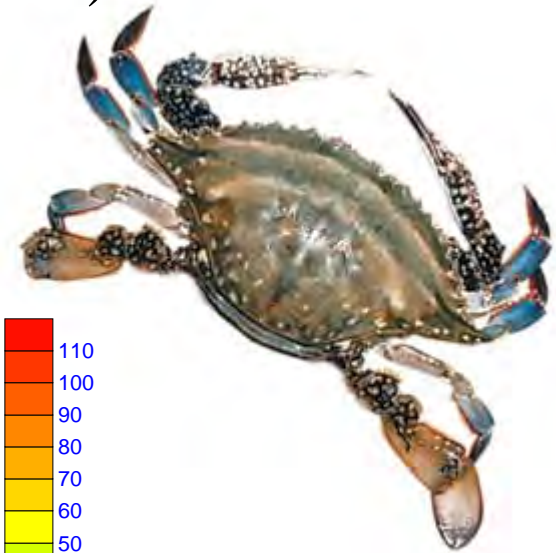
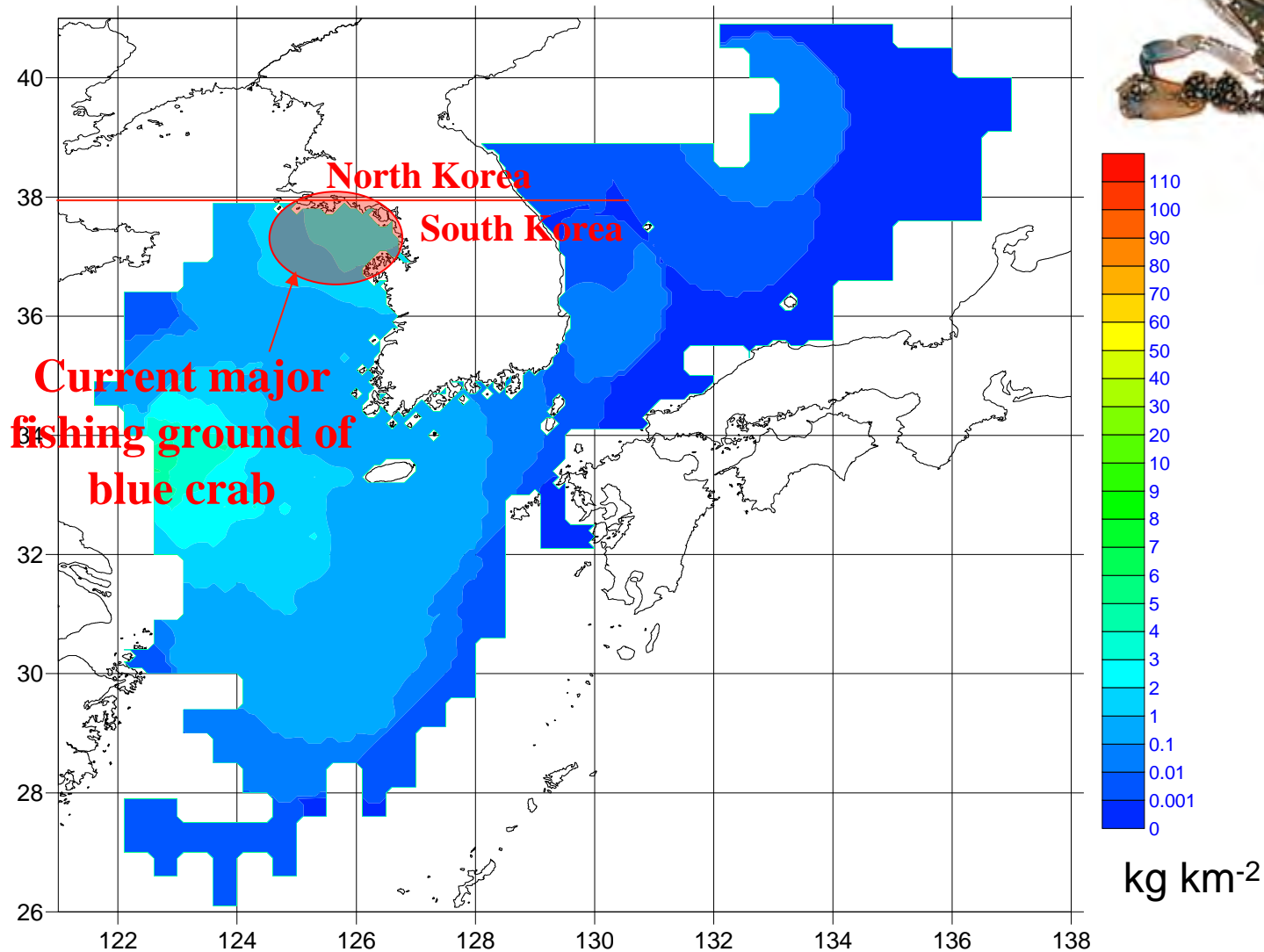


Climate-driven ecosystem shifts indicated in fishery catch statistics (1968- 2009) from Korean coastal waters

Sukgeun Jung, Young Shil Kang, Young-Sang Suh,
Sukyung Kang and Yeong Gong



Catch of blue crab (*Portunus trituberculatus*) in South Korea, averaged for 1983-2007





[부산] 2030년이면 연평도 낚게 못 잡을 수도

입력시간 : 2010-02-11 18

[앵커멘트]

우리나라 연근해에서 기후 변화에 따른 어종 변화가 다양하게 나타나고 있습니다.

현재는 다양한 어종이 분포해 상황이 좋지만 오는 2030년이면 주요 어종의 어장이 대부분 북상해 연평도 낚게 잡이가 힘들어 질 것으로 예측했습니다.

손재호 기자가 보도합니다.

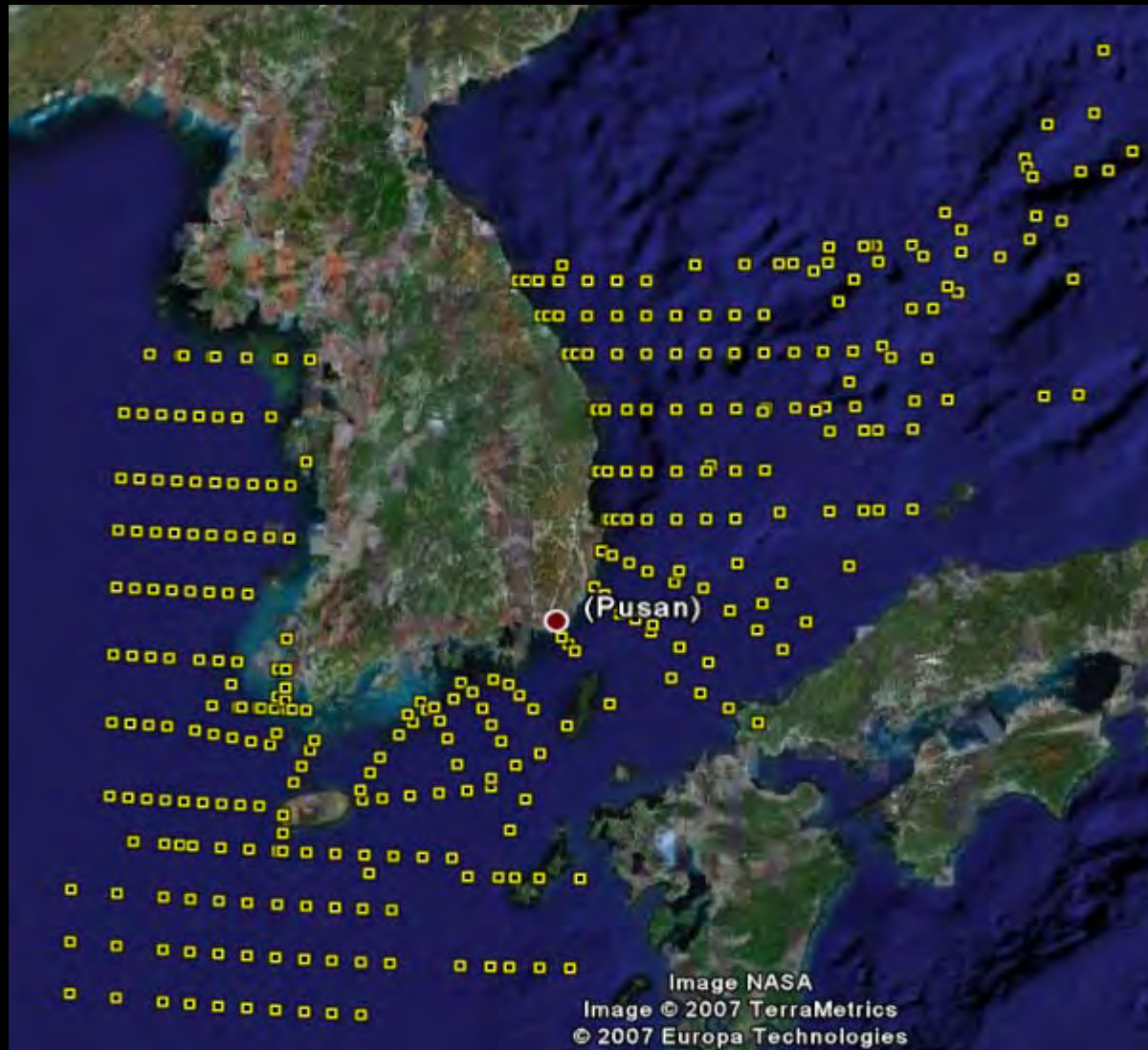
[리포트]

“According to NFRDI, in 2030, South Korean fishermen may not catch blue crab any more, as global warming will shift its major fishing ground to North Korean water.”

