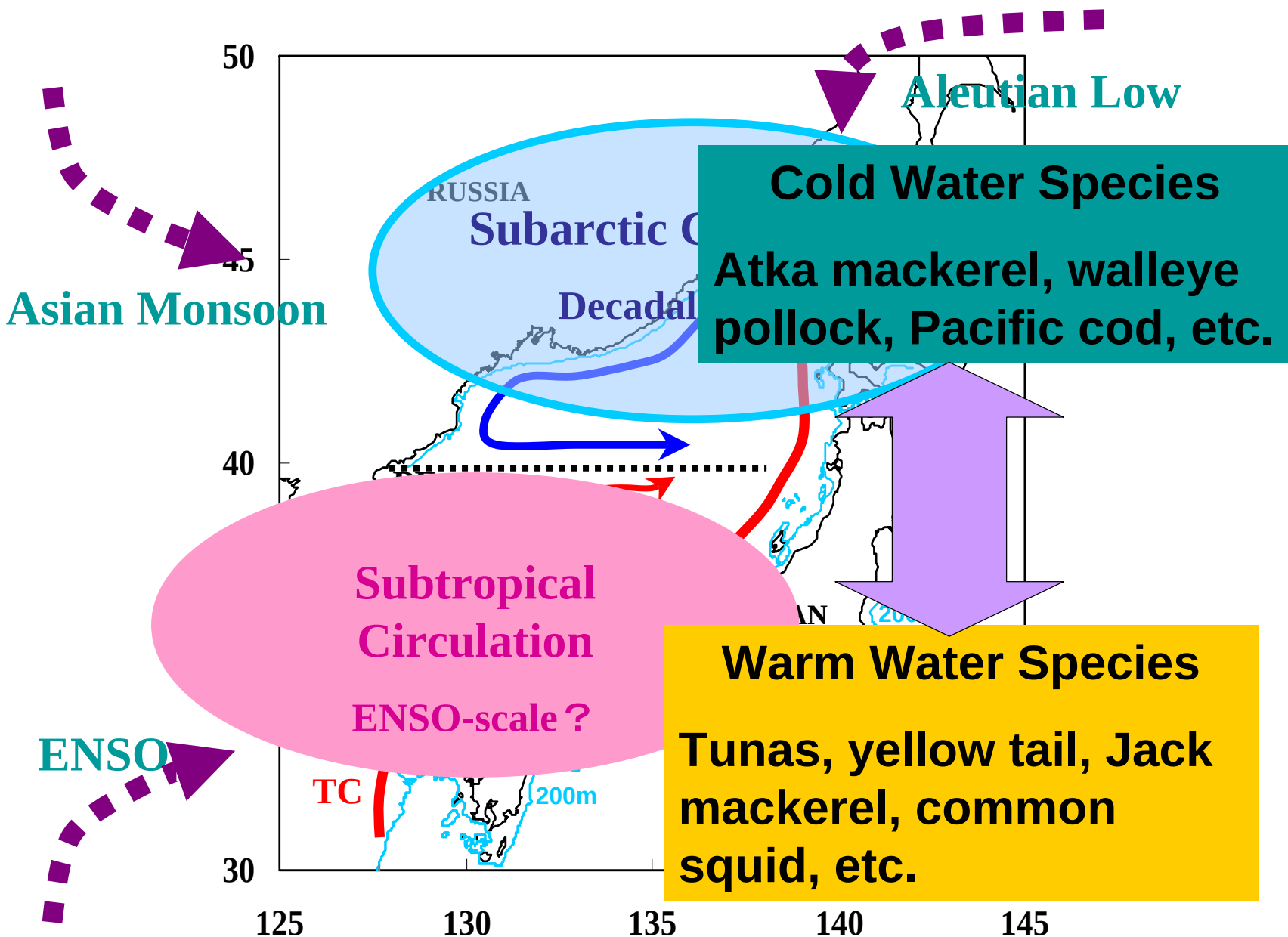


Differing response patterns of pelagic and demersal fish assemblages to the late-1980s regime shift in the Japan Sea

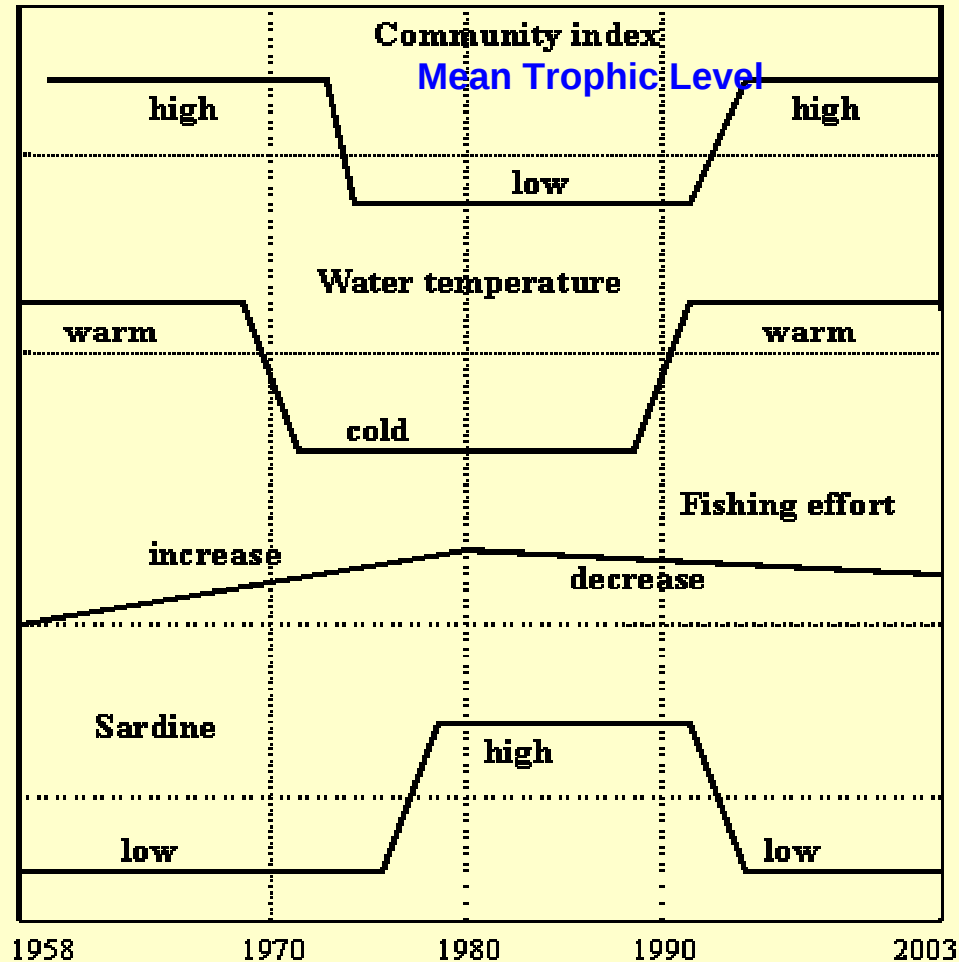
Yongjun Tian, Hideaki Kidokoro and Tatsuro Watanabe
*Japan Sea National Fisheries Research Institute,
Fisheries Research Agency (FRA), Niigata, JAPAN*

Outlines of This Study

1. Backgrounds and objectives
2. Data and methods
3. Late 1980s oceanic regime shift in TWC
4. Variation patterns of pelagic and demersal fish assemblages: analysis of fisheries statistics data (1958-2003)
5. Changes in the abundance and distribution of demersal species: analysis of “Offshore Trawl Data (1979-2004)”
6. Summary and conclusions

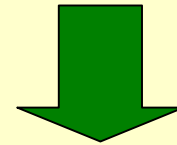


Environmental impacts on the fish community in the Japan Sea



Tian et al. (in press)

Fish community (index) is abruptly changed around late 1980s and largely associated with oceanic regime shift.



What is the response of different fish assemblages ?

Differences in life history characteristics

		Warm Water Species	Cold Water Species
Distribution depth		<200m (coastal and continental shelf water)	>200m (deep water)
Climate system (main distribution)		Subtropical (south of polar front	Subarctic (north of polar front)
Current system (water layer)		Tsushima Warm Current (surface water)	Cold Current (deep water)
Life span		< 10 years (short-lived)	>10 years (long-lived)
Main (indicator) species	Pelagic (migratory)	Pacific sardine, anchovy, mackerel, albacore, tunas, yellowtail, common squid	Pacific herring, salmons, sharks
	Demersal	Silver & crimson seabream, deepsea smelt, largehead haretail, willowy flounder, pointhead flounder	Pacific cod, walleye Pollack, tanner crab, pink shrimp, flathead flounder, witch flounder

TWO OBJECTIVES

1. To identify the various fish species that inhabit the pelagic and oceanic regions of the Mediterranean Sea
2. To understand the function and structure of the ecosystem toward ecosystem-based fisheries management

Final Goal

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

Data and Methods

1. Catch statistics:1958-2003:

55 species items, 90% of total catches

2. Japan Sea Offshore Trawl Data:

1979-2004: 28 demersal species, catches
and CPUE with spatial resolution of 10 minutes

