

Marine Ecosystem Status in China Sea --focused on YSLME

Mingyuan Zhu

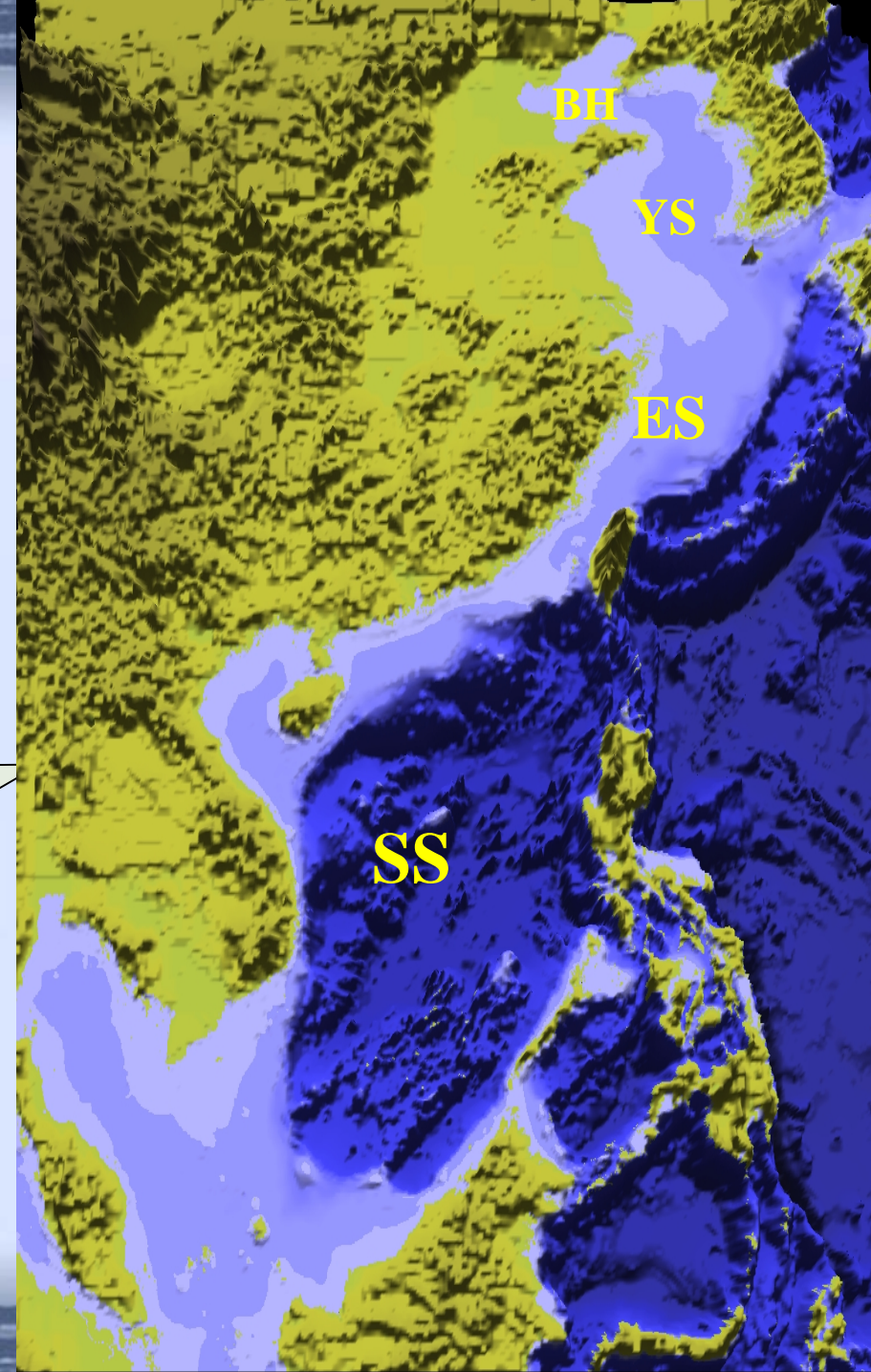


The First Institute of Oceanography, SOA

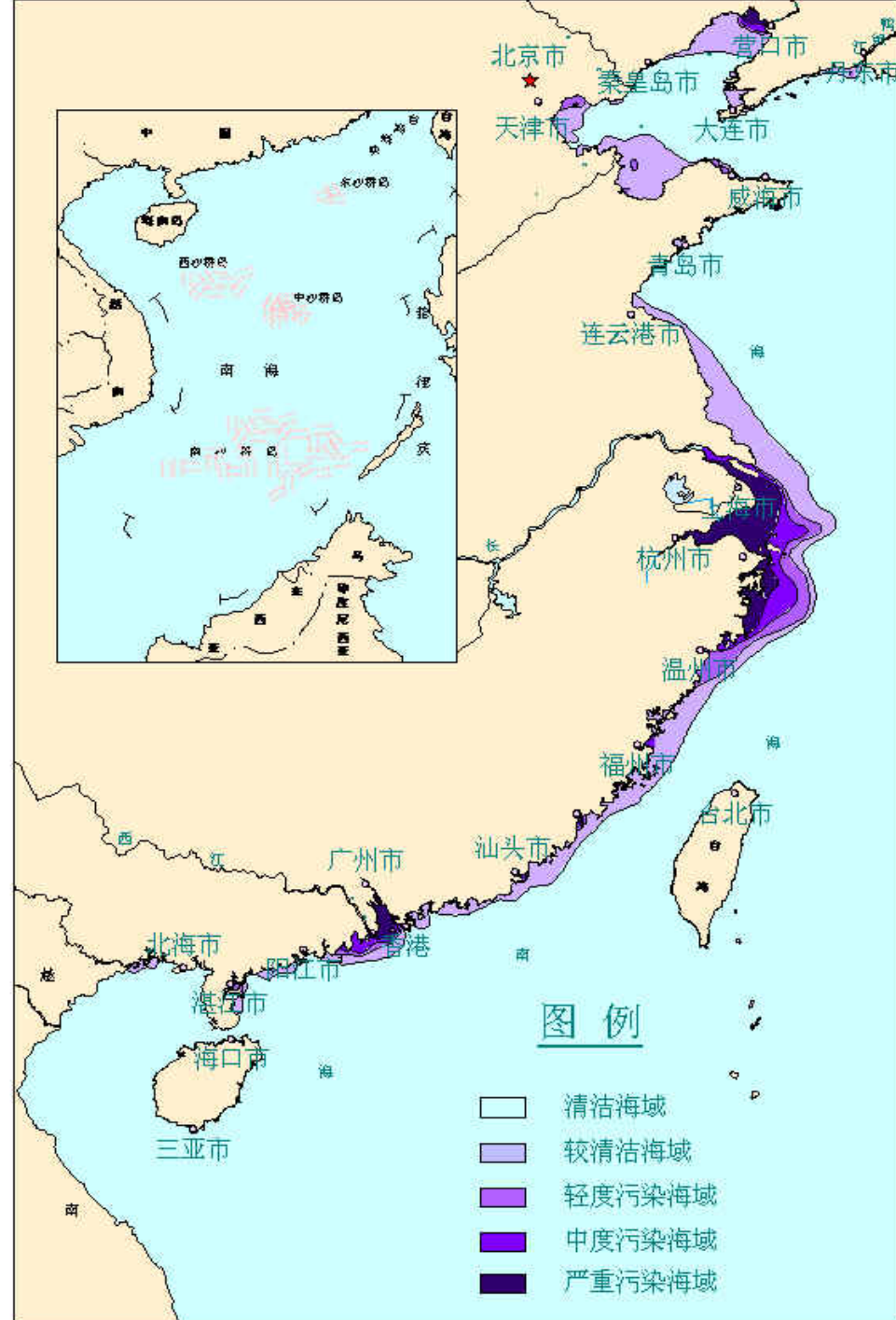
Aug.14, 2003

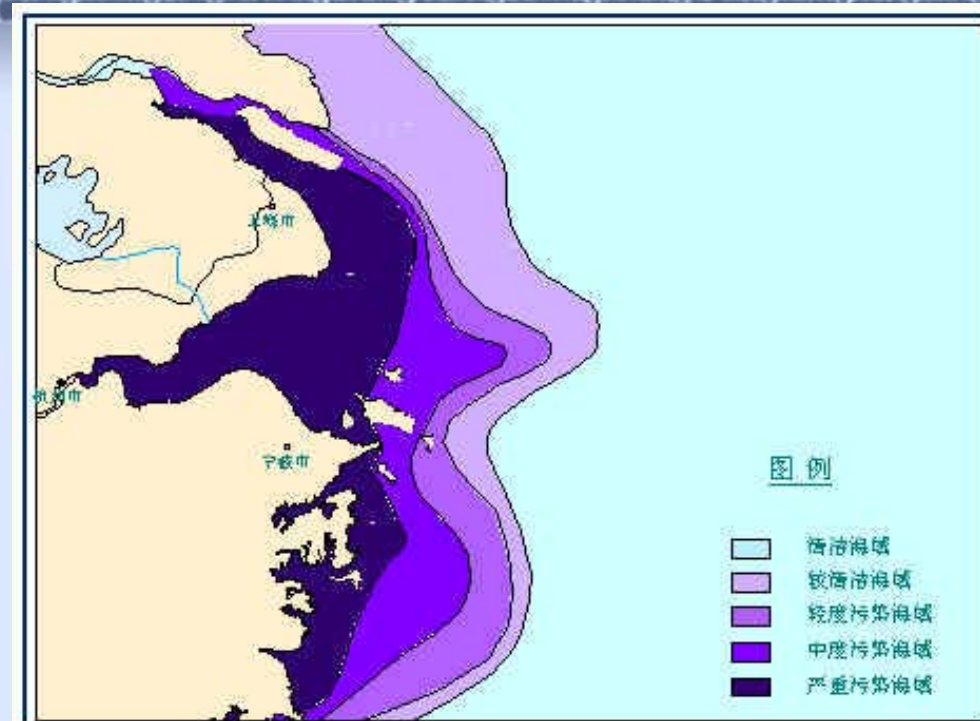
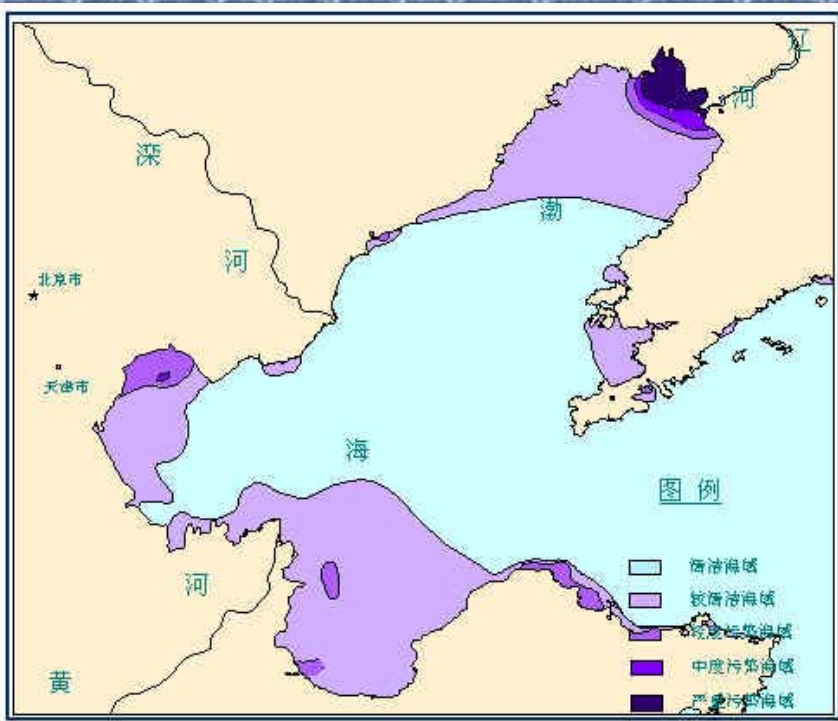
● The China Seas are located in North west margin of Pacific Ocean and consist of Bohai Sea, Yellow Sea, East China Sea and South China Sea.