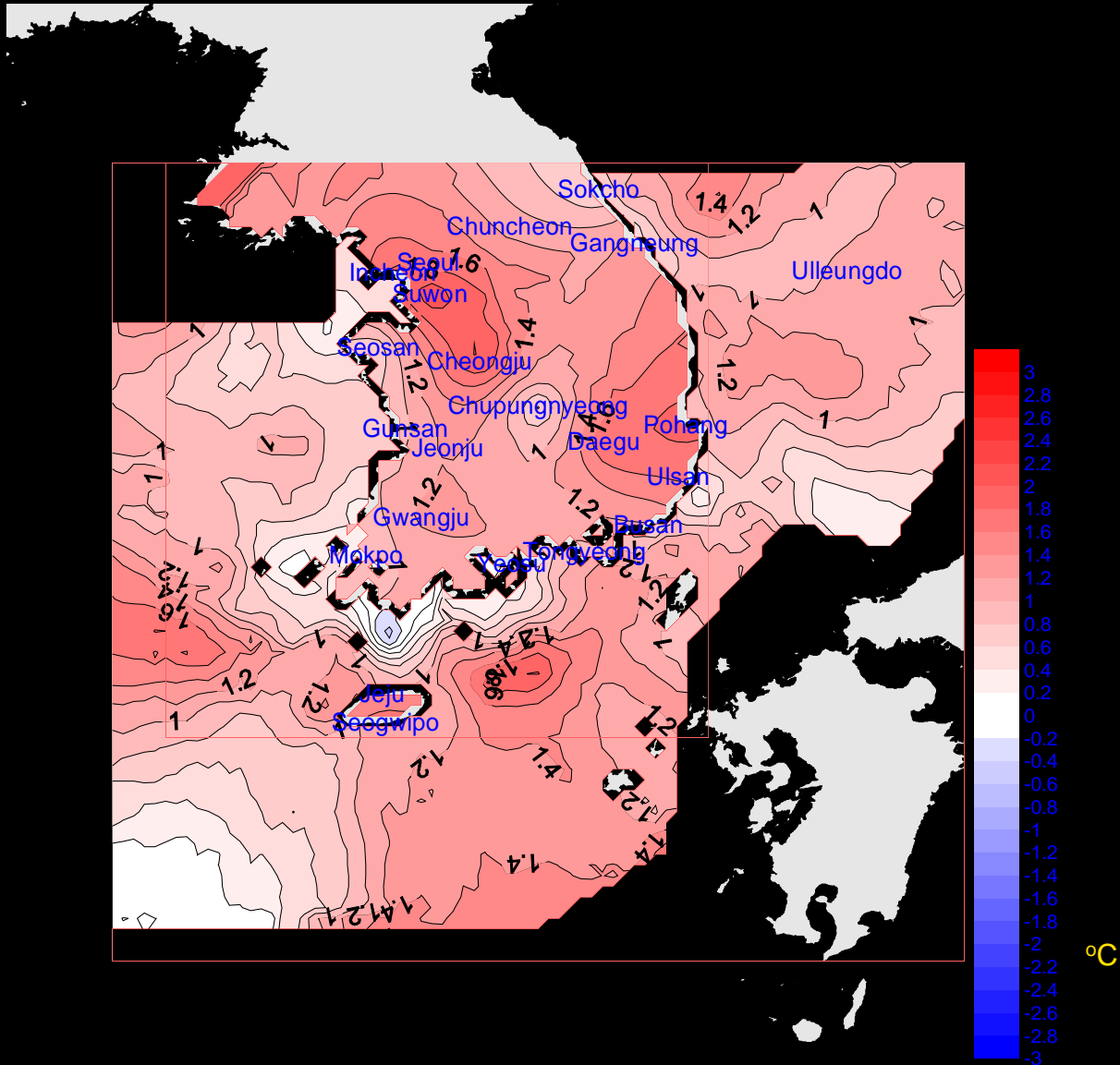
Outline of talk

1. Long-term changes in Korean waters
 - 1) Hydrographic conditions, 1968-
 - 2) Fish community (commercial catch), 1968-
 - 3) Zooplankton community, 1978-
 - 4) Correlations with respect to climate and Tsushima Warm Current
2. Future works

Stations of Serial Oceanographic Data NFRDI (Korea Oceanographic Data Center) 1961-2009

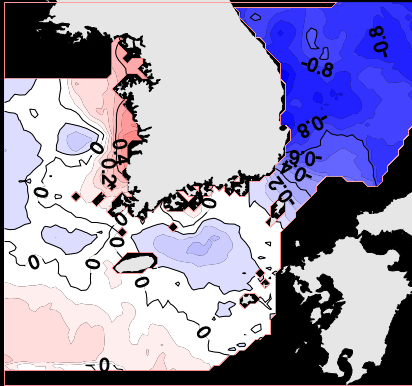


Linear trend of temperature change (°C) in the land and sea surface (1968-2005)

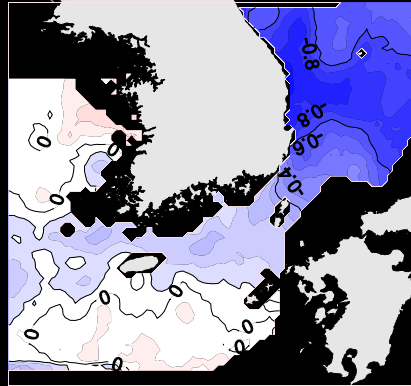


Linear trend of DO changes (1968-2005)

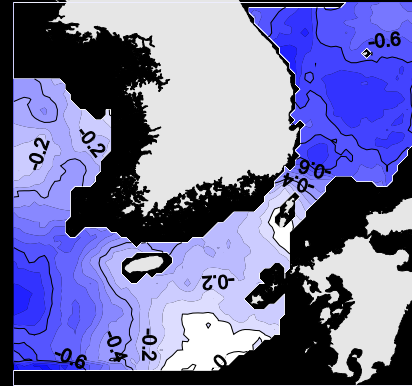
0 m



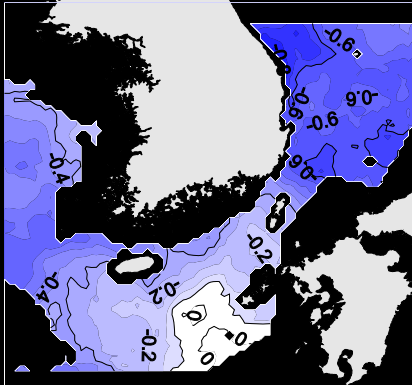
10 m



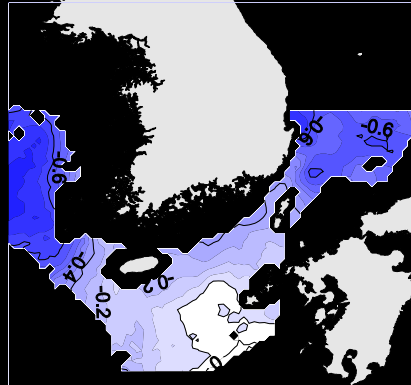
30 m



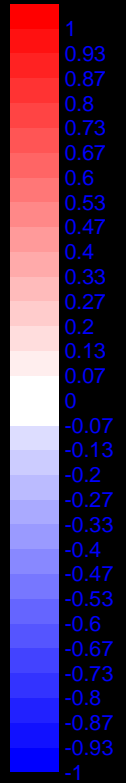
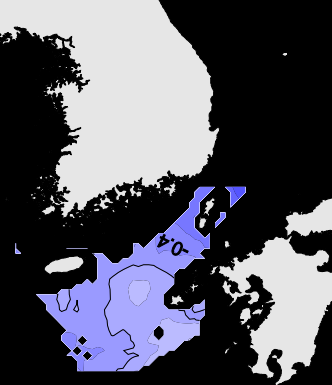
50 m



