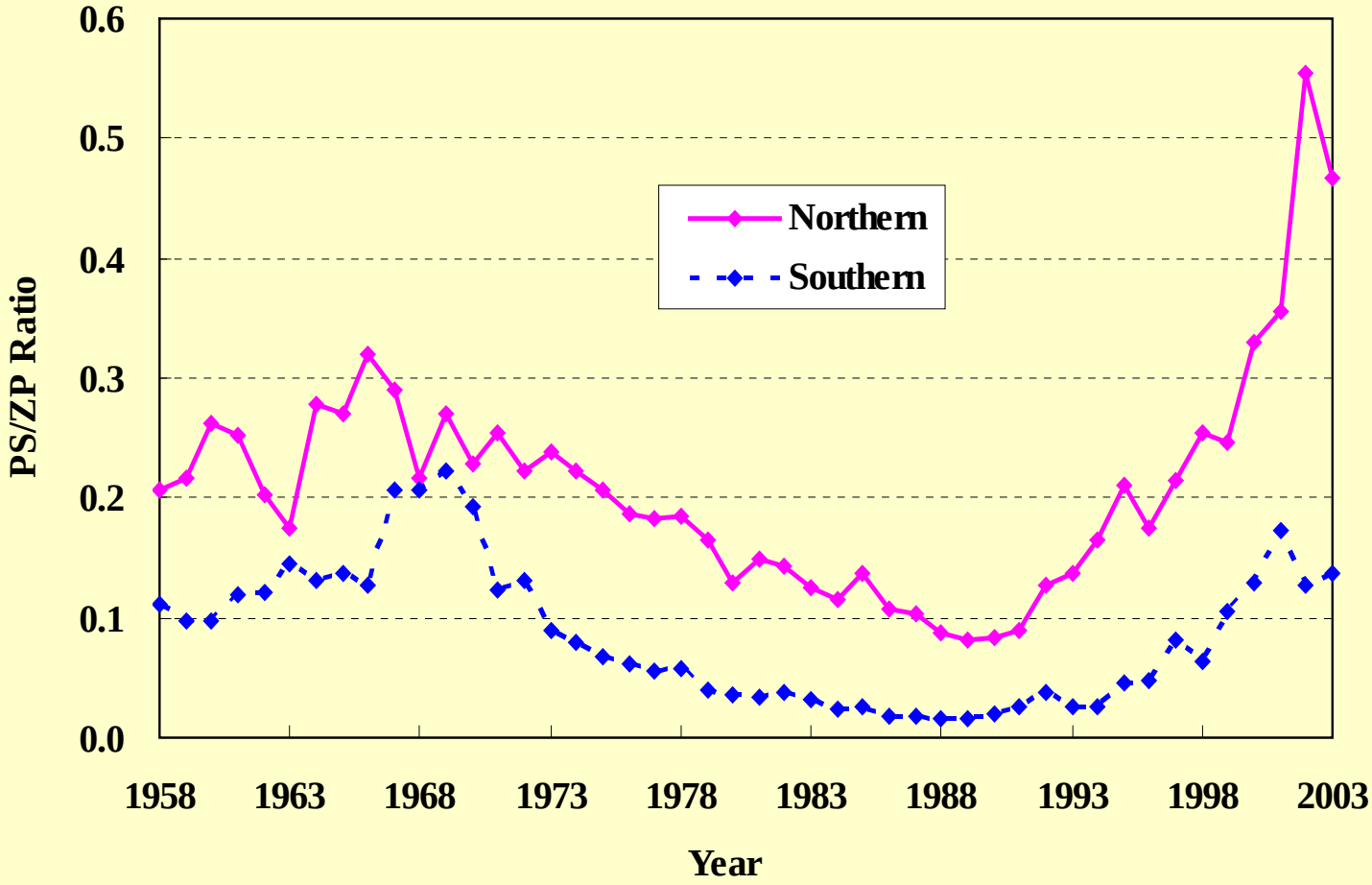

Response to climatic regime shifts
ENSO,
(Winter Monsoon)
Interannual
Fish community in the Japan Sea
Interdecadal ?
Decadal
Mid-1970s Regime Shift:
Primary Production
Late 1980s Regime Shift:
Water Temperature

CONCLUSIONS

- The fish community structure is forced by oceanic conditions; Large decline in community indices during 1980s is resulted from dominant sardine.
- No fishing down food web
- Mid-1970s and late 1980s regime shifts largely associated with the variability in the fisheries resources.


50
45
40
35
30
125
130
135
140
145
RUSSIA
LC
PF
KOREA
JAPAN
TC

Piscivores/zooplanktivores (PS/ZP) ratio



Outline of This Work

1. Climatic and oceanographic conditions in the Japan Sea

2. Features of fisheries production trend

3. Change in community indices

4. Response to climate regime shift