3. Oceanographic data (SST): 1950-2004

1°×1°grid data set from JMA

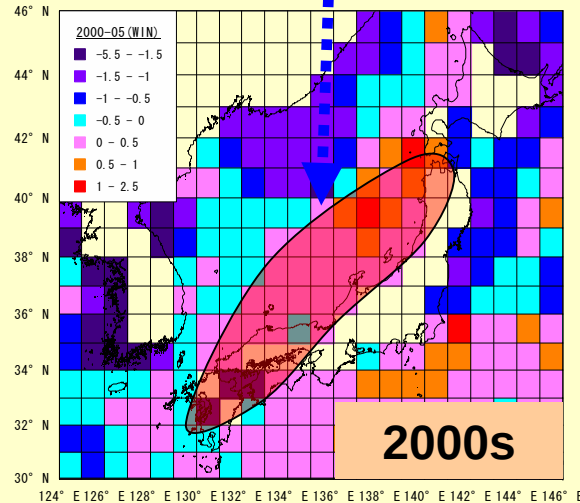
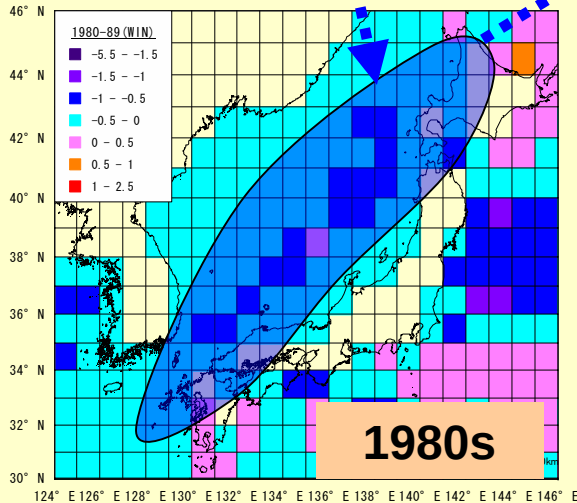
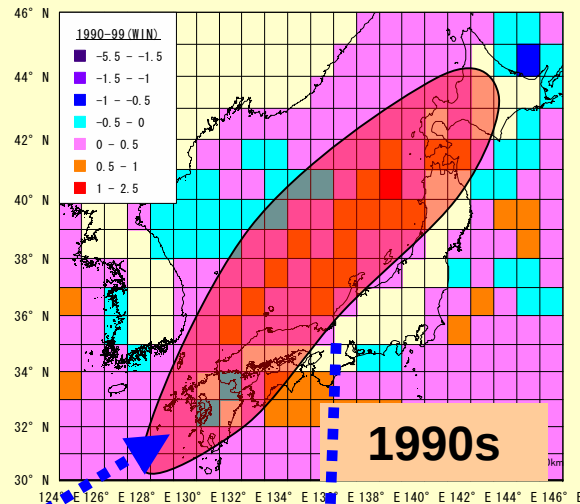
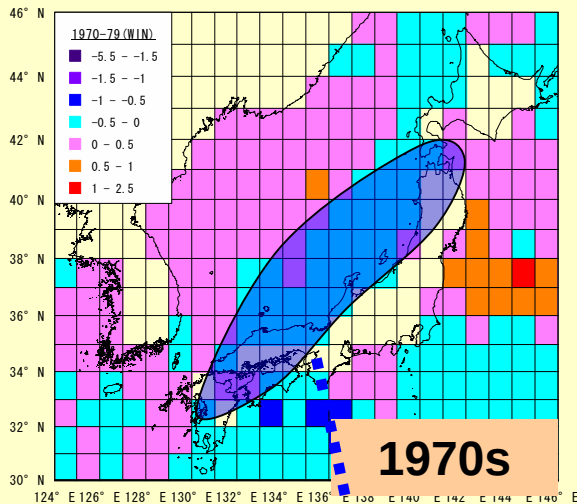
4. 50 & 200 m depth water temperature:

1964- 2004: an indicator of Tsushima Warm Current

5. Principal Component Analysis (PCA)

and GIS Approach

Spatial differences in winter SSTs

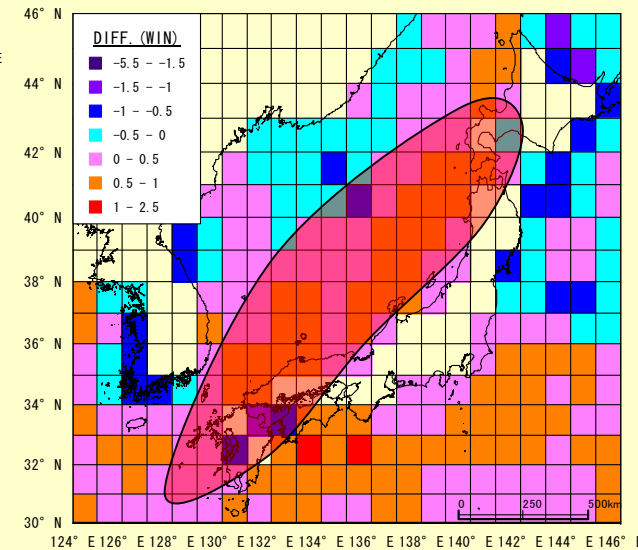


Regime difference:

mean of 1987-2004

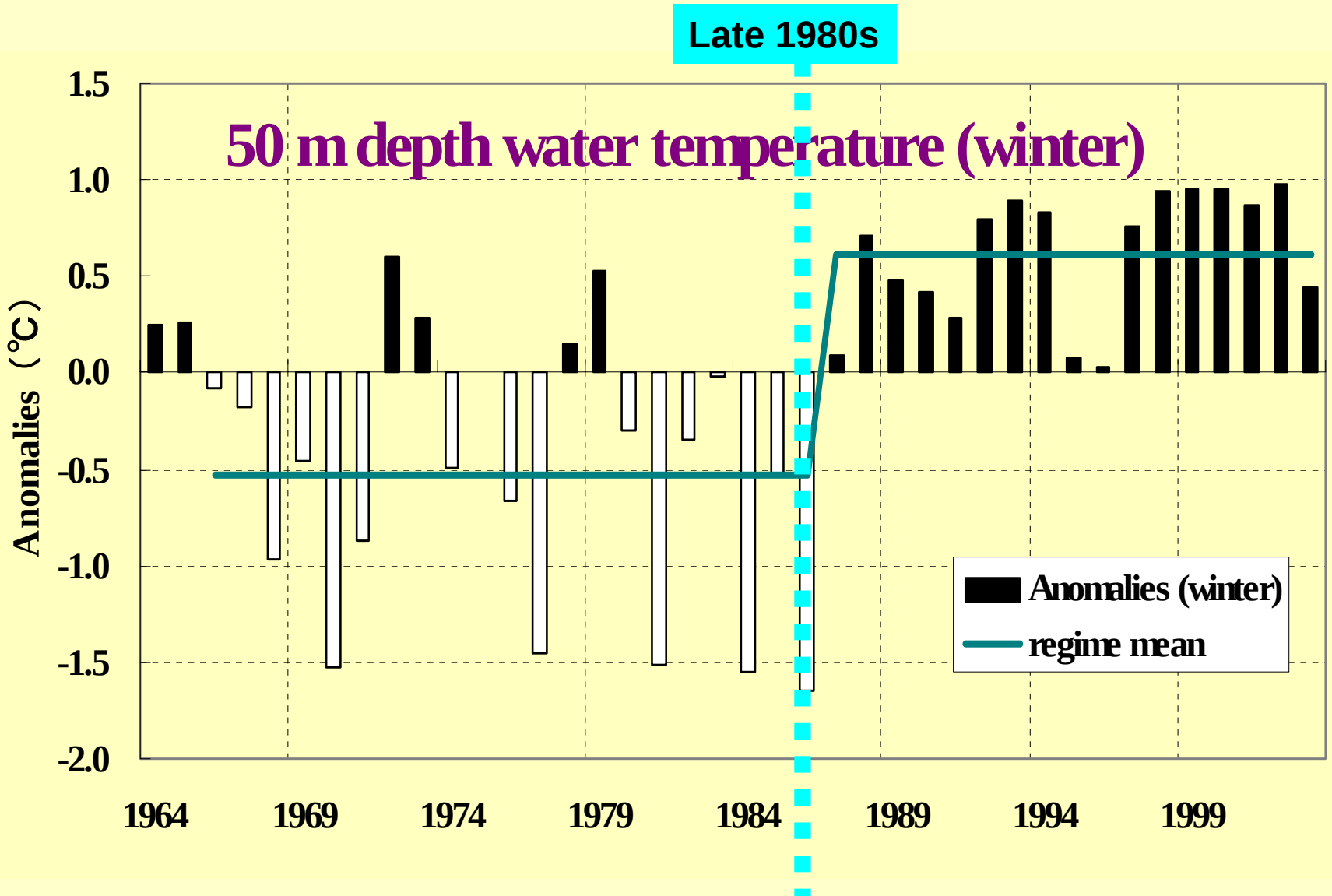
-

mean of 1976-86

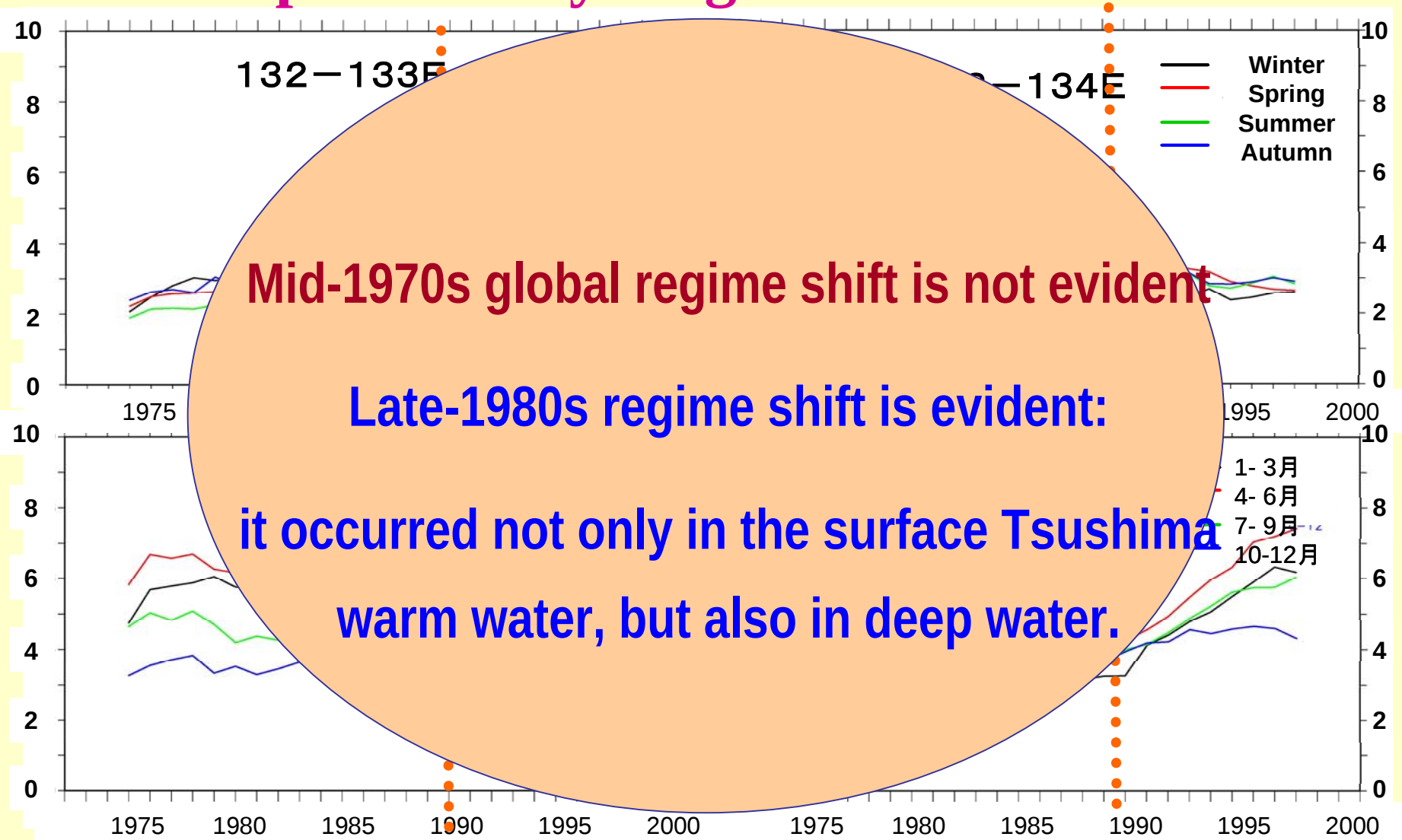


Decadal mean - 30 years (1970-1999) mean

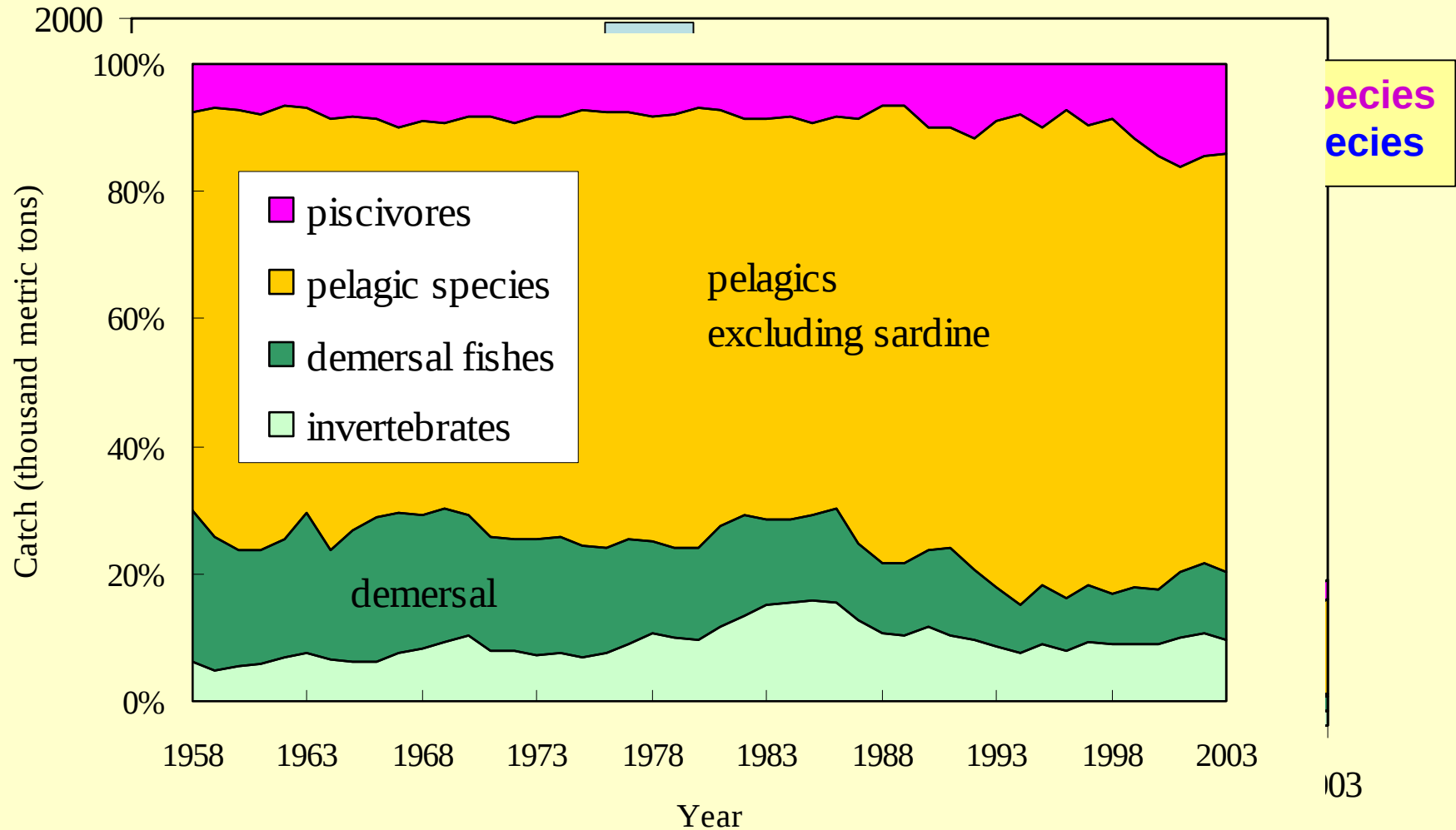