75 m

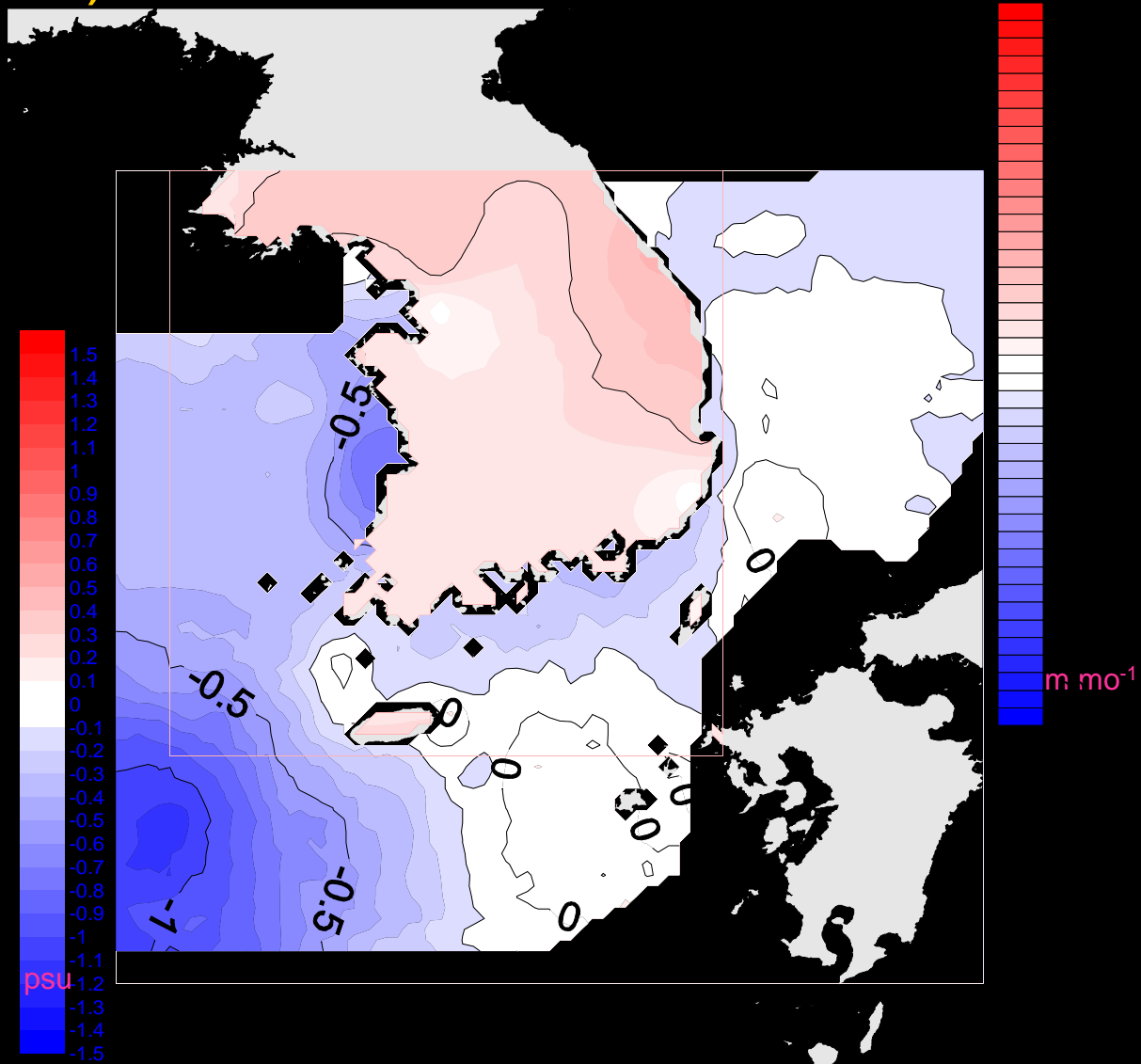


100 m

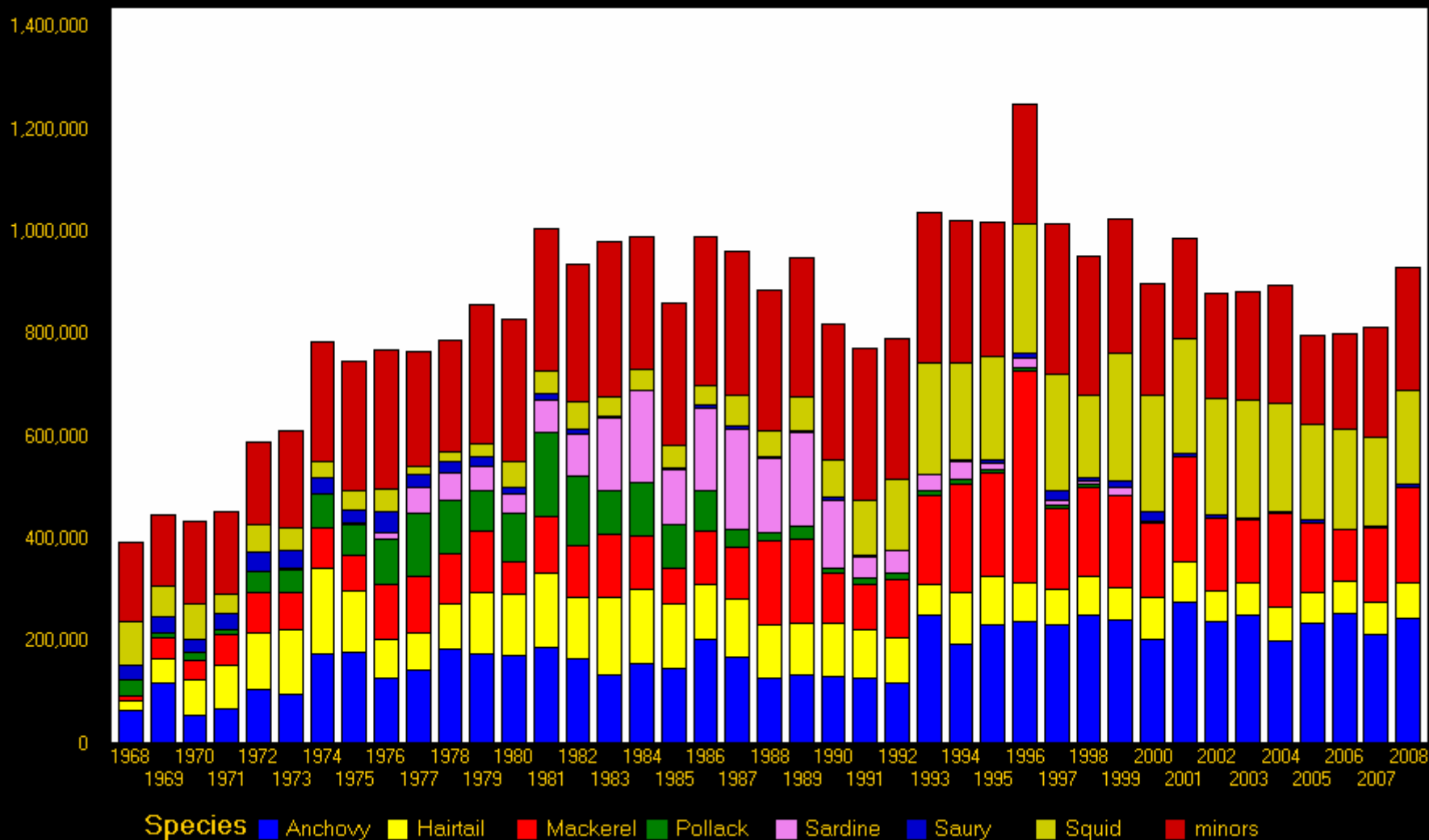


$ml\ l^{-1}$

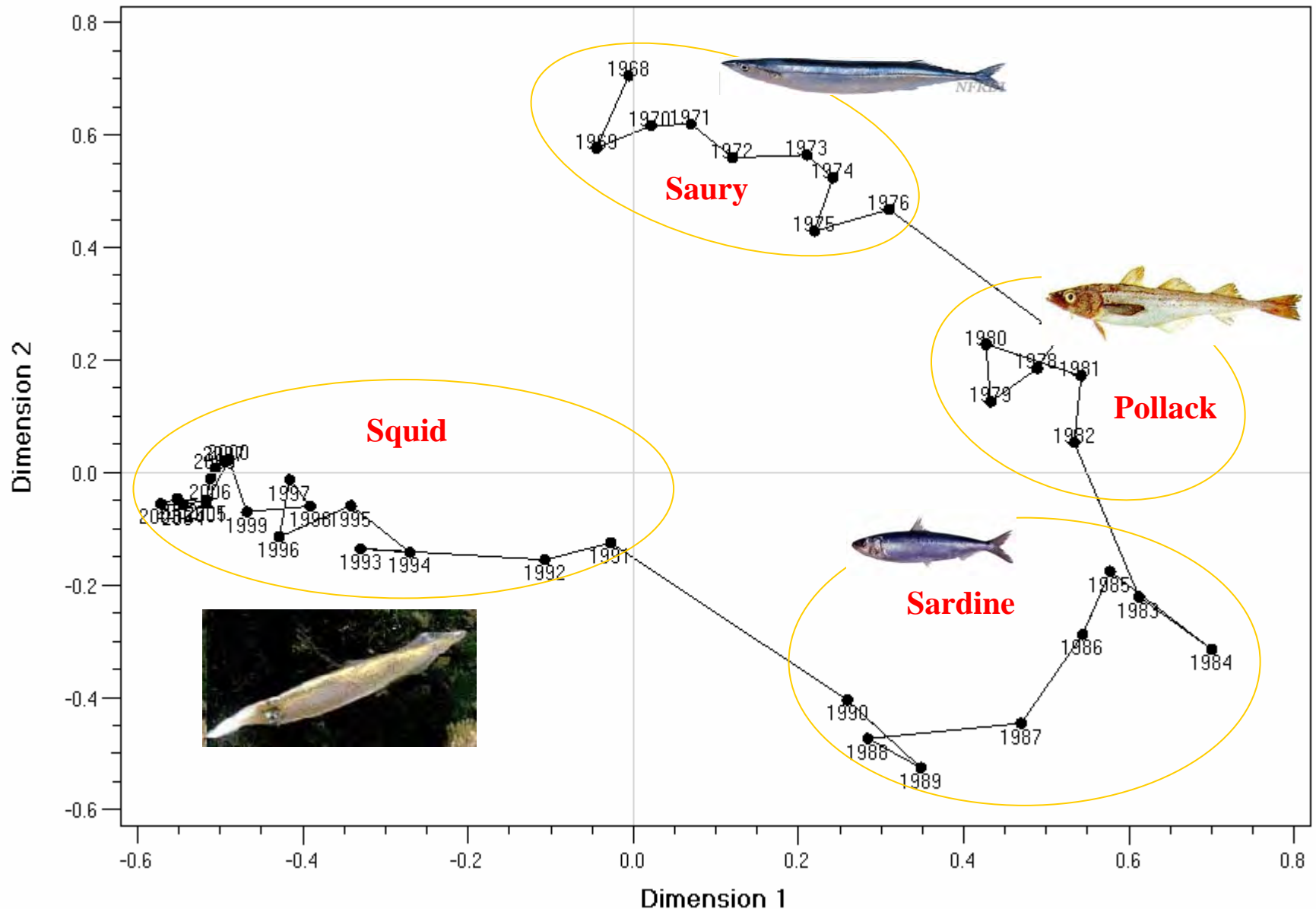
Linear Trend of Mean rainfall and salinity changes (1968-2005)



Annual Catch from Korean Sea Waters by Species (marine capture fisheries, metric tons, 1968-2008)