● It is influenced by many oceanic currents such as Kuroshio warm current.

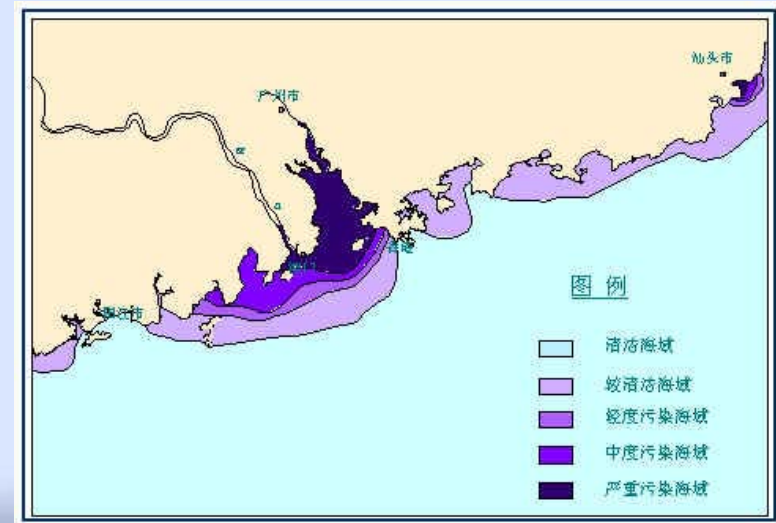


Eutrophication is major problem in coastal waters





There are 3 more seriously eutrophicated areas, e.g. Bohai Sea, Estuary of Changjiang River, Coastal water of Guangdong



They are also
the area with
Frequent HAB
In Chinese
coastal waters



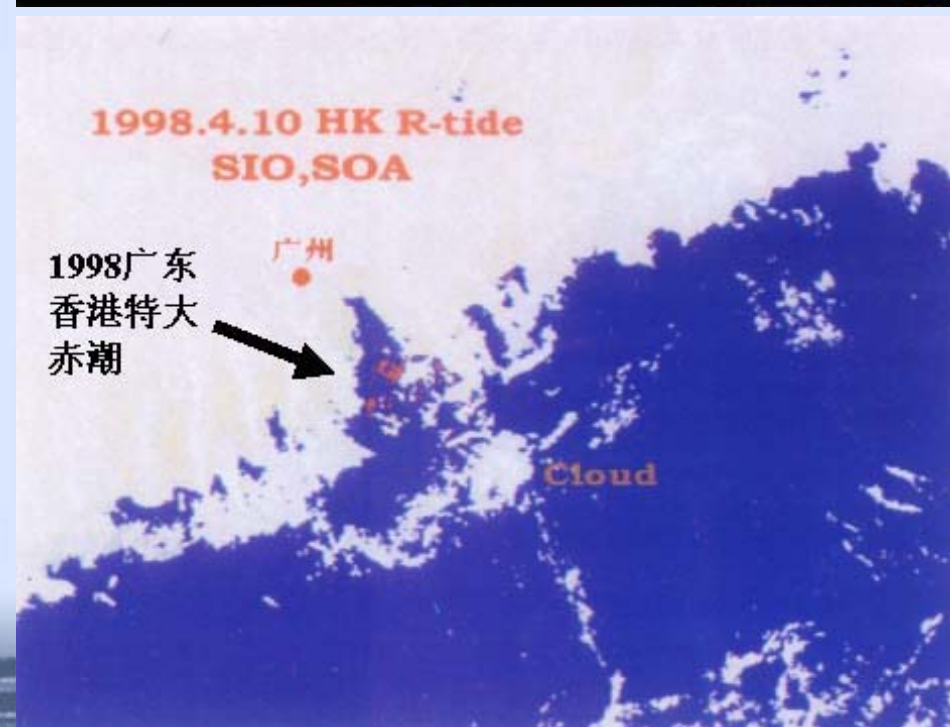
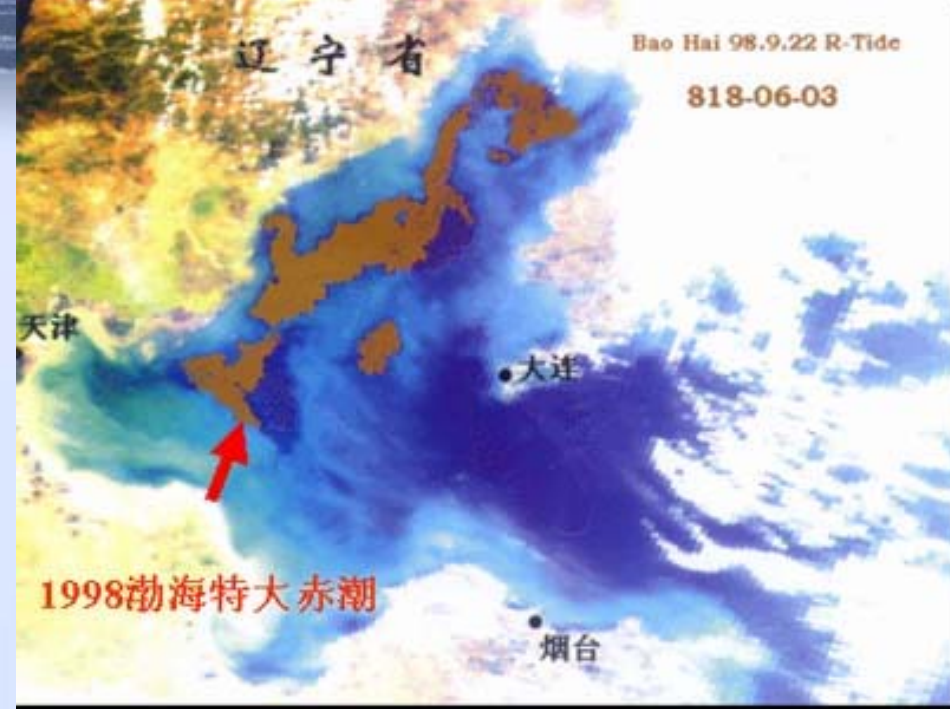
Nature of HAB

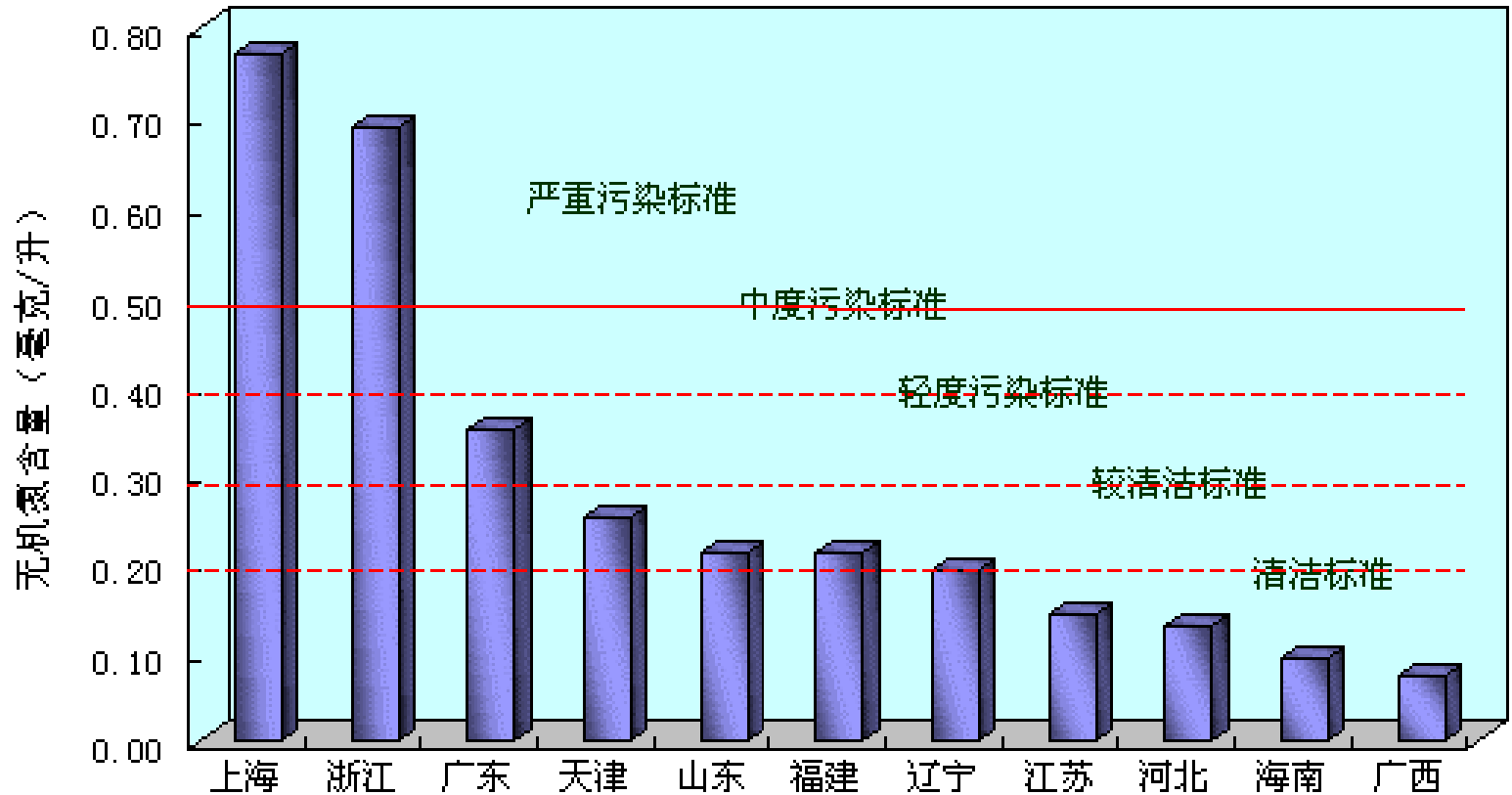
North : Large scale

South: high frequency

East China Sea:

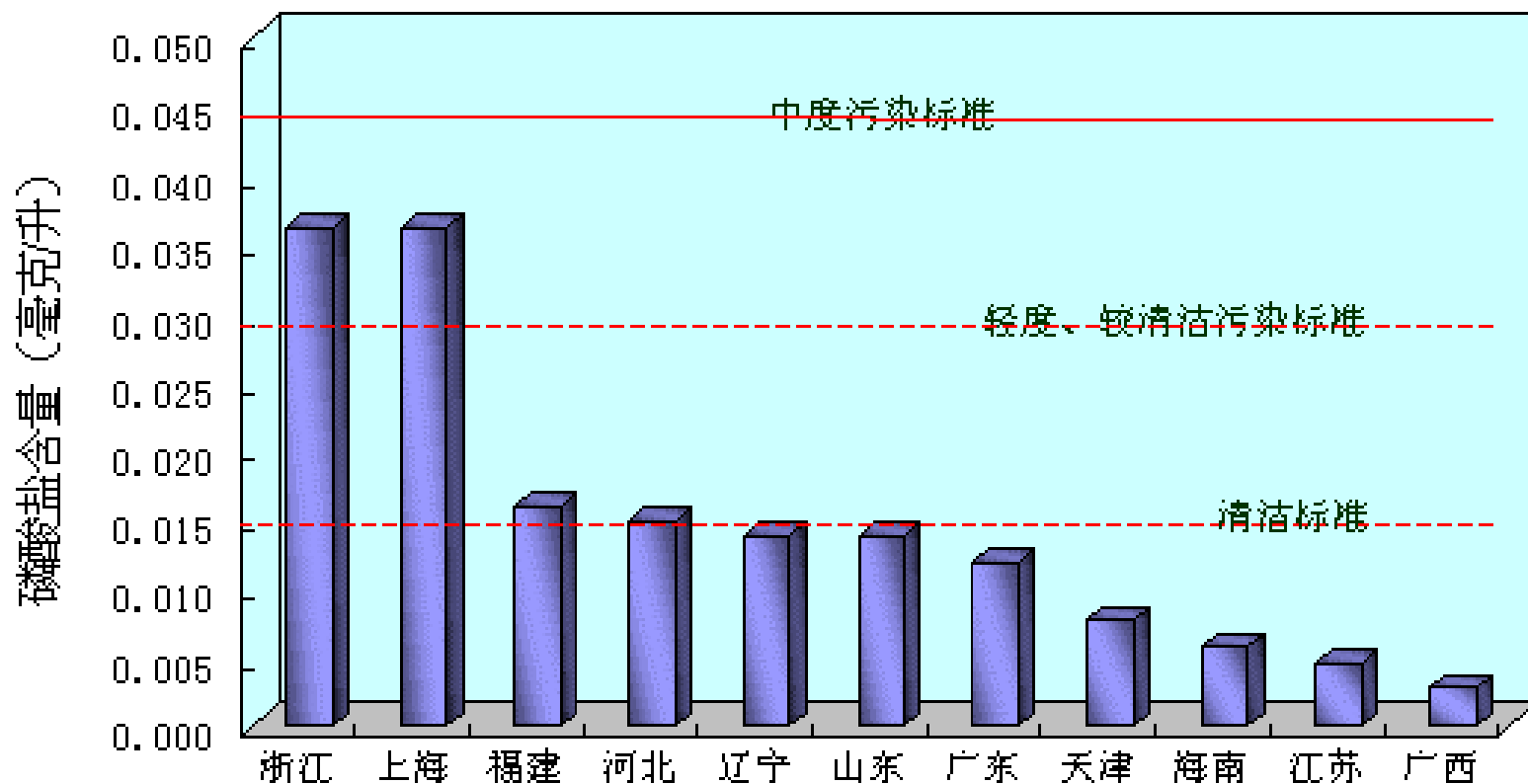
Both large and frequent





沿海省（自治区、直辖市）近岸海域海水中无机氮平均含量

Mean DIN concentration in Coastal waters



沿海省（自治区、直辖市）近岸海域海水中磷酸盐平均含量

Mean DIP concentration in coastal waters

Biodiversity

There are 20,278 species recorded in China Seas

Kingdom & Phyla	Species	Kingdom & Phyla	Species
MONERA	229	ANIMALIA	12 794
Bacteria	79	Porifera	106
Actinobacteria	18	Coelenterata	989
Cyanomycete	131	Ctenophora	9
Chloroxybacteria	1	Platyhelminthes	574
PROTISTA	4 956	Nemertea	52
Bacillariophyta	1 395	Kinorhyncha	10
Pyrrophyta	255	Nematoda	122
Chrysophyta	14	Acanthocephala	32
Xanthophyta	3	Rotifera	17
Cryptophyta	1	Priapulida	2
Ciliophora	291	Annelida	979
Sarcomastigophora	2 997	Sipuncula	39
FUNGI	188	Echiura	9
Yeast	61	Mollusca	2554
Other fungi	127	Arthropoda	2971
Mycophycophyta	1	Bryozoa	488
PLANTAE	1 203	Entoprocta	9
Rhodophyta	443	Brachiopoda	8
Phacophyta	153	Phoronida	4
Chlorophyta	194	Chaetognatha	37
Pteridophyta	11	Echinodermata	471
Gymnospermae	3	Hemichordata	6
Angiospermae	399	Urochordata	125

Key protected marine organisms

- 1989 China issued 《The law of wild animal protection》 and “List of National key protected wild animals” including, 2 category, 257 species of animals , among them , 47species are marine, Class I : 17 species, Class II: 30 species
- Red book is published and information at web site <http://monkey.ioz.ac.cn>



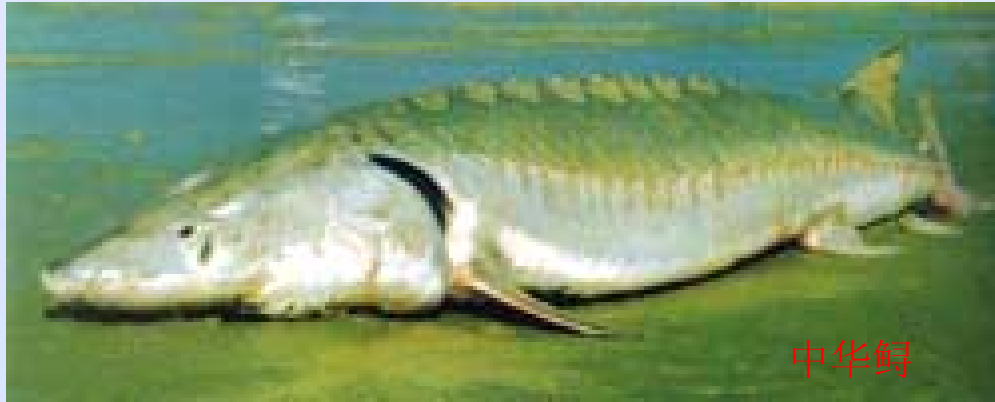
中华白海豚

Sousa chinensis



儒艮

Dugong dugong



中华鲟

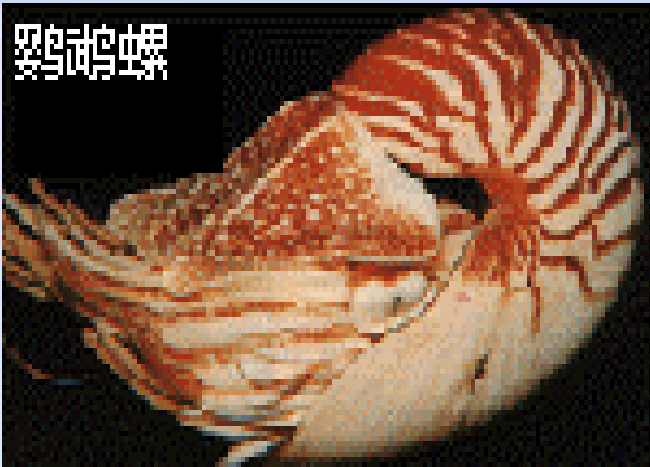
Acipenser sinensis

Tachypleus tridentatus



鲎

鹦鹉螺



Nautilus pompilius

海蛙



Rana cancrivora

金丝燕窝



Collocalia spp.



Phoca largha (Schreber)