Indicator of Tsushima Warm Current



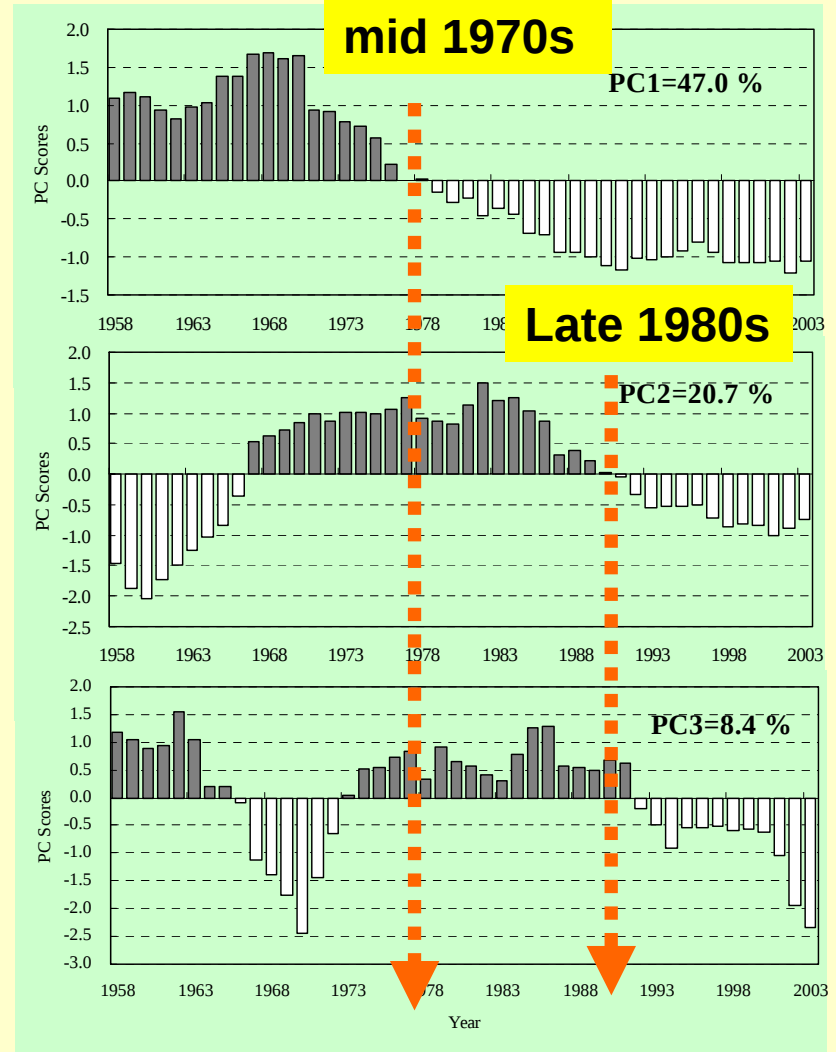
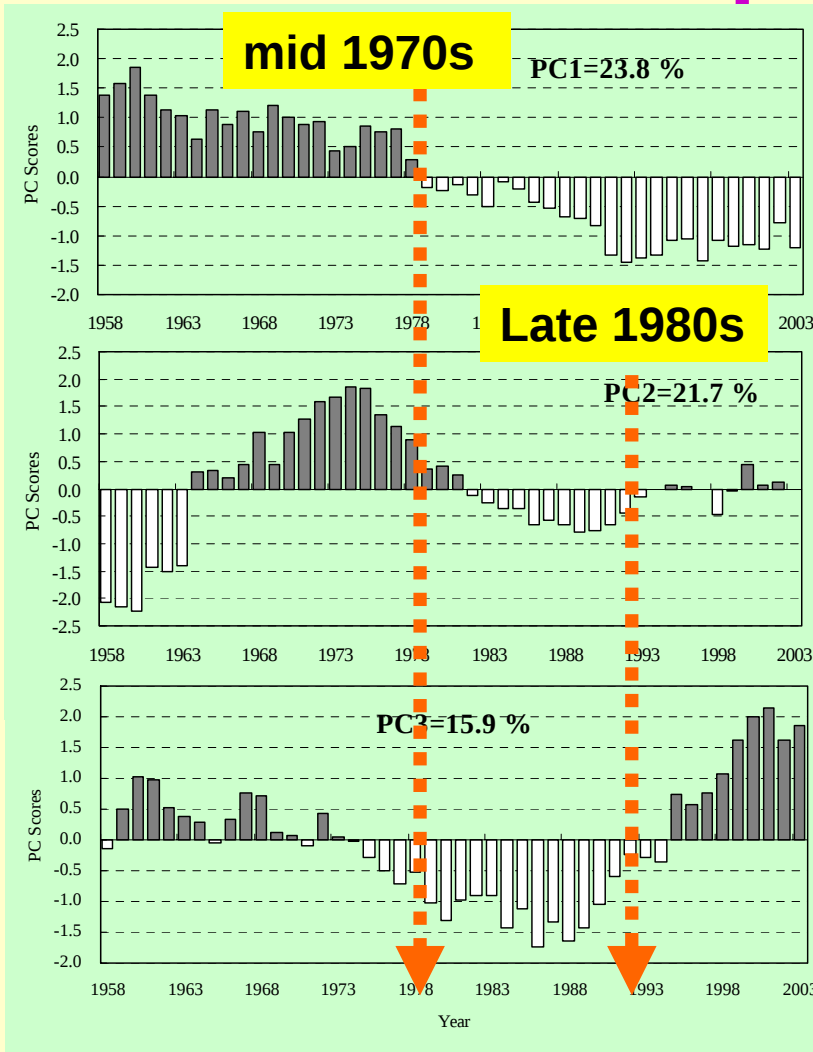
Yearly changes in 200m depth water temperature by longitude and season