Correspondence analysis (COA) of species composition in Korean fishery catch (1968-2009)



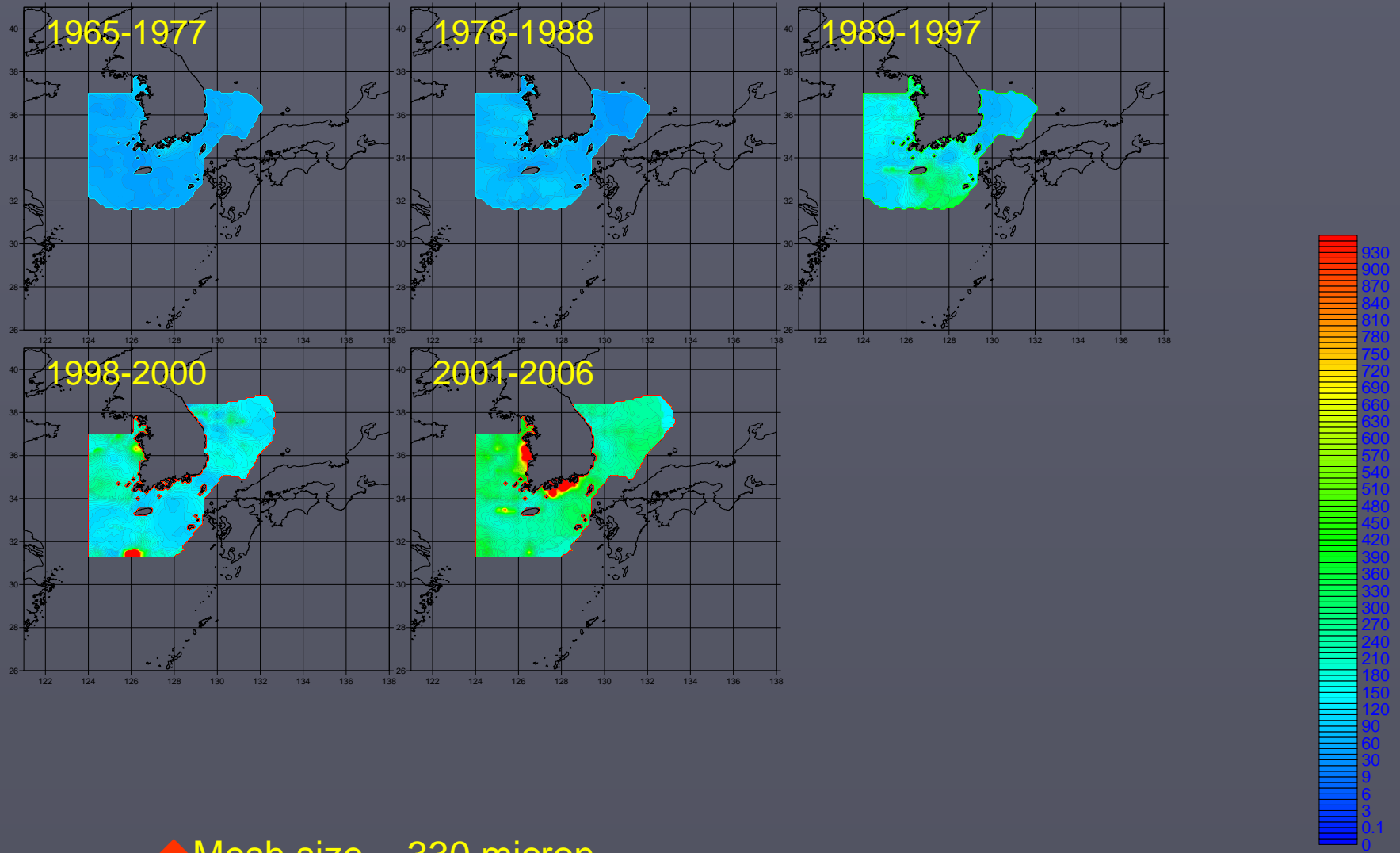
Summary of Fish Species Changes in Korea, 1968–2009

- Dominant species along the Tsushima Warm Current have fluctuated greatly.