Apostichopus janonicus Selenka

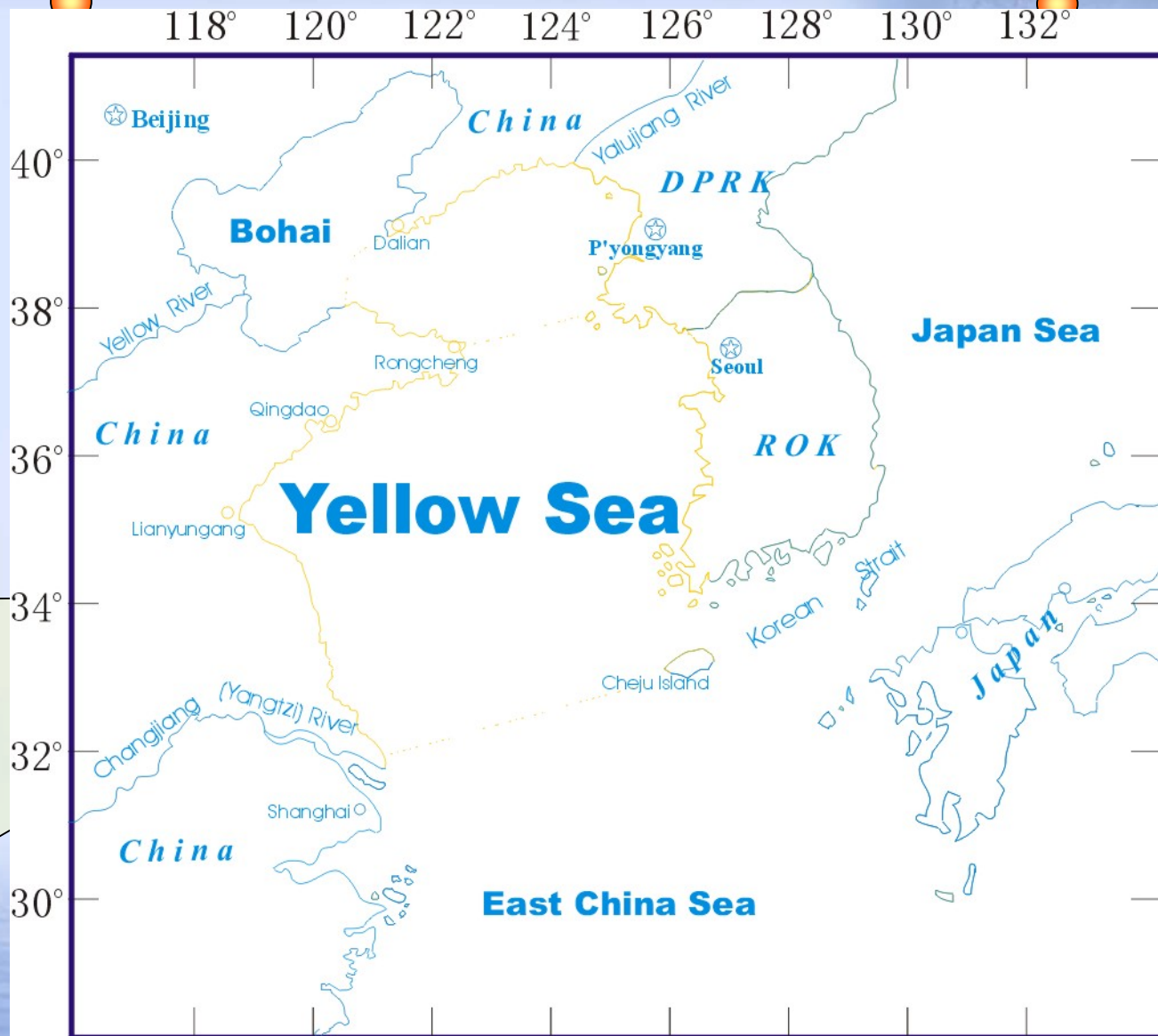


***Balanoglossus misakiensis* Kuwano**



Brachyostoma belcheri

- The Yellow Sea is a semi-enclosed, shelf-type shallow sea, situated between the Chinese mainland and the Korean Peninsula.
- Three states --- the People's Republic of China (PRC), the Republic of Korea (ROK), and the Democratic People's Republic of Korea (DPRK) -- share its coastline.



- **The Yellow Sea encompass the longitudes 31°40'N to 39°50' N and the latitudes 119°10'E to 126°50'E, with a length of 870 km from the north to the south and 556 km from the east to the west, and a total area of 380,000 km².**
- **Mean depth of Yellow Sea is 44 m.**
- **The residence time of the Yellow Sea Proper Water is about 5-6 years and particles reside for less than 2 months in the water column.**
- **Over 20 rivers influence the Yellow Sea, with the Changjiang (Yangtze) River and Yellow River dominating.**
- **River water discharge is averaged $117 \times 10^9 \text{ m}^3 \text{ yr}^{-1}$, and Chinese side contributes more than 70% of the total input.**

1. General description of Yellow Sea Ecosystem

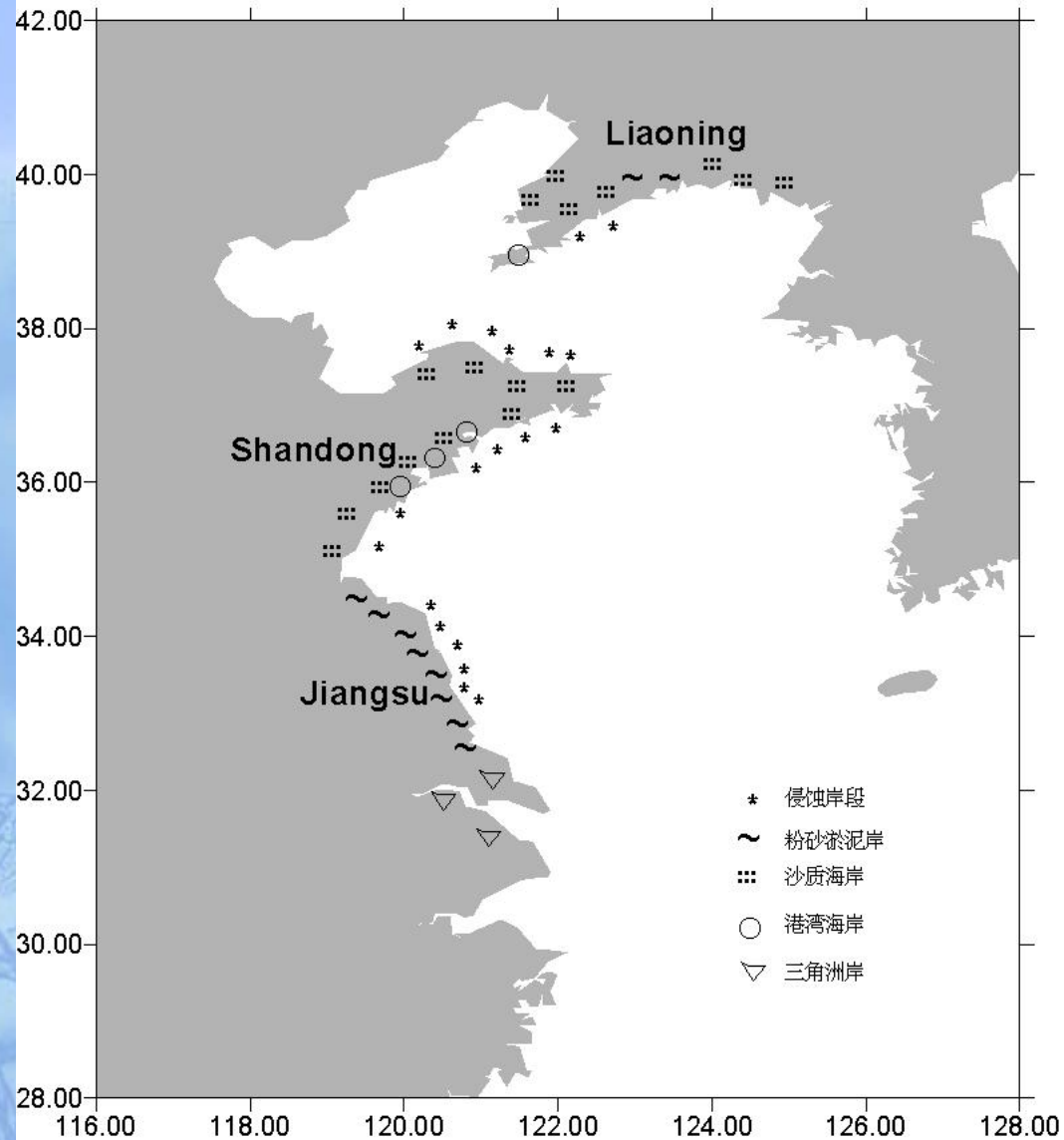
- The Yellow Sea encompass the longitudes $31^{\circ}40'N$ to $39^{\circ}50' N$ and the latitudes $119^{\circ}10'E$ to $126^{\circ}50'E$, with a length of 870 km from the north to the south and 556 km from the east to the west, and a total area of 380,000 km².
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- **The Yellow Sea is highly productive biologically**
- **The mixing of different water masses creates favorable spawning and nursery grounds for many fish species, as well as preferred habitat for mackerel, jack mackerel, sardine and other species.**
- **Trawling and purse seine fishing in the region produce large catches of commercial products from around 100 species, with 66% from demersal fishes, 18% from pelagic fishes, 7% from cephalopods and 7% from crustaceans.**

The Yellow Sea coast varies at different regions. In Liaoning, it is sandy coast from the estuary of Yalujiang River to Pikou, and rocky coast from Pikou to Dalinan and Lushun.

Most part of the Yellow Sea coast in Shandong Province is rocky. There are sandy beaches in many bays, where sand ridge, lagoons or spits are developed.

Muddy and silt flat is dominant in the coast of Jiangsu Province, but there are sandy coasts from Taishan to the estuary of Changjiang River.



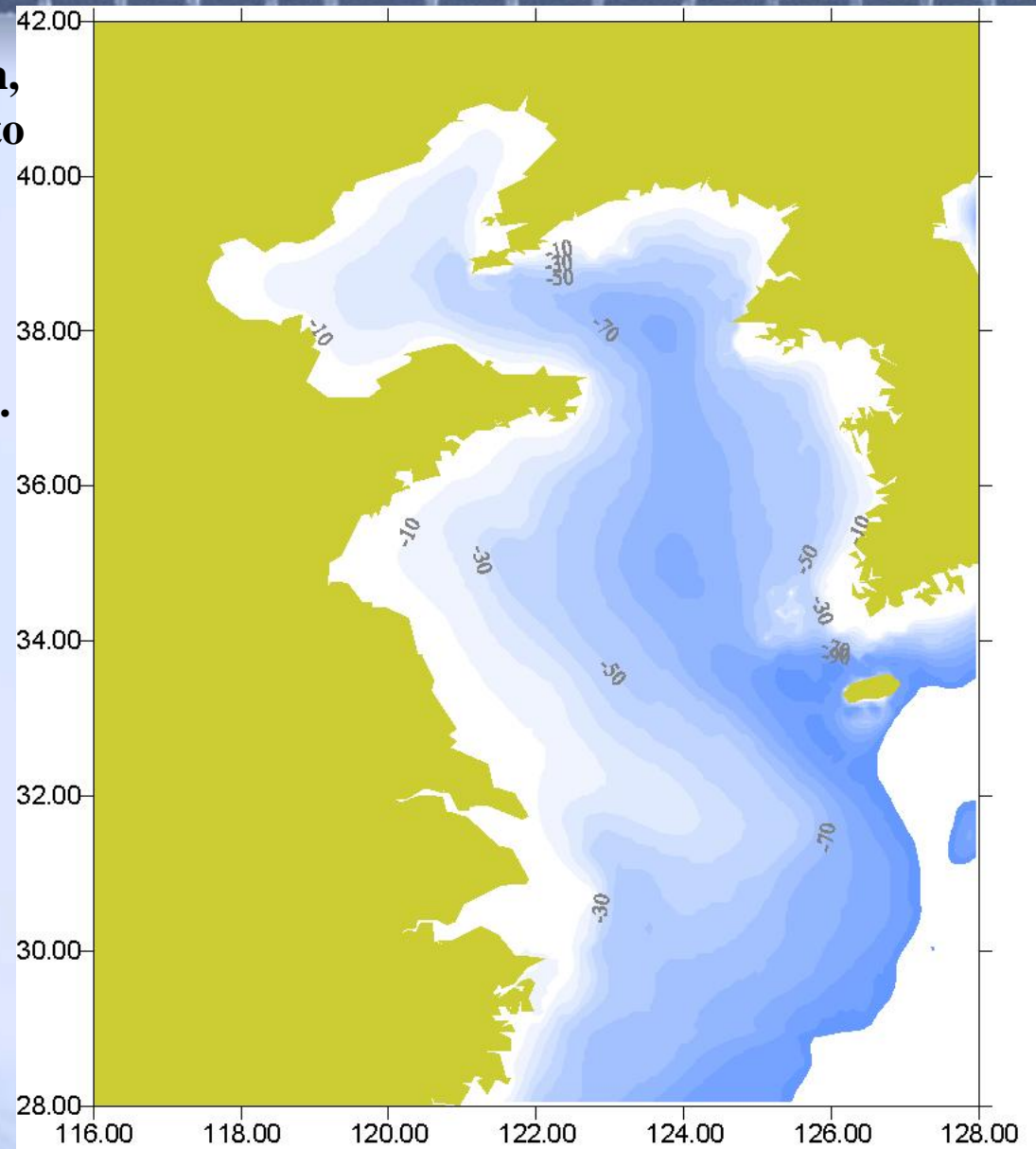
Coastal erosion of Yellow Sea.