Catches Trend of 55 Species Items in the Japan Sea during 1958-2003



PCAs of 55 species: 1958-2003



Pelagic (28) species

Warm water

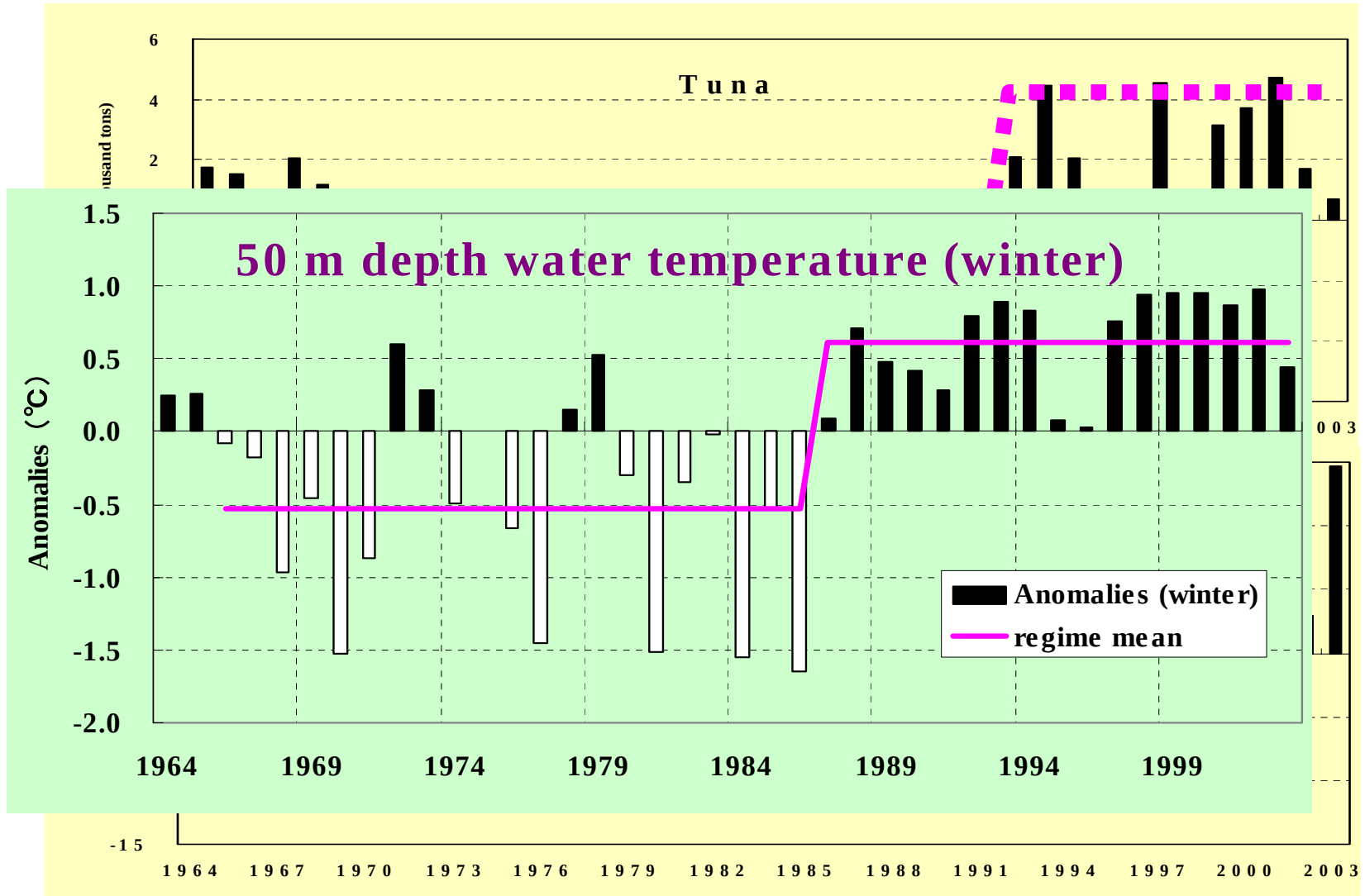
61%<----

Demersal (27) species

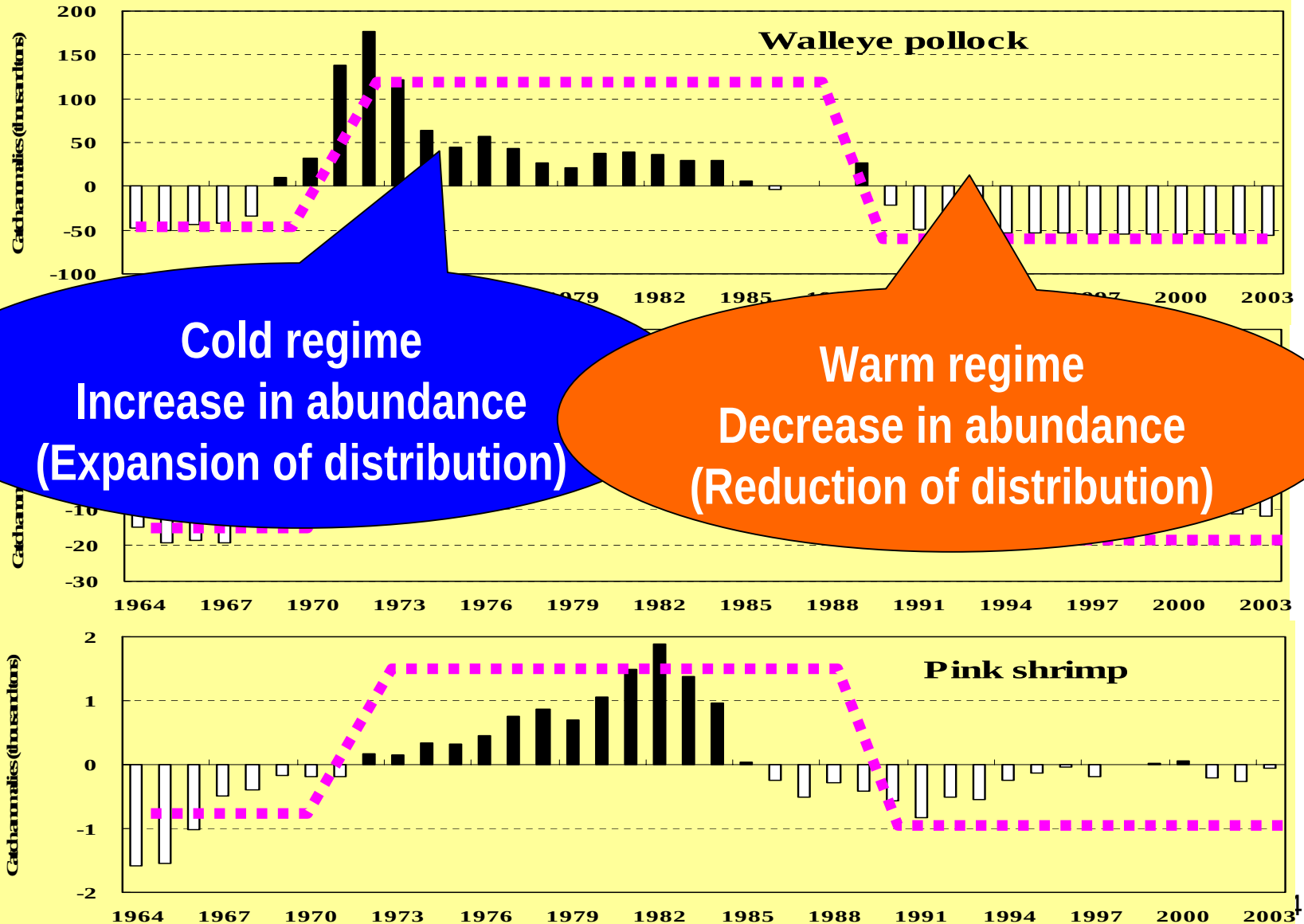
PC1-3--→76%

Cold water

Large Predatory Warm Water Species



Demersal Cold(Deep) Water Species



Offshore Bottom Trawl : Target species

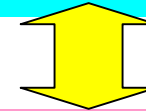
No	Japanese Name	Scientific Name	English Name	Depth (m)	Life span (years)	Current
1	マダラ	<i>Gadus macrocephalus</i>	Pacific cod	200-300	>12	CW
2	スケトウダラ	<i>Theragra chalcogramma</i>	Walleye pollock	100-500	>11	CW
3	ホッケ	<i>Pleurogrammus azonus</i>	Arabesque greenling	<200	>8	CW
4	ハタハタ	<i>Arctoscopus japonicus</i>	Japanese sandfish	300-500	5	CW
5	サメ・エイ (アブラ)	<i>Squalus acanthias</i>	Piked dogfish	150-180	>10	CW
6	ハツメ	<i>Esbastes owstoni</i>	Owenton's rockfish	190-300	>10	CW
7	ヒレグロ	<i>Glyptocephalus stelleri</i>	witch flounder	200-300	>12	CW
8	アカガレイ	<i>Hippoglossoides dubius</i>	flathead flounder	150-500	>10	CW
9	マガレイ	<i>Pleuronectes herzensteini</i>	brown sole	30-130	>10	CW
10	その他のカレイ	<i>Pleuronectidae</i>	other righteye flounder			CW
11	ホッコクアカエビ	<i>Pandalus borealis</i>	Pink shrimp	200-600	11	CW
12	ズワイガニ	<i>Chionoecetes opilio</i>	Tanner crab	200-500	>10	CW
13	ソウハチ	<i>Hippoglossoides pinetorum</i>	pointhead flounder	150-190	8	WW
14	ムシガレイ	<i>Eopsetta grigorjewi</i>	shotted halibut	<140	>10	WW
15	ヤナギムシガレイ	<i>Tanakius kitaharai</i>	willowy flounder	80-150	>10	WW
16	ニギス	<i>Glossanodon semifasciatus</i>	Deepsea smelt	<200	5	WW
17	ヒラメ	<i>Paralichthys olivaceus</i>	bastard halibut	<150	>10	WW
18	マダイ	<i>Pagrus major</i>	Silver seabream	<100	>10	WW
19	チダイ	<i>Evynnis japonica</i>	crimson seabream	30-130	>6	WW
20	キダイ	<i>Dentex tumifrons</i>	deepsea snapper	<200	>8	WW
21	エソ	<i>Synodontidae</i>	Lizardfish	<120	<4	WW
22	グチ (シログチ)	<i>Sciaenidae (Argyrosomus a</i>	Croaker	20-120	6?	WW
23	マアジ	<i>Trichiurus japonicus</i>	Horse mackerel	<200	4	WW
24	カナガシラ	<i>Lepidotrigla micropetera</i>	redwing searobin	70-140	6	WW
25	タチウオ	<i>Trichiurus japonicus</i>	Largehead hairtail	20-140	8	WW
26	アカムツ	<i>Doederleinia berycoides</i>	blackthroat seaperch	80-150	10 (Female)	WW
27	イカ類		Squids	<200	<2	WW
28	タコ類		Octopus	<200		WW

12 cold water species:

Deep water

Long-lived

Northern distribution



14 warm water species:

Coastal and continental shelf

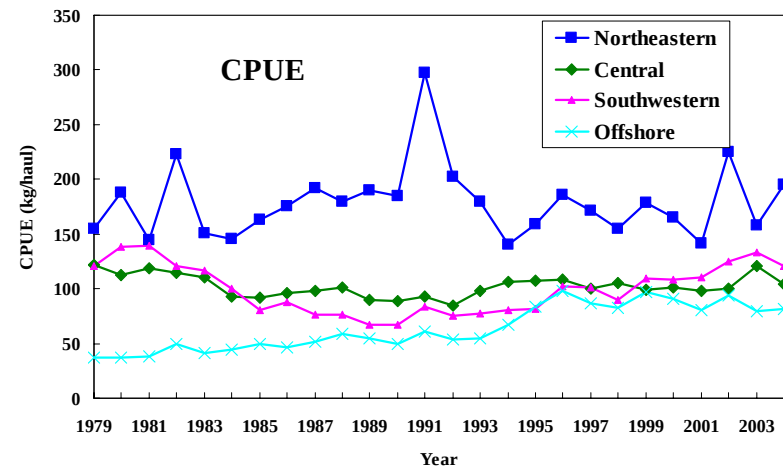
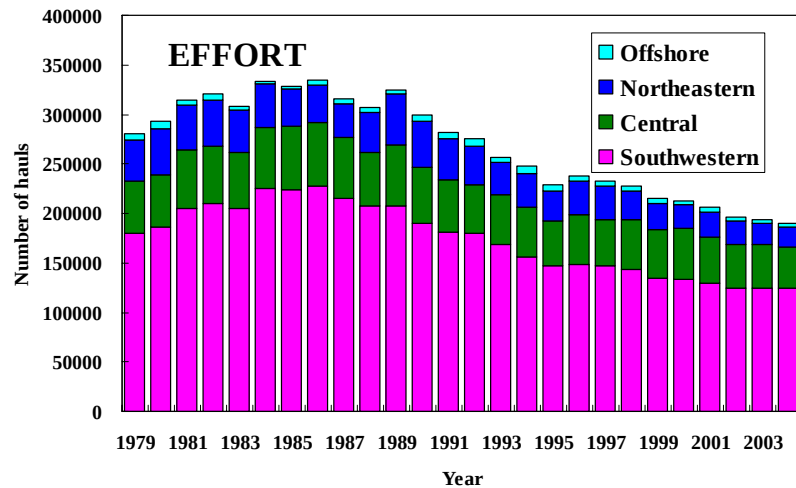
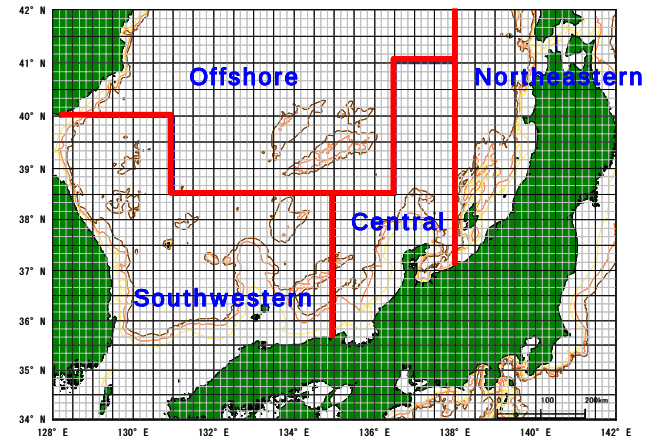
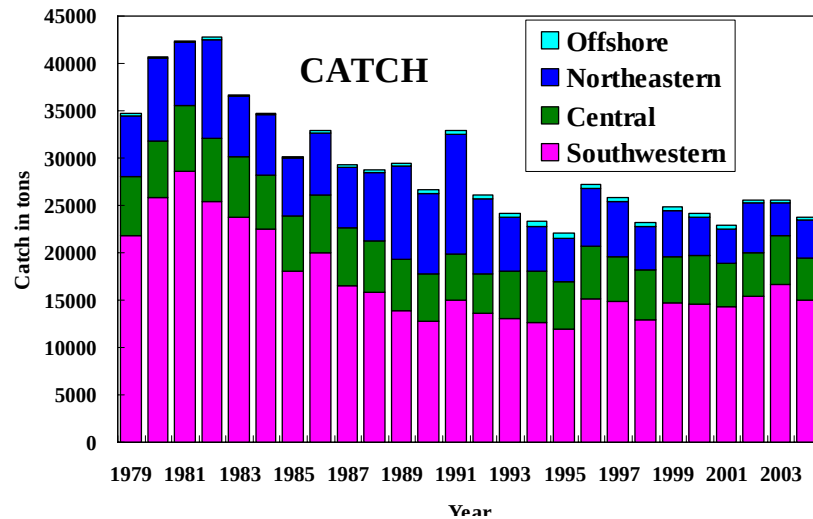
Short-lived