Proposed long-term monitoring lines for NFRDI



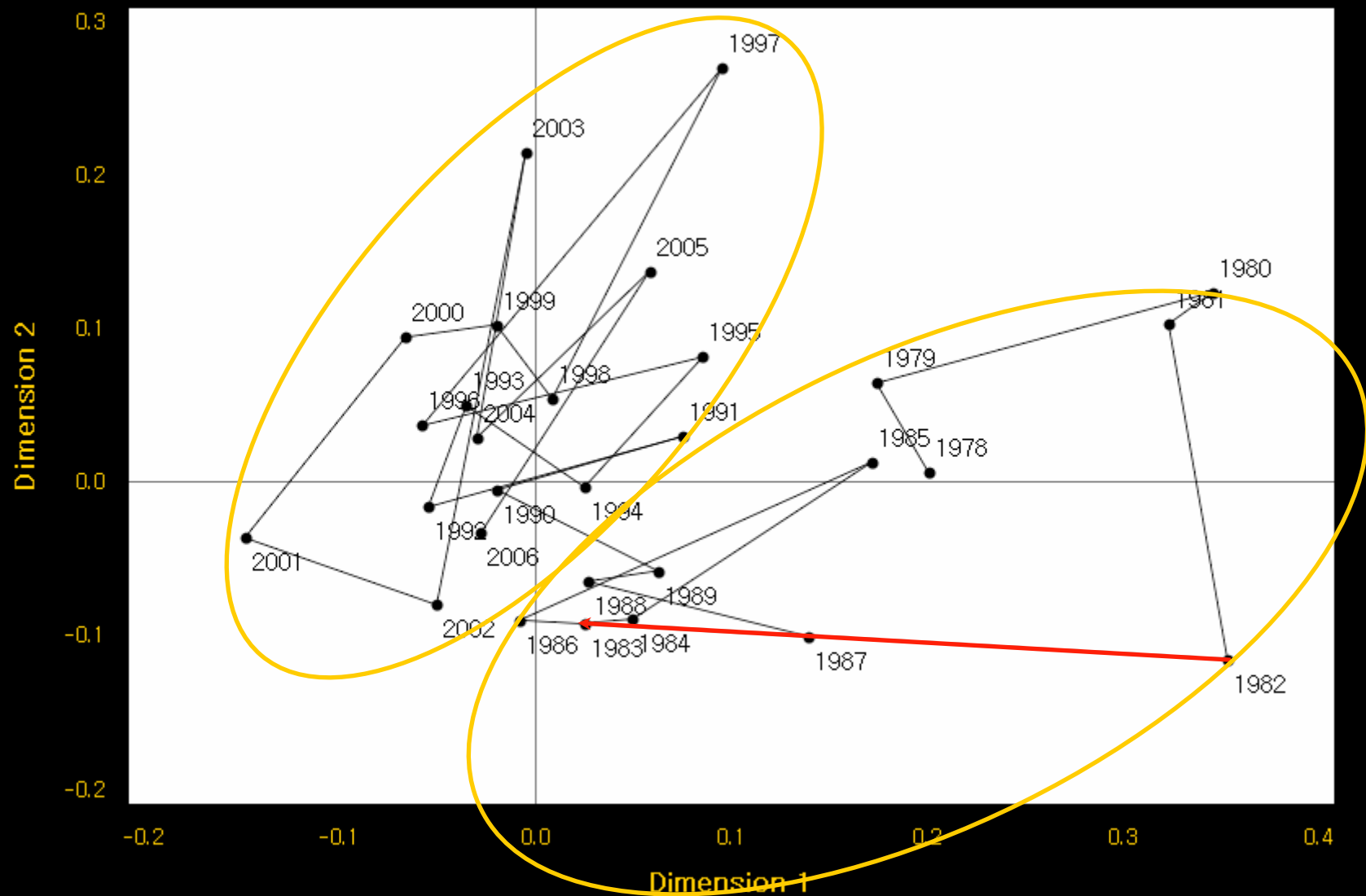
Meso-zooplankton Averaged biomass (1965-2006)



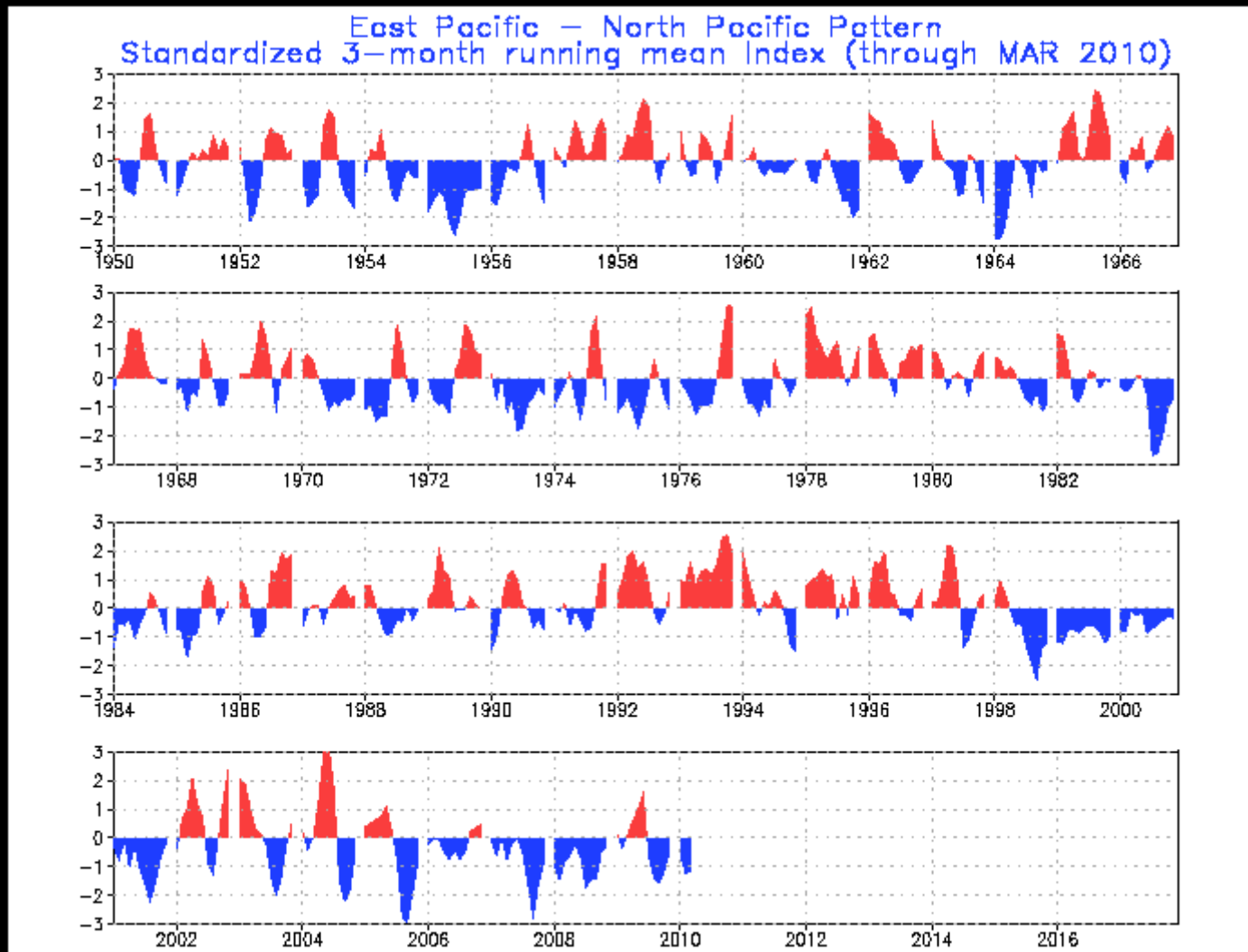
◆ Mesh size = 330 micron

mg m^{-3}

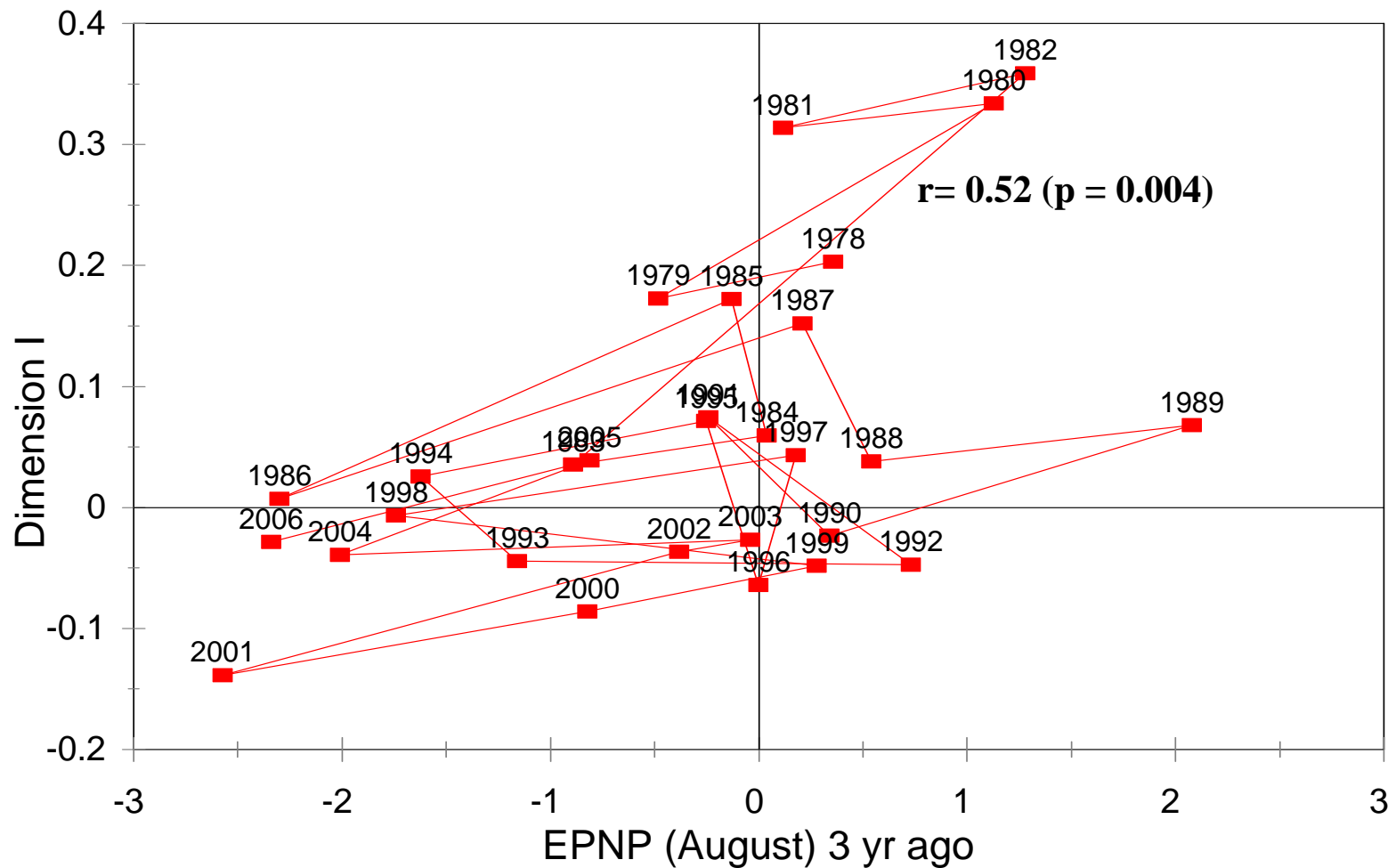
COA of numerical composition of the 4 zooplankton groups (Copepods, Chaetognaths, Amphipods and Euphausiids)