○ erosion coast; ■ siltation coast; ::: sandy coast
 □ embayment coast; ▽ delta coast

**The Yellow Sea bed is a shallow basin,
It inclines from east, west and north to
the middle and southeast with
an average slope of $0^{\circ}1'21''$.**

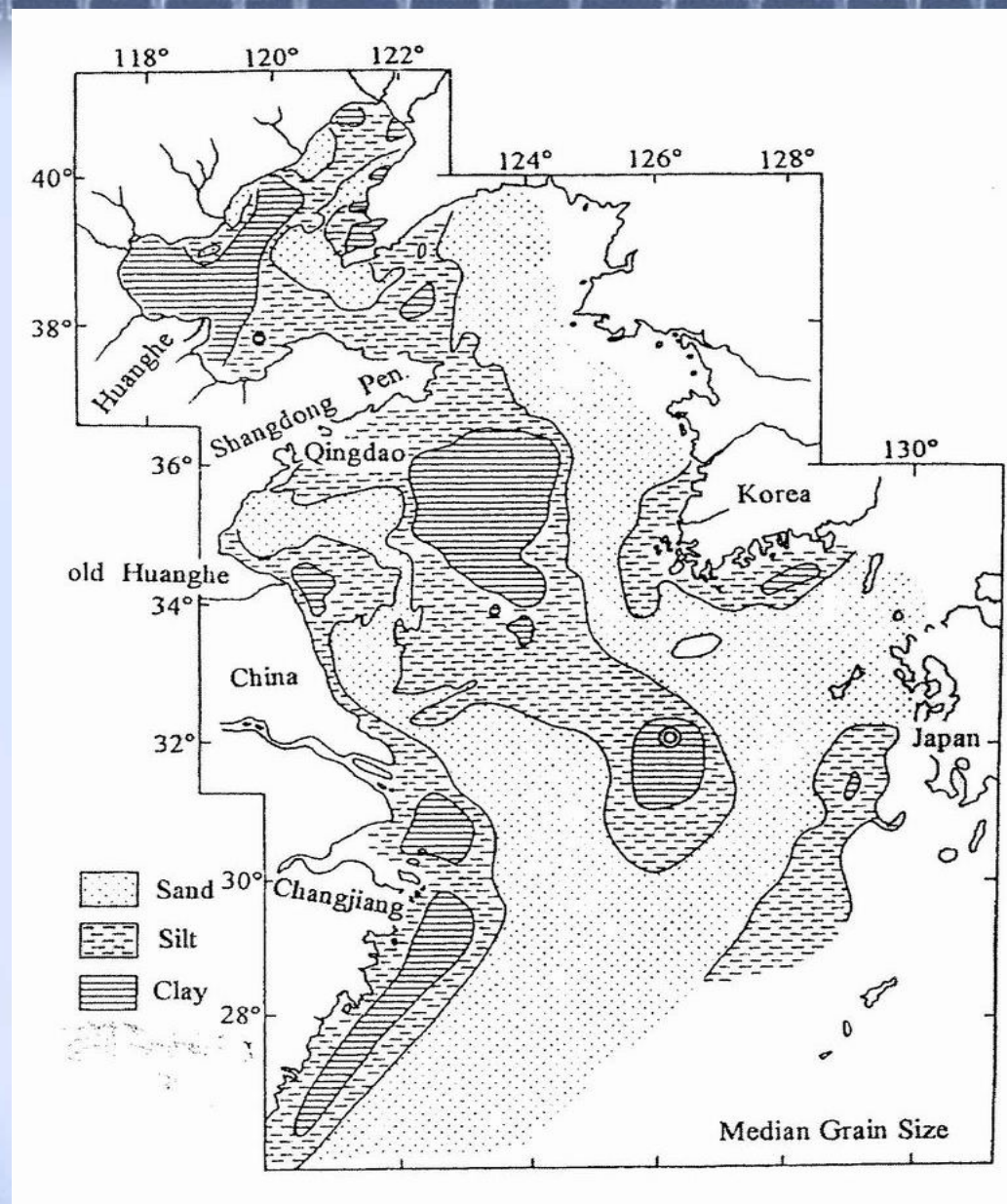
**The so-called Yellow Sea Trough
lies in the south of Yellow Sea,
with the water depth from 60 to 80 m.
The trough starts at south to
the Cheju Island, stretching through
the central part into the northwest
of Yellow Sea,
finally one branch ends
near Qingdao and Haizhou Bay
and the other ends in the Bohai Sea.**

**The mean water depth is 38 m for
the North Yellow Sea, 46 m
for the South Yellow Sea,
and 44 m for the whole area.
In most part of Yellow Sea,
the water depth is smaller than 60 m
and the largest depth is 140 m
in the area northwest to the Cheju Island**

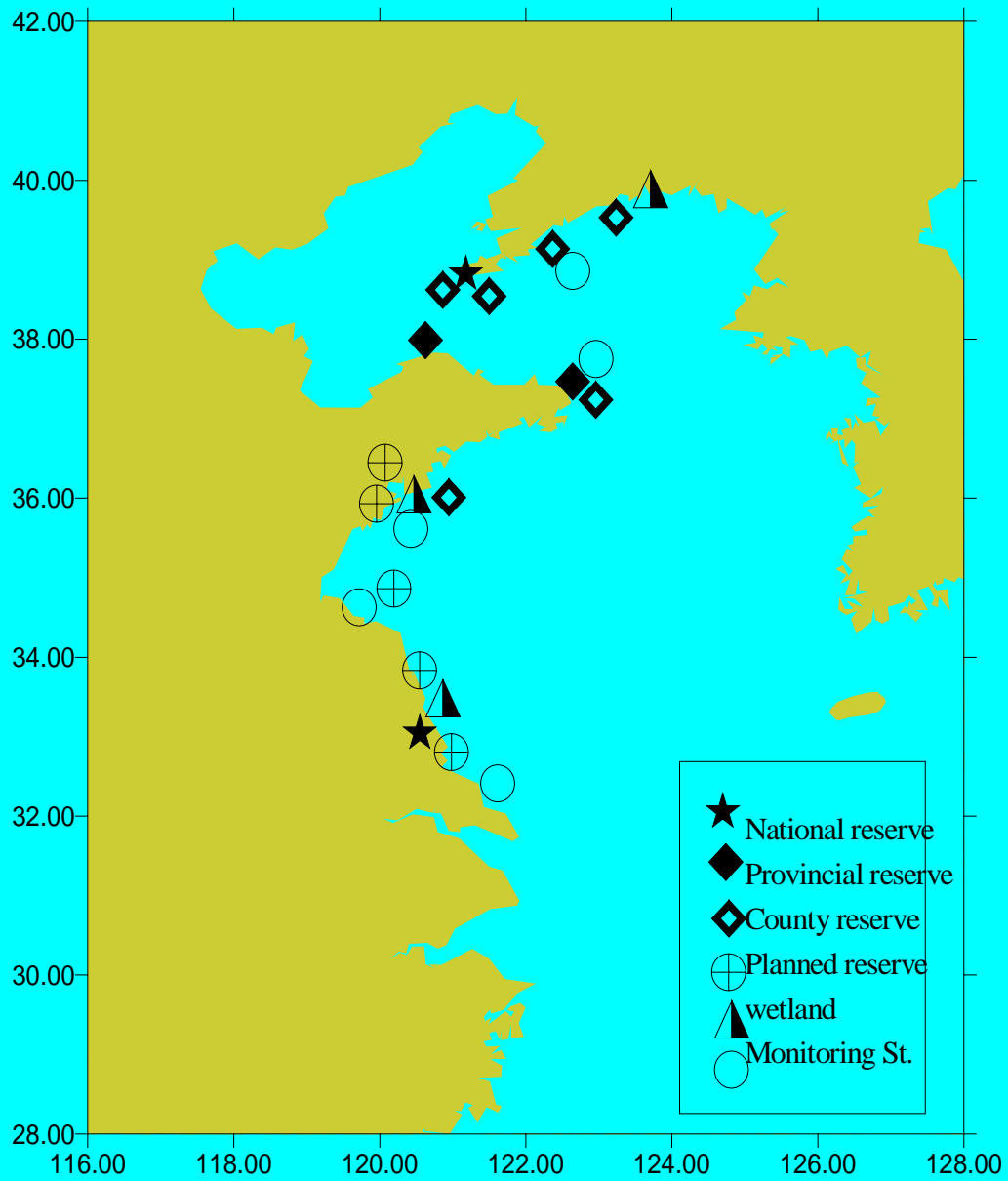


Bathymetry of Yellow Sea

The bottom of Yellow Sea is muddy and silt sedimentary basin. The grain size is larger in near shore area and smaller in offshore. In the Bohai Strait, Haizhou Bay and central North Yellow Sea, the sediment is coarser; while in central and South Yellow Sea and the old Yellow River delta, it is finer.