Southern distribution

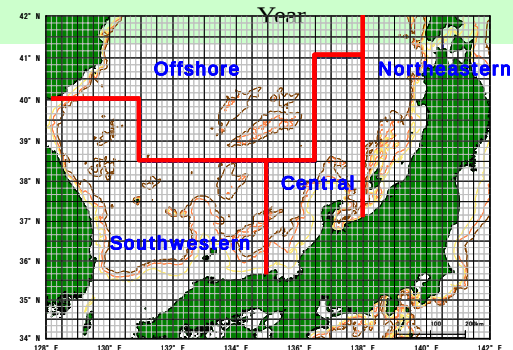
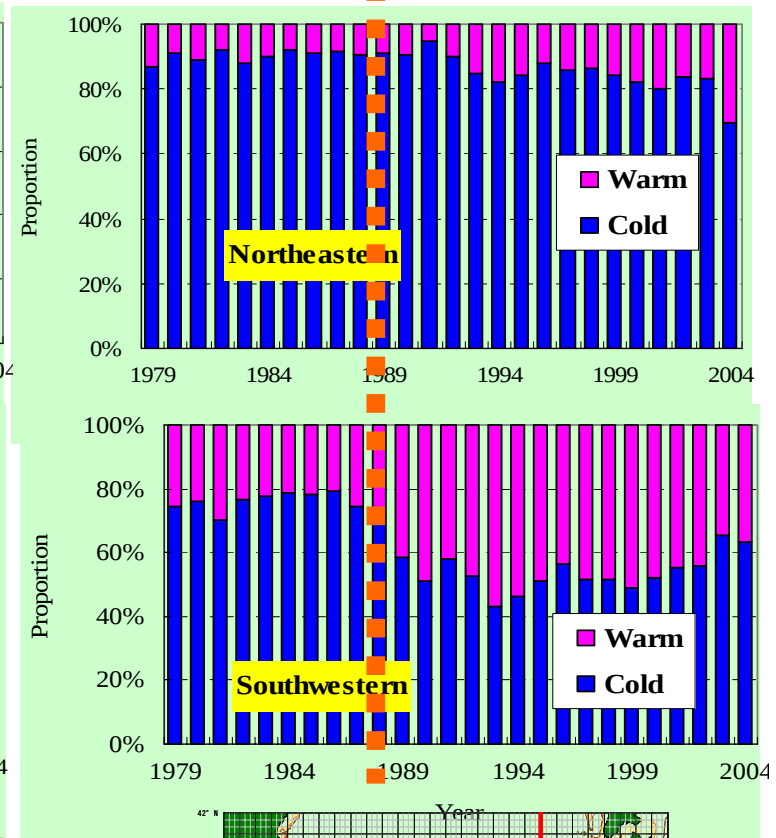
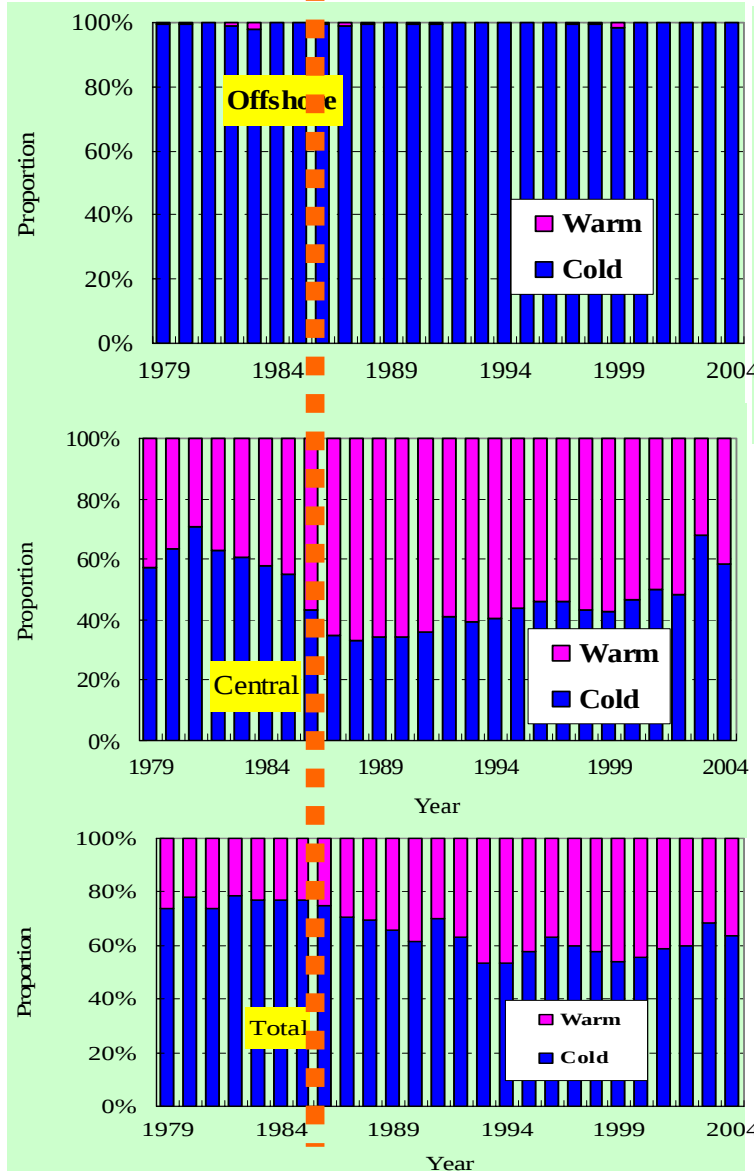
CW: Cold Water