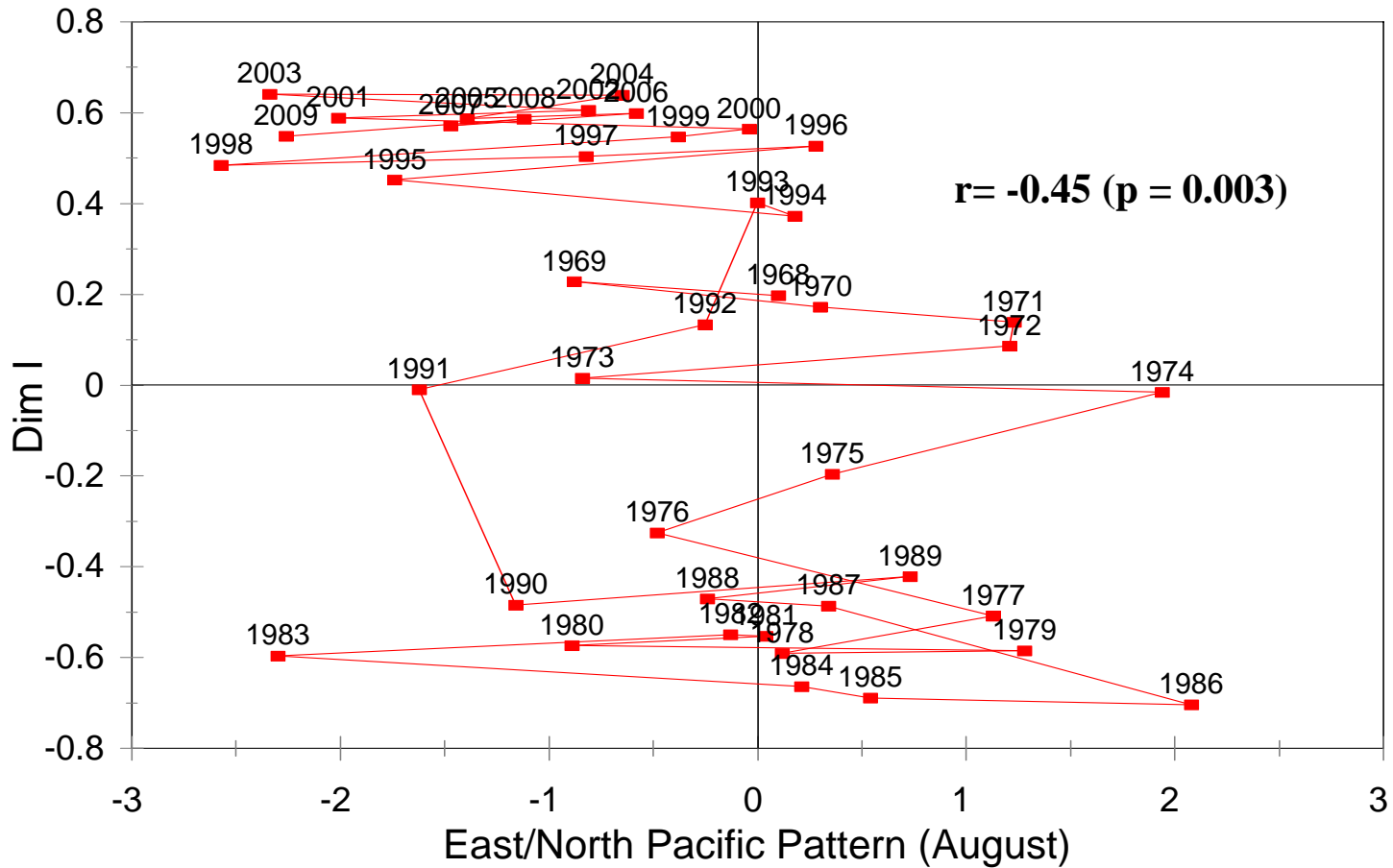
East Pacific-North Pacific Pattern index



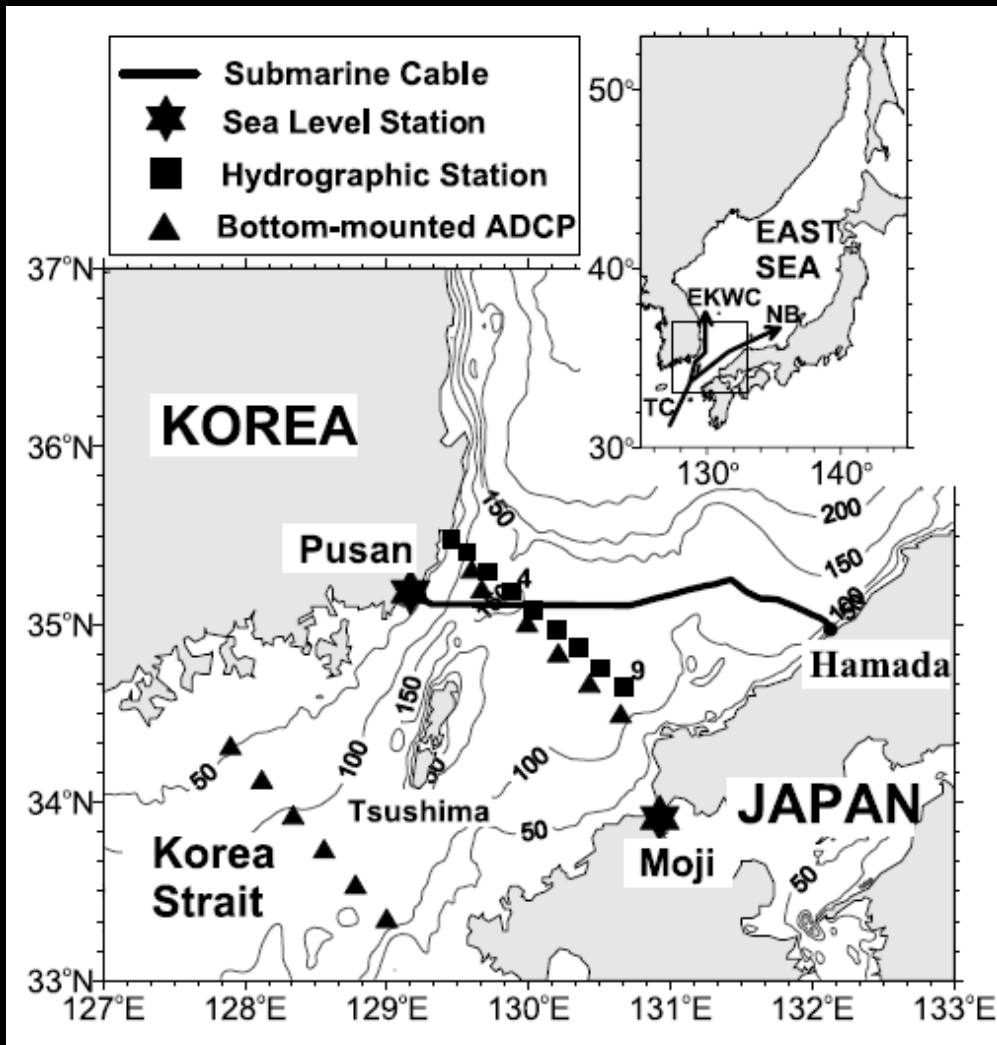
Teleconnection index vs. Zooplankton COA (1978-2006)