Sediment of Yellow Sea

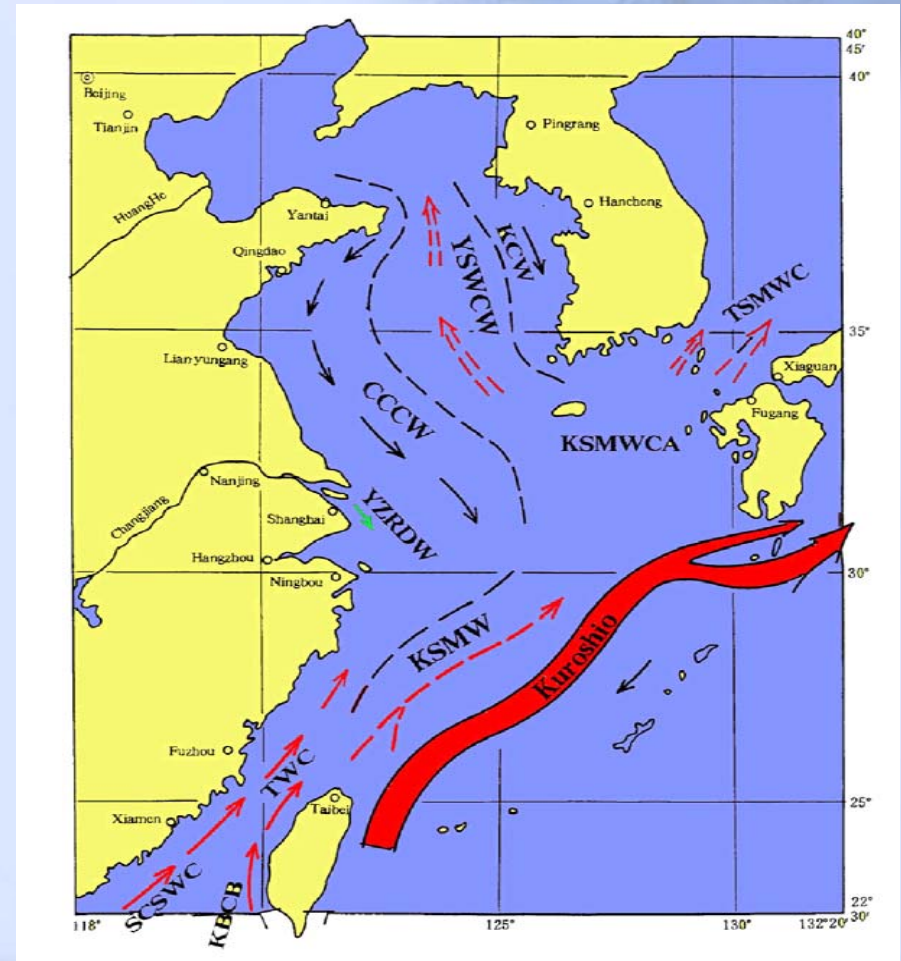


**Natural reserves, important wetland and ecosystem monitoring stations
in the Yellow Sea**

2. Ecosystem feature

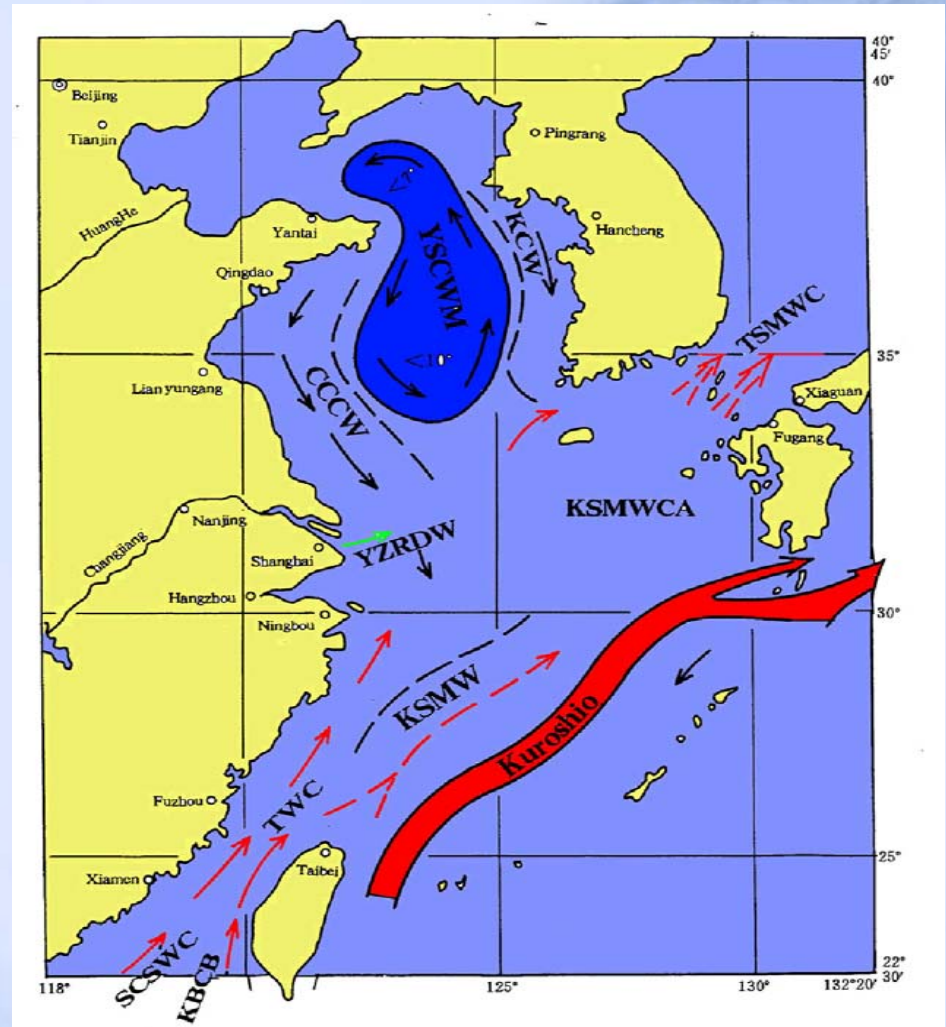
1) Physical environment

- Major currents in the Yellow Sea: the Kuroshio, Yellow Sea Warm Current, the coastal currents.

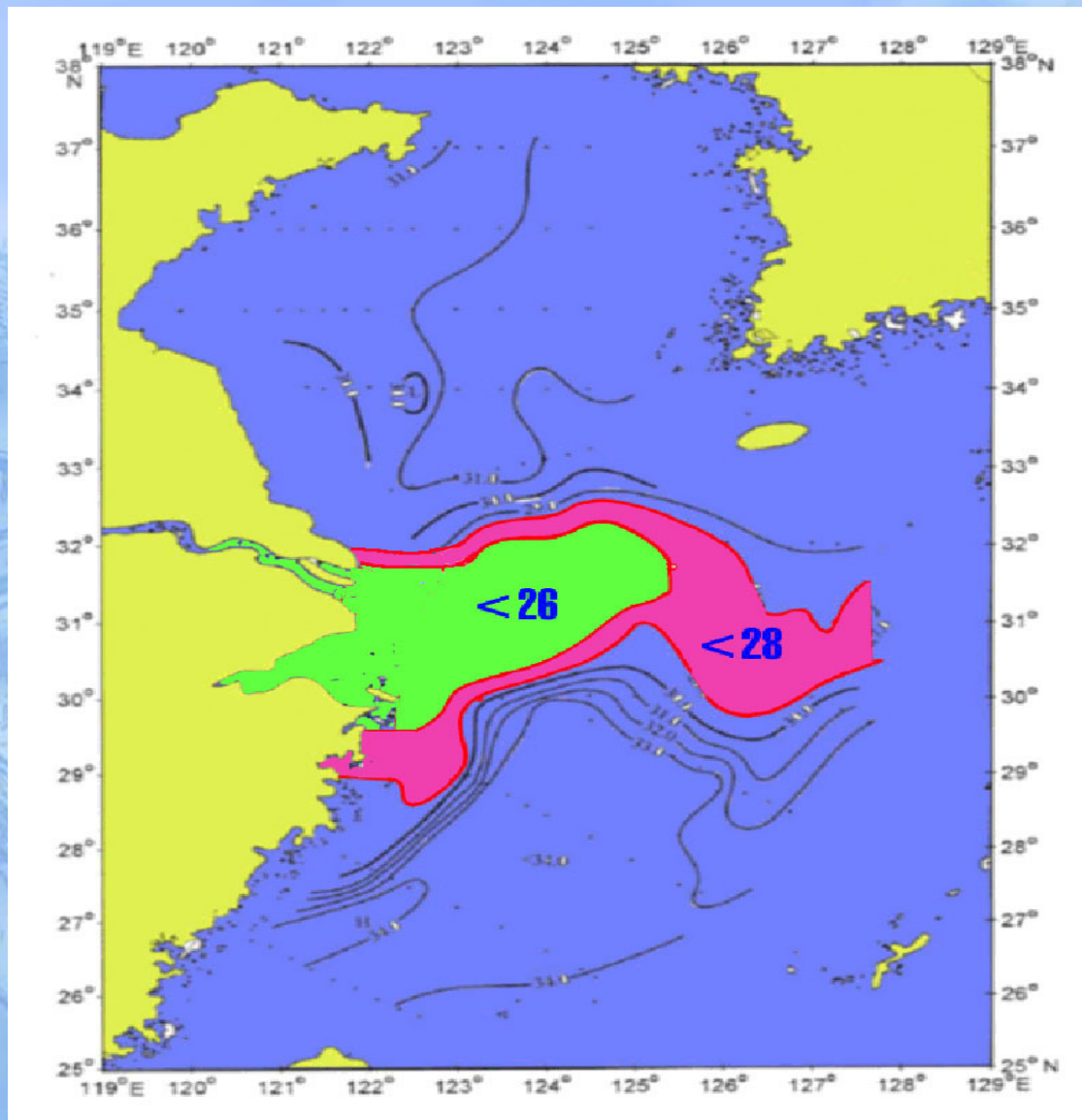


Water circulation of the Yellow Sea (winter)

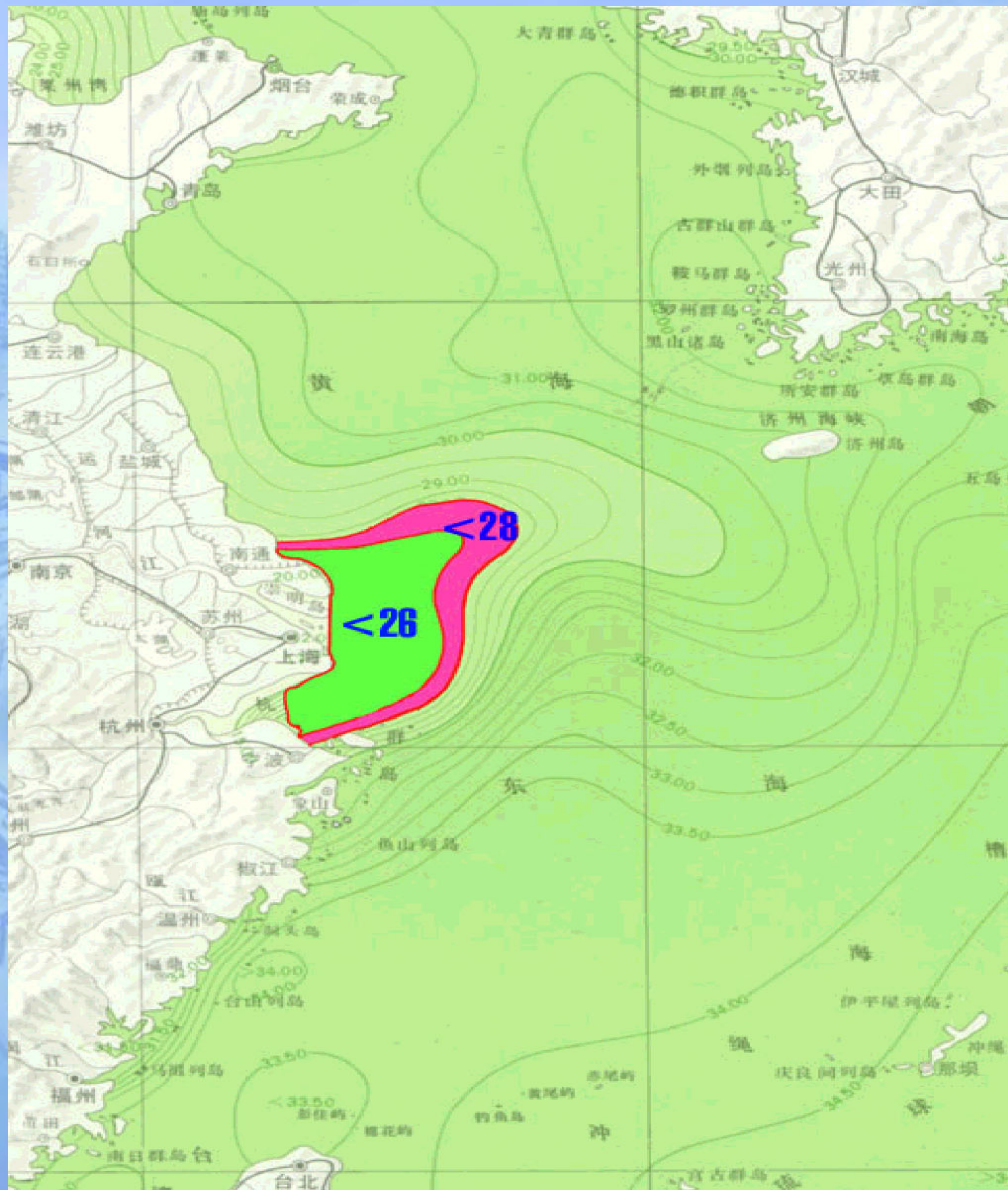
- Major currents in the Yellow Sea: the Kuroshio, Yellow Sea Warm Current, the coastal currents.



Water circulation of the Yellow Sea (summer)

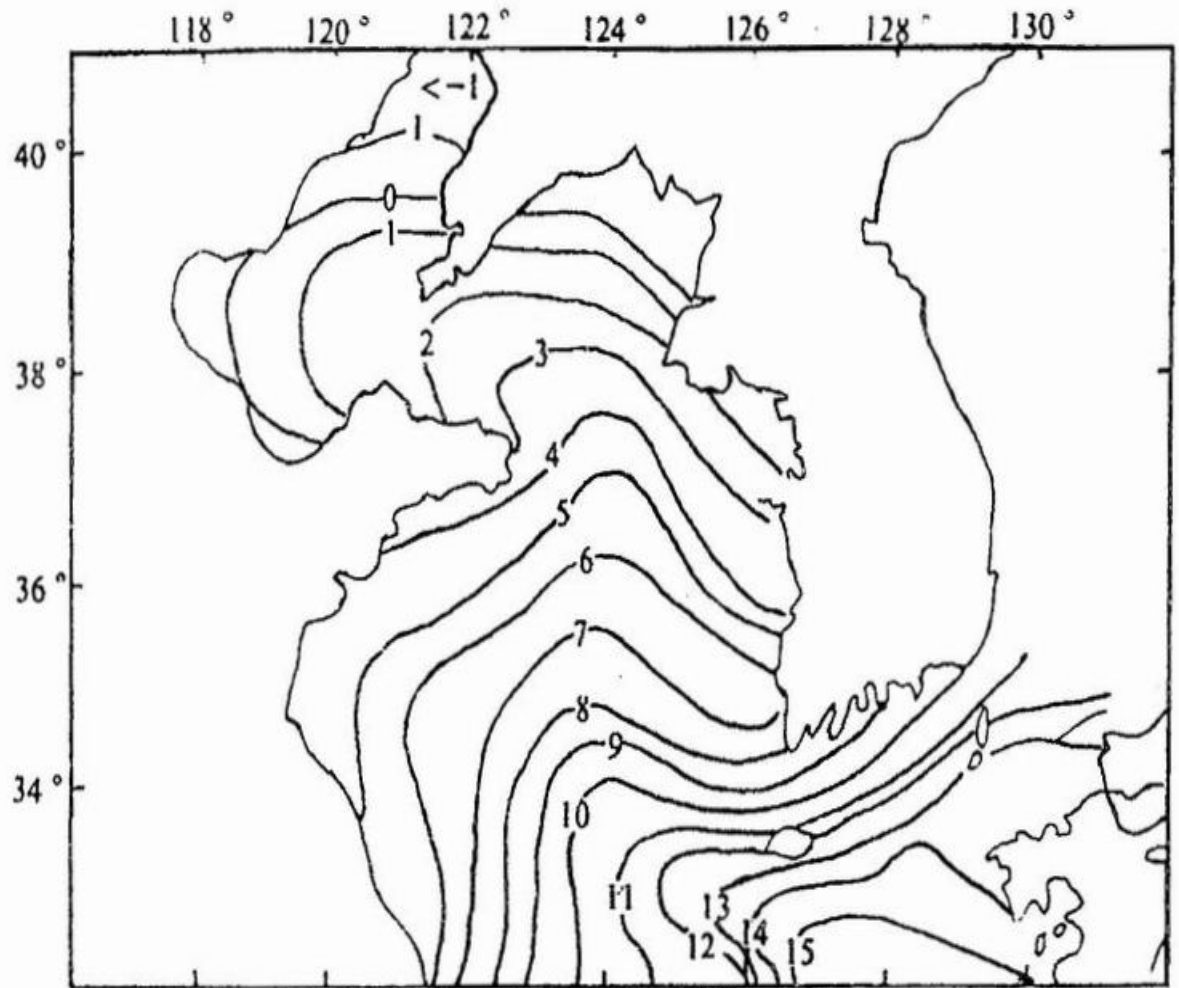


the Yangtze River diluted water during the wet season of 1998.

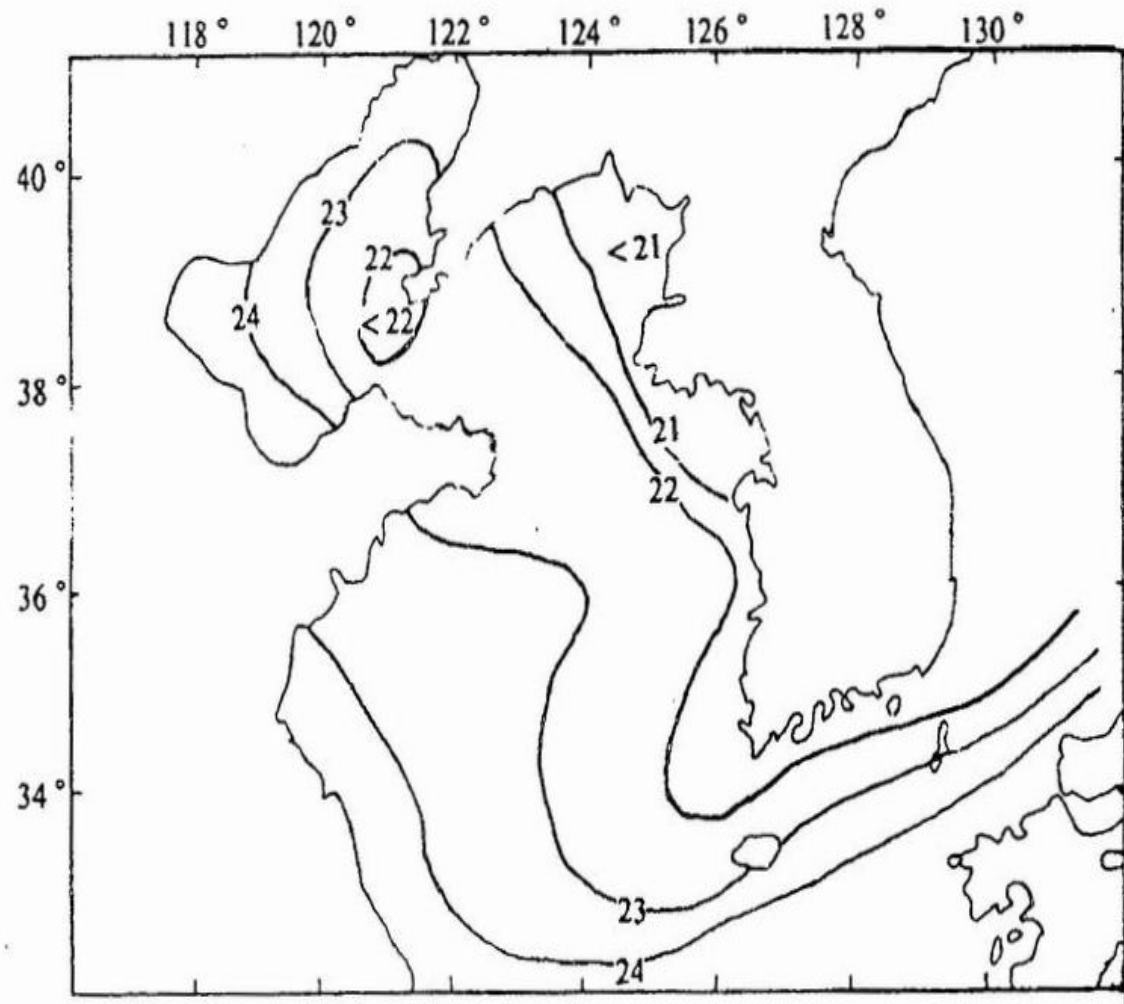


the Yangtze River diluted water during wet season in average.