WW: Warm Water

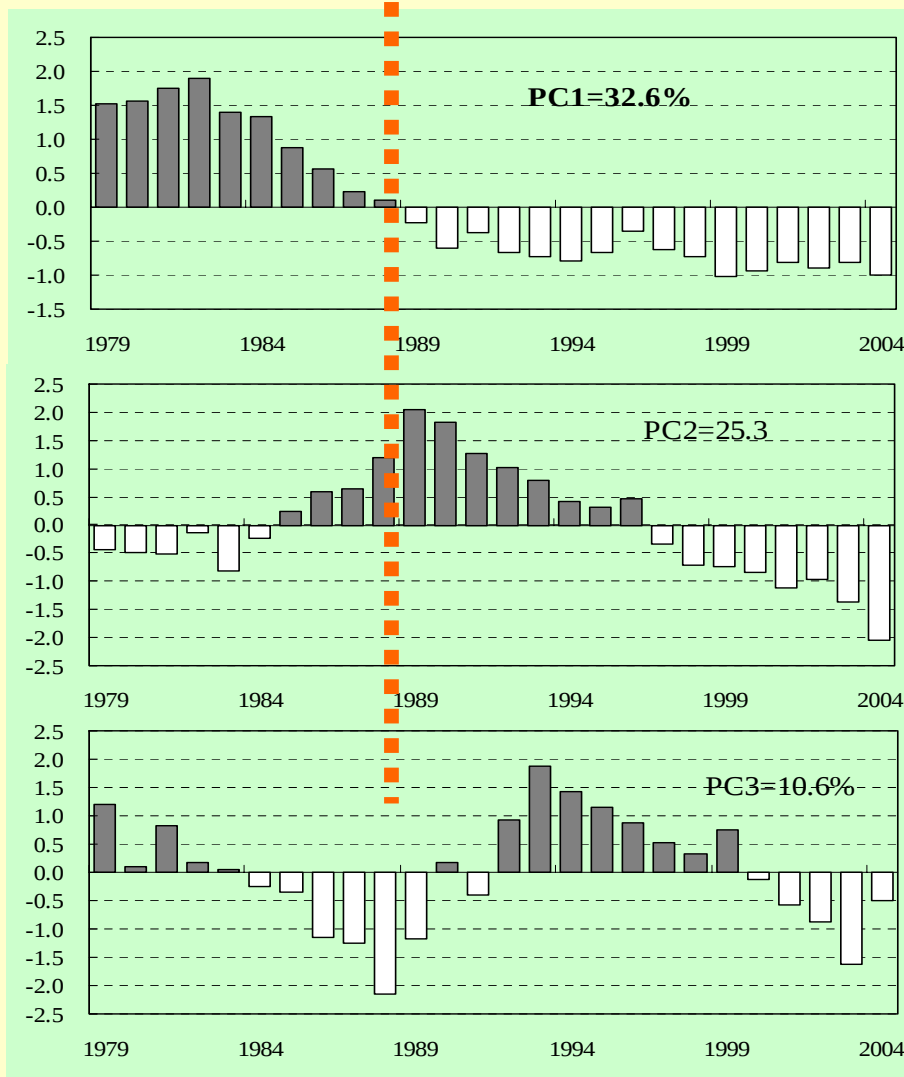
Offshore Bottom Trawl : Catch and CPUE



Changes in compositions



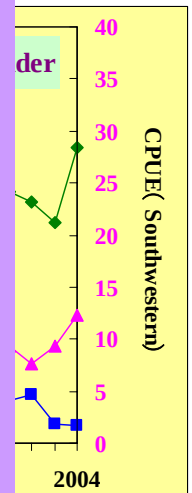
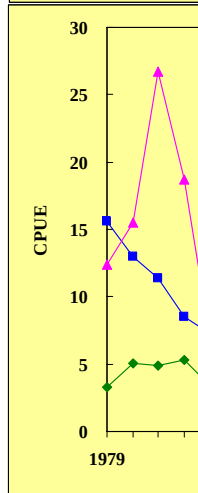
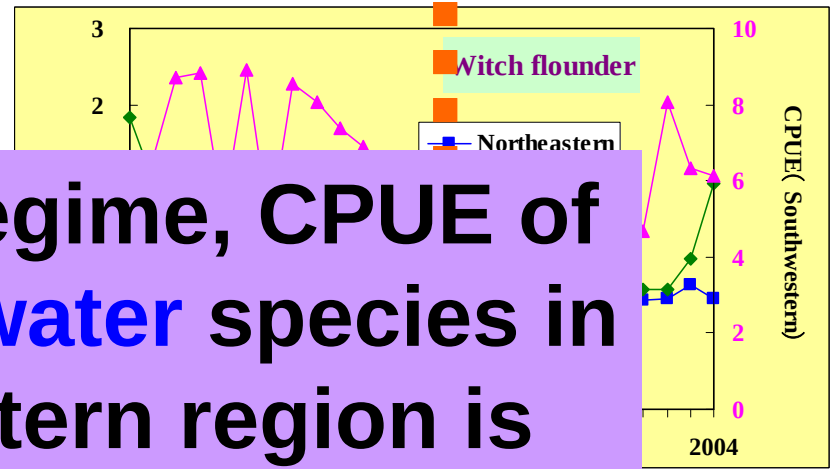
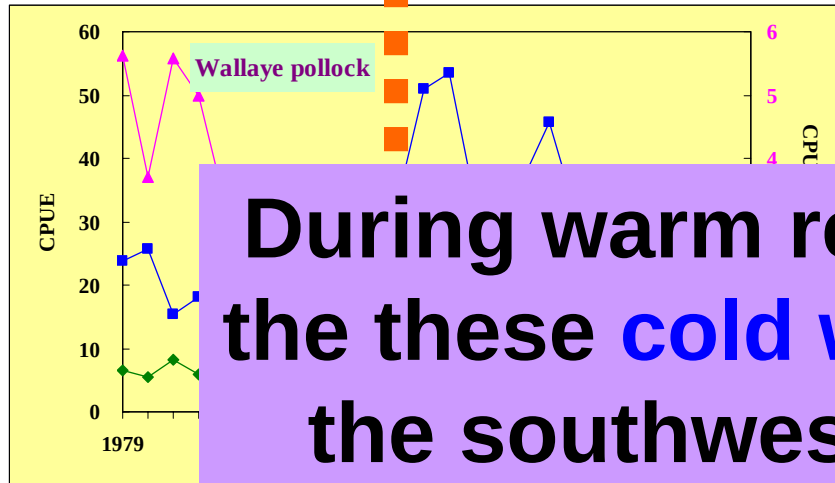
PCAs of demersal species from offshore trawl fisheries data 1979-2004



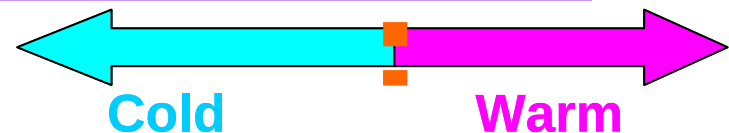
**PC1-3: 69%
of total
variance**

**PC1:
changed
around late
1980s**

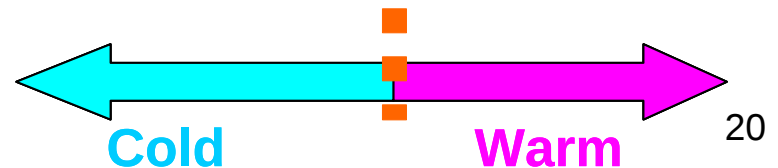
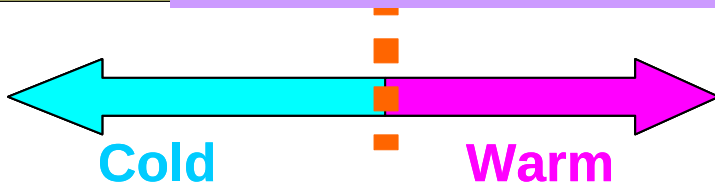
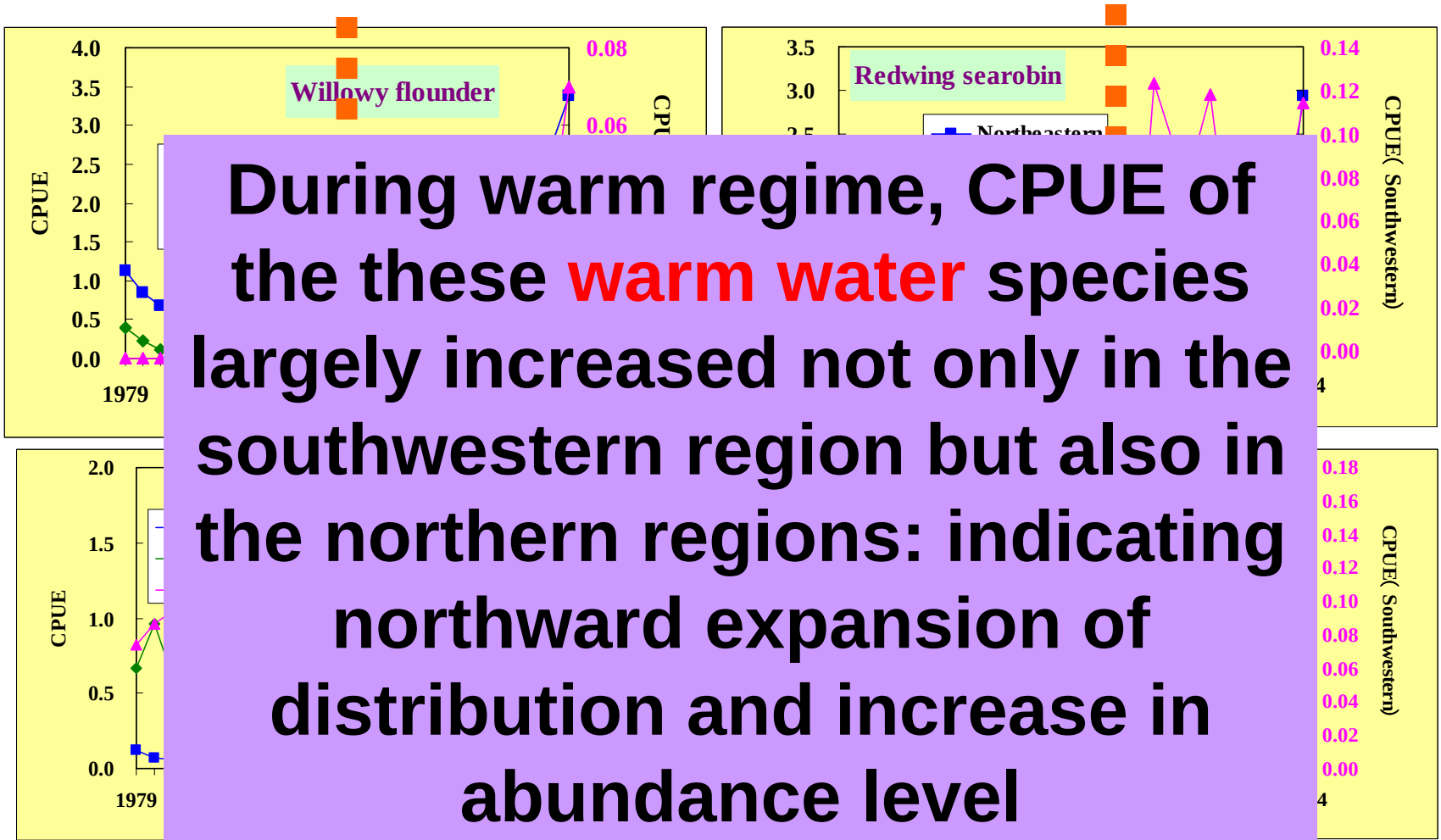
CPUE for four cold water species



During warm regime, CPUE of the these cold water species in the southwestern region is decreased; while CPUE in the northern regions maintained in a relative high level: indicating a reduction of southwestern distribution

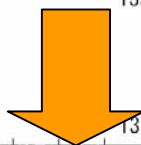
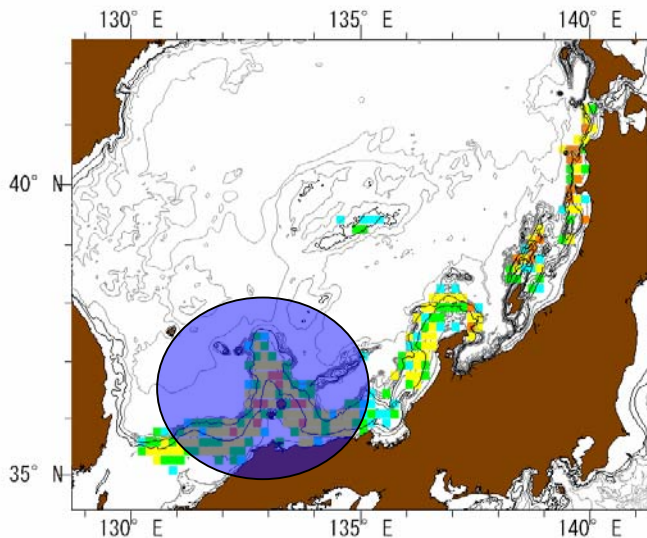