Teleconnection index vs. Fish COA in Korea (1968-2009)

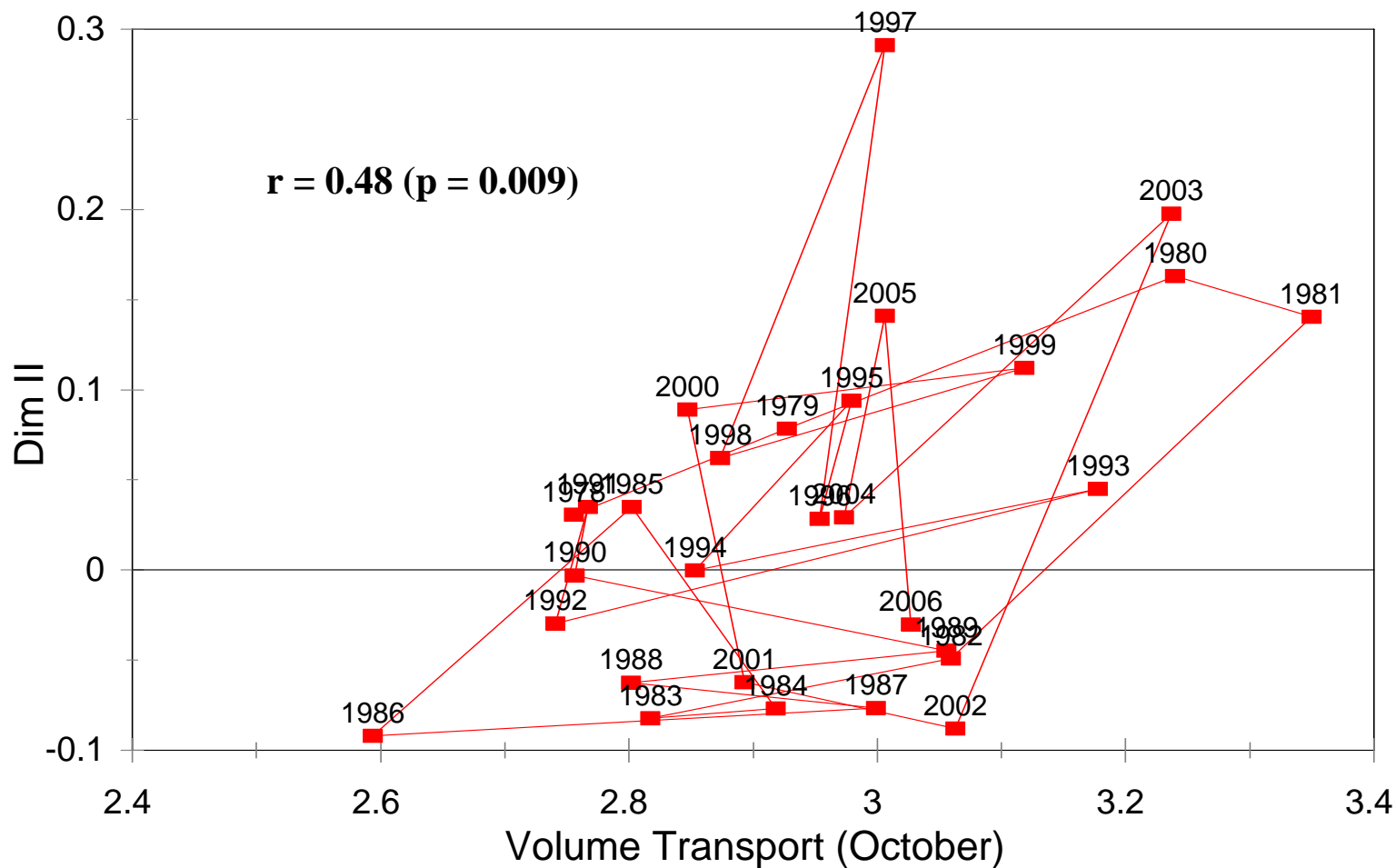


Volume Transport by the Tsushima Warm Current

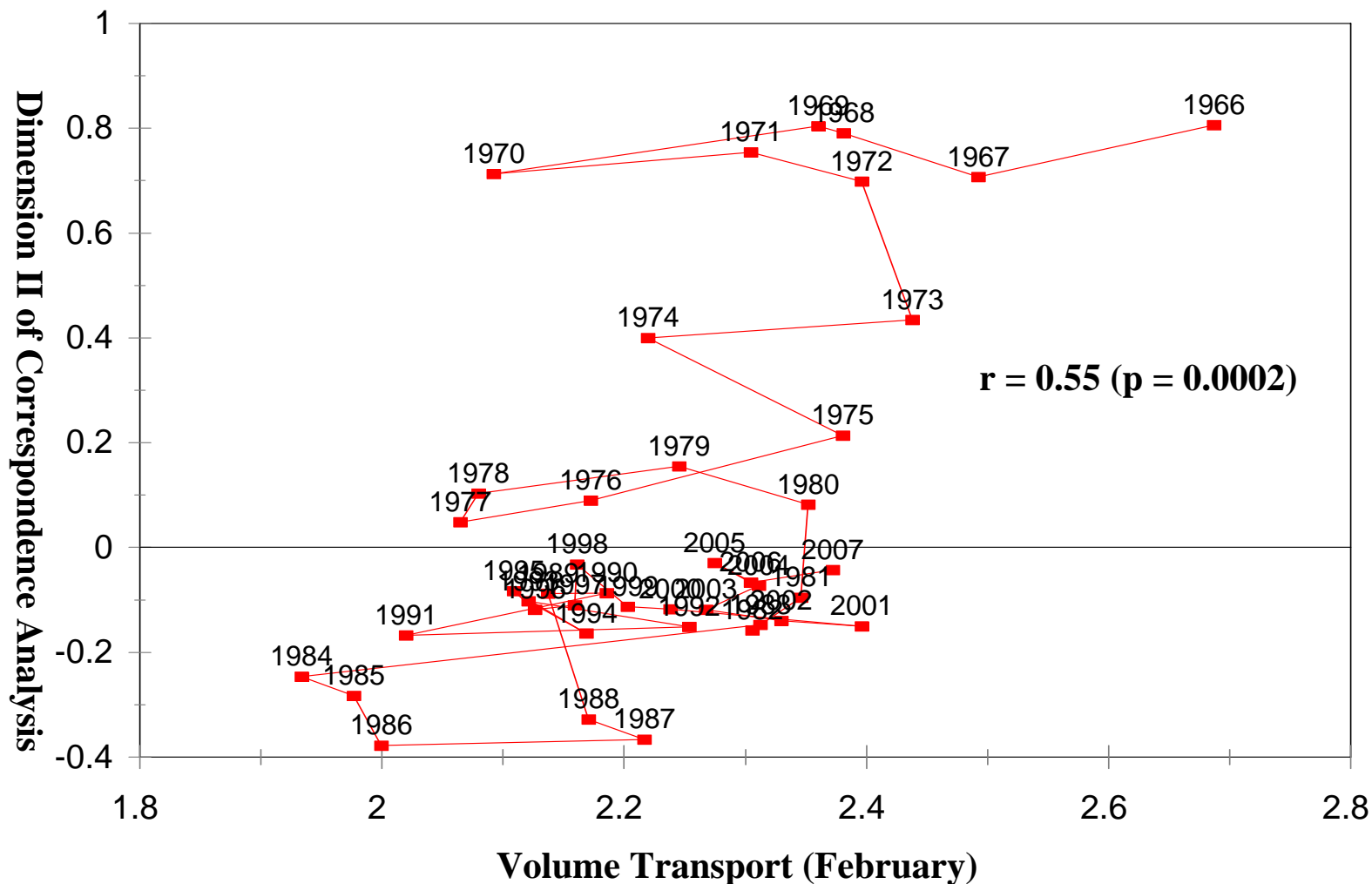


**From Lyu & Kim. 2003.
Absolute transport from the sea
level difference across the
Korea Strait. Geophysical
Research Letters 30(6): 18-1 -
18-4.**

TWC volume transport in October vs. Dim 2 of Zooplankton COA



TWC volume transport in February vs. Fish COA (Time lag = 2 yr)



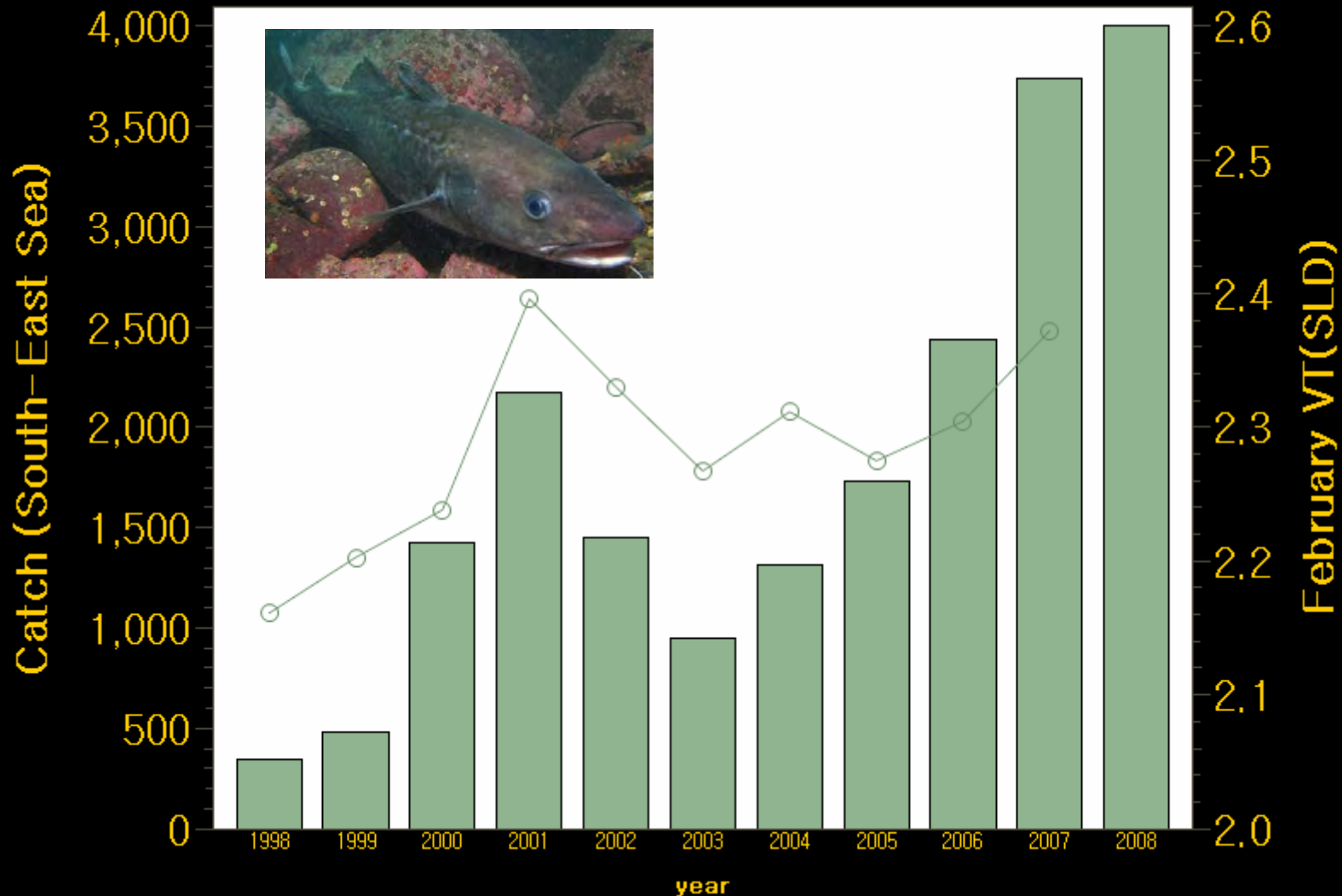
Larvae of most of the dominant fish species in Korea start migration in February.

Summary of COA

- Dimension I was correlated with climate indices for both zooplankton and fish
- Dimension II was correlated with volume transport by the Tsushima Warm Current for both zooplankton and fish

Correlation between TWC VT and Pacific Cod Catch along TWC

$r = 0.79$ ($p = 0.007$) **A2 Poster Session (S. Jung)**



**Summary of responses of Korean marine ecosystems
to the past regime shifts and El Niño events
(Kang et al. Submitted to Progress in Oceanography)**

	Region	1977 regime shift	1982 El Niño	1989 regime shift	1998 El Niño
Temperature	EYS	X	X	O	O
	NECS	X	X	O	O
	SJES	X	X	O	O
	NJES	X	X	O	X
Salinity	EYS	O	X	X	O
	NECS	X	X	X	O
	SJES	O	X	X	O
	NJES	–	–	–	–
Zooplankton biomass	EYS	X	X	O	O
	NECS	X	X	O	X
	SJES	X	X	O	X
	NJES	–	–	X	O
Zooplankton community structure	EYS	–	O	O	O
	NECS	–	X	O	O
	SJES	–	X	O	O
	NJES	–	–	X	O
Fish	Korean waters	O	O	O	X

Symbols: X = Not detected, O = Detected, – = Data unavailable

Conclusion

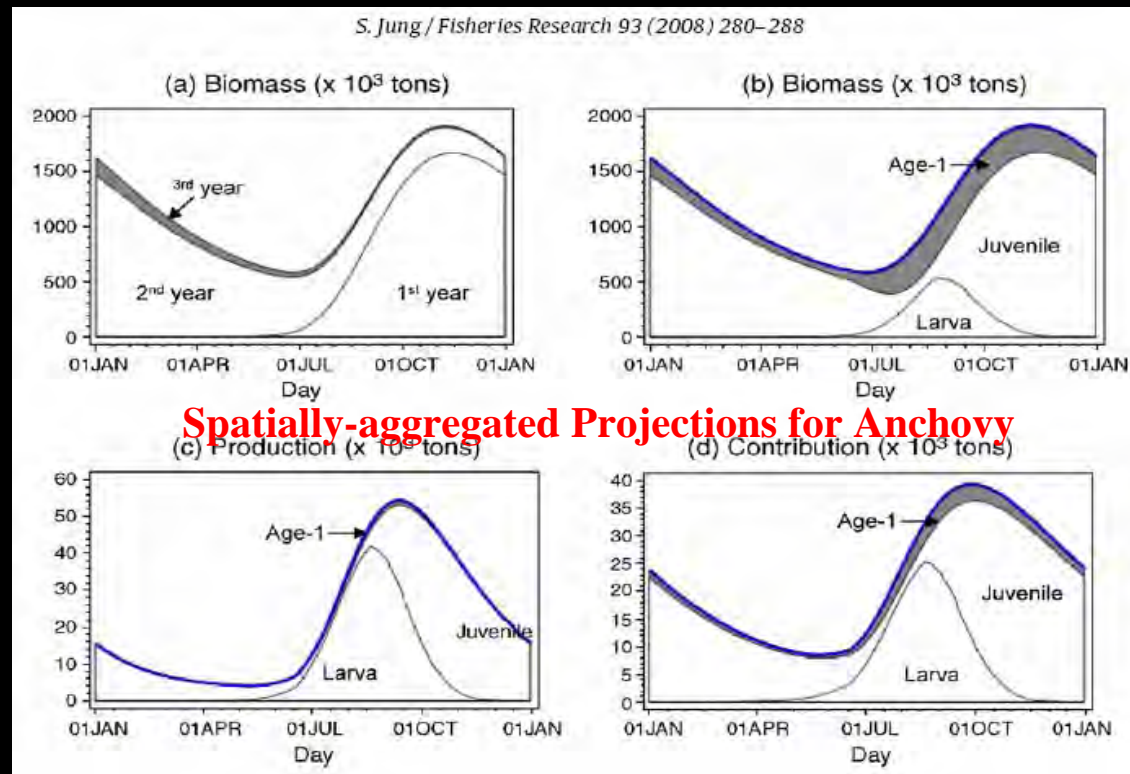
- Coincidence with the regime shifts and correlation analysis alone do not say so much about processes and mechanisms in climate-related researches

Future work 1

- Process-oriented studies
 - Long-term monitoring in the 2 designated lines along the Tsushima Warm Current
 - CTD, PP, LOPC, Acoustics, Collection by nets
 - Preliminary cruises in May and October 2010



Future work 2



- Develop simple, but spatially-explicit Individual-based models to test hypotheses, and to project effects of climate change in Korean waters (Anchovy first)

Acknowledgement

- MIFAFF-NFRDI
 - A program titled “consequences and countermeasures for the effects of climate change on marine ecosystems and fisheries resources”.
- Seoul National University
 - CREAM-PICES EAST-1 program
- Korea Metrological Administration