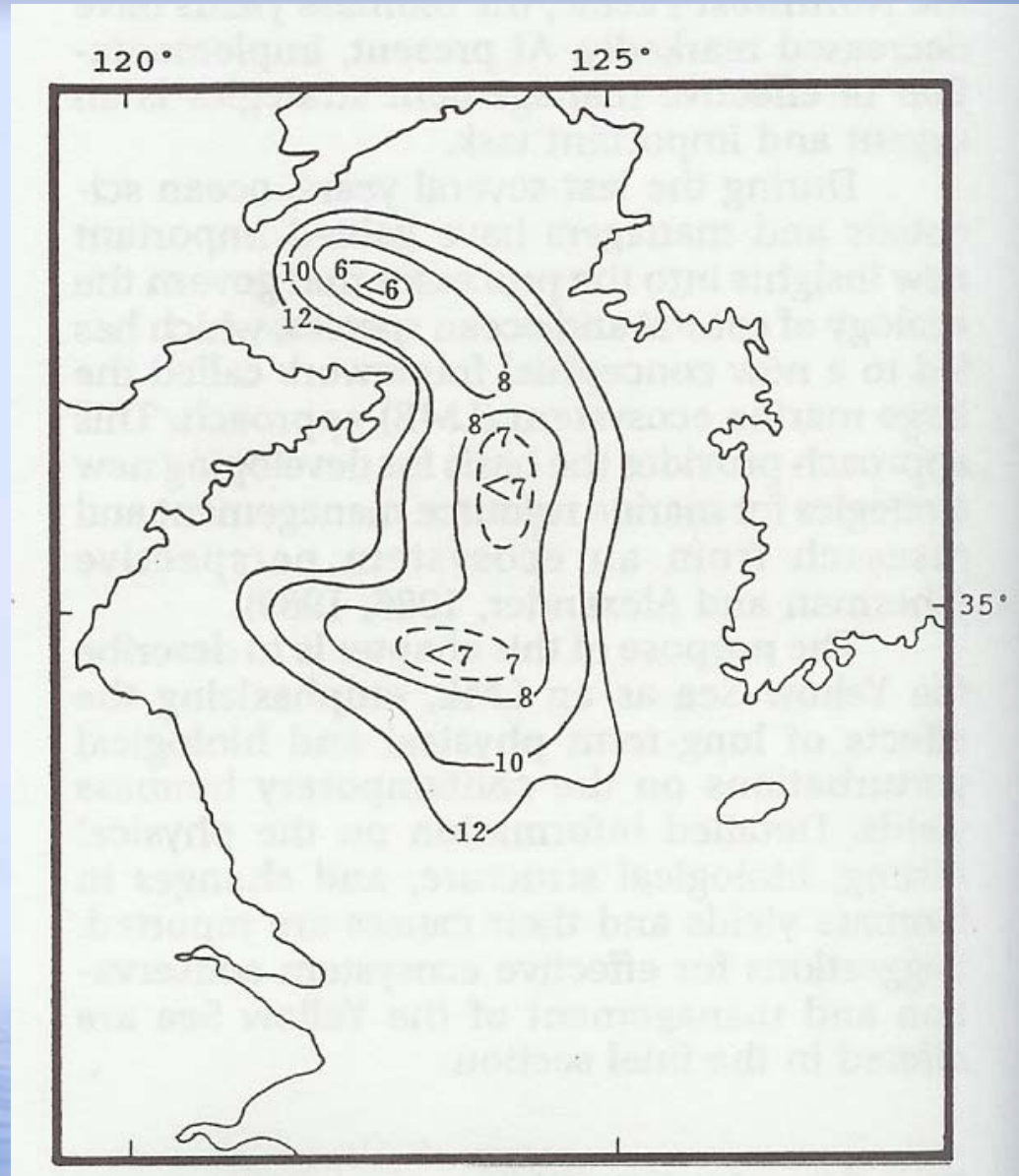
Surface
water
temperature
of Yellow
Sea in
January



Surface
water
temperature
of Yellow
Sea in June



Bottom
water
temperature
of Yellow
Sea in
summer



Main rivers
of Yellow
Sea

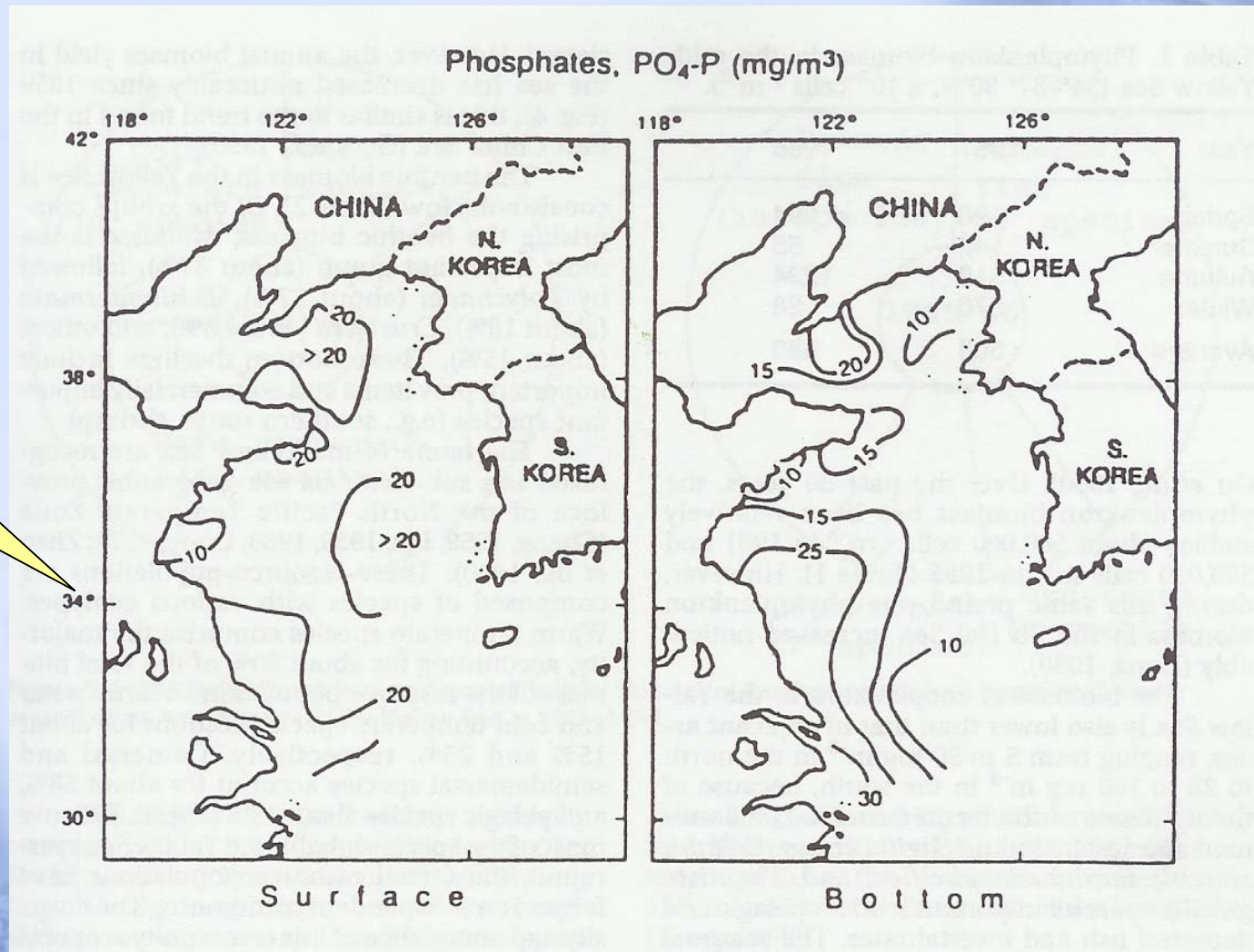
River	Drainage area (km ²)	Length (km)	Flow rate (10 ⁸ m ³ /yr)	Silt discharge (10 ⁴ t/yr)
Yalujiang River	61889	790	289.47	206.3
Dayanghe			20.5	68.4
Zhaunghe			2.44	13.2
Biliuhe			8.76	50.3
Dengshahe			0.27	5.8
Dagujiahe	2295.5	80	3.03	35.4
Xin'anhe	315	40	0.79	20.1
Muzhuhe	1253.5	65	4.89	42.21
Huangleihe	651.7	69		
Rushanhe	954.3	64		1.02
Baishahe	221	42		
Wulonghe	2653	124	5.63	84.0
Lianyinhe	130.9	41		
Moshuihe	356.2	42.3	0.19	2.87
Daguhe	4631	179	7.08	56.4
Mouhe	287.2	41	0.56	25.81
Liangchenghe	496.8	47		
Fuzhuanghe	1048.2	51.5	1.91	
Xiuzhenhe	370.2	46.0		
Guanhe	640	74.5	15	70
Huaihe---Subeiguanquzongqu	269150	1000	261*	1308*
Changjiang River	1808500	6300	9211	49960

2) Chemical characteristics and marine pollution

- The main pollutants in seawater of Yellow Sea are found as COD, oil, inorganic nitrogen and inorganic phosphorus.
- The nutrient concentration in the region displays an increase tendency.
- The pollution of heavy metals badly threatens to the offshore water. Meanwhile the concentration of oil is higher than the value permitted in seawater quality standard.

- **Inorganic nitrogen** over assessment standard is about **46%**. The maximum value of inorganic nitrogen is 2.21mg/l, 3.4 times higher than the 4th class of seawater quality standard. The rate of values of inorganic nitrogen over the standard is 83% in Jiaozhou Bay and 50% in Dalian Bay.
- The rate of values over standard for **inorganic phosphorus** is **28%** in Yellow Sea area, the maximum value for inorganic phosphorus is 0.099 mg/l, 1.2 times higher than the 4th class of standard value. The concentrations of inorganic phosphorus in the all observation of Dalian Bay and Jiaozhou Bay are higher than the value of the 1st class of seawater quality standard; and the over-standard rates are 56% and 25% respectively.
- The rate of values of **oil concentration** over the assessment standard in the Yellow Sea area is **6%**.
- For **lead** concentration, the rate of values over the 1st class of the standard is **85%**, and the mean value is one time higher than the value of 1st seawater quality standard. The rate of values of total **mercury** over the standard is **19%**.

Phosphate
distribution
in the
surface and
bottom of
Yellow Sea



The comprehensive quality status of coastal waters in Yellow Sea and Bohai Sea in 1996

Sea areas	Items exceeded standards	Comprehensive index	Water quality class range*
Liaodong Bay	IN,IP,Oil	0.74	B ₁
BohaiSea Bay	IN,Oil	0.81	B ₂
Laizhou Bay	IN,IP,Oil	0.92	B ₂
Middle Bohai sea		0.34	A ₁
Dalian Bay	IN	0.90	B ₂
North Yellow Sea	IN,Oil	0.90	B ₂
South Yellow Sea		0.33	A ₁
Jiaozhou Bay	IN,Oil	0.65	B ₁
Jiangsu coast	IN	2.04	C ₂
Changjiang Estuary	IN,IP	2.29	C ₂

Biodiversity