CPUE for four warm water species

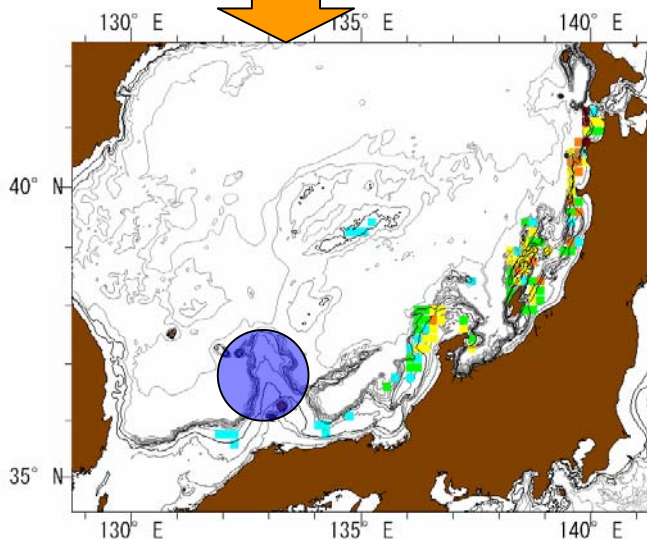


Walleye pollock

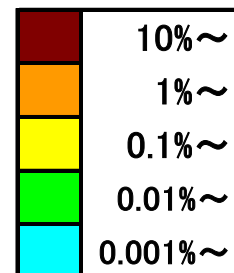
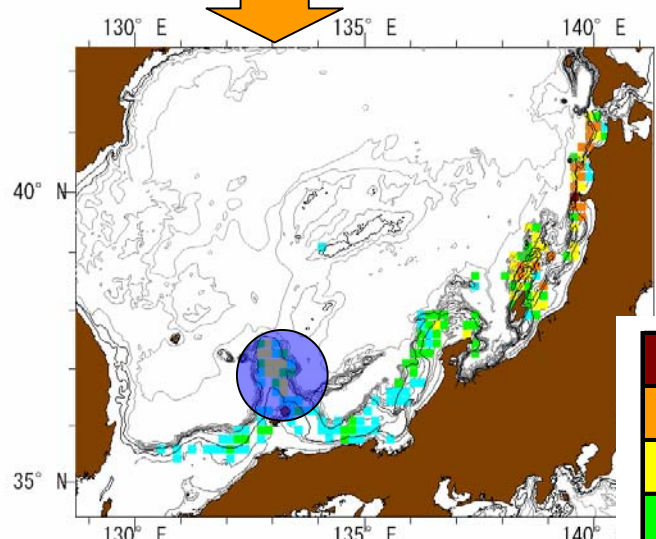
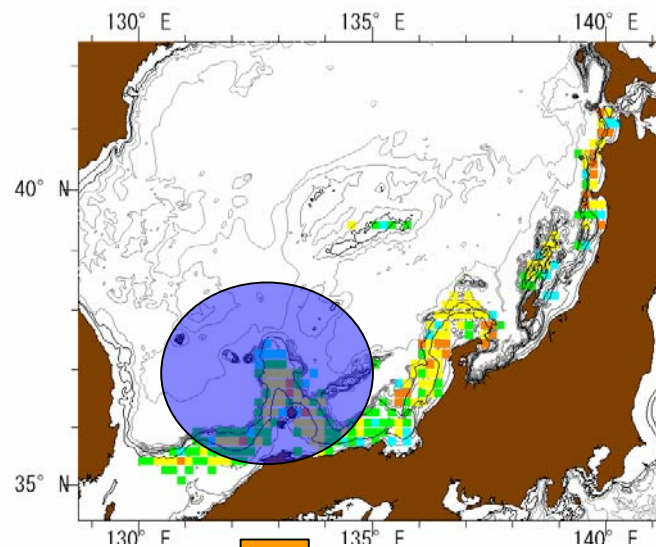
1982
cold



1997
warm

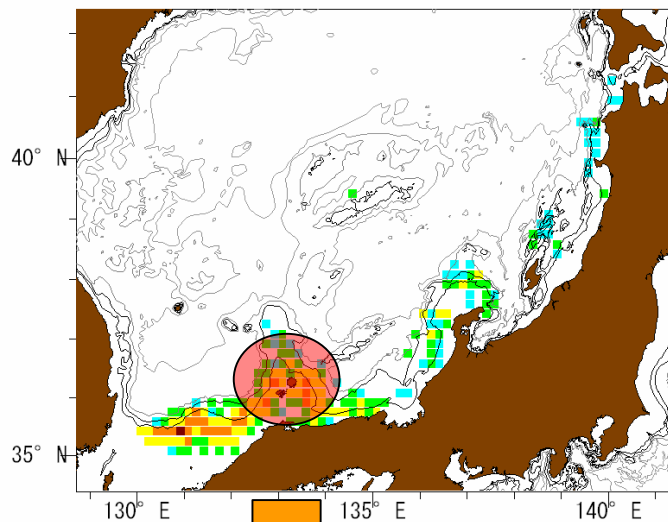


Pacific cod

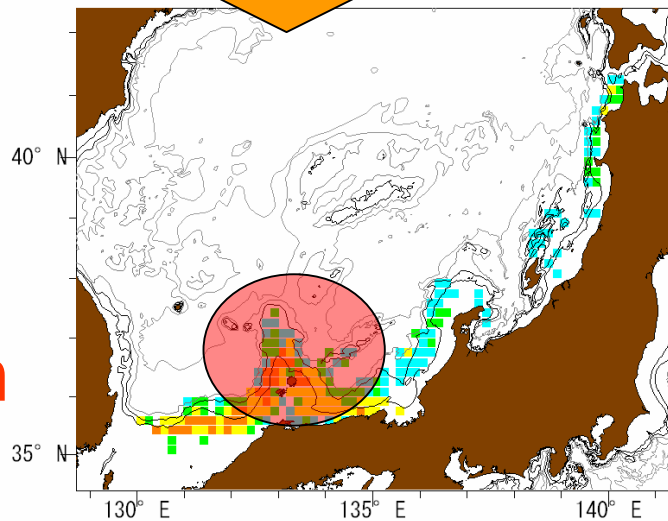


Pointhead flounder

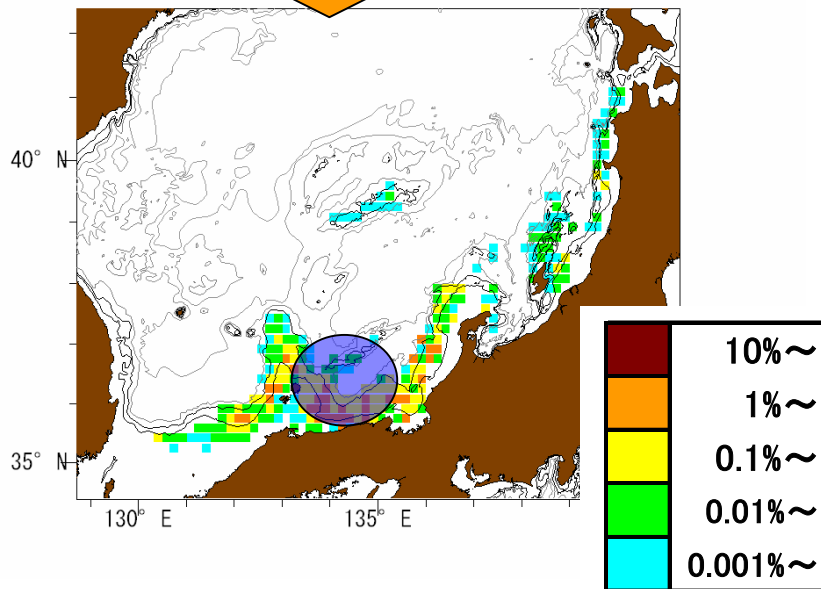
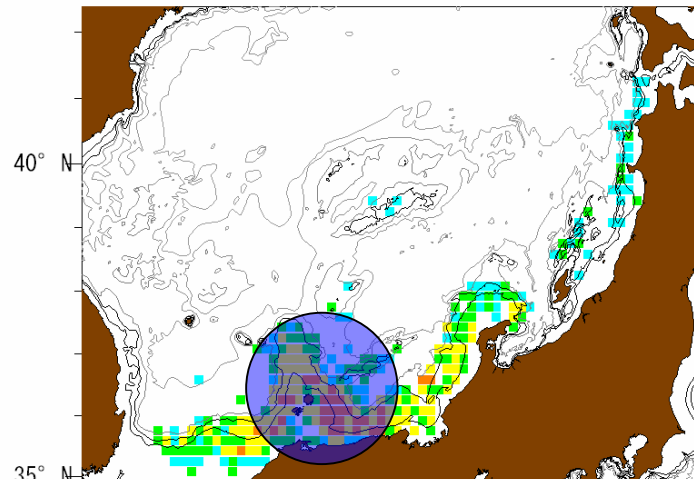
1982
cold



1997
warm



Flathead flounder



CONCLUSIONS

- **An oceanic regime shift from cold to warm water is identified in Tsushima Warm Current Region in late-1980s.**
- **Both the pelagic and demersal fishes show decadal variation patterns and changed with the late-1980s oceanic regime shift.**
- **Response patterns are different between cold and warm water species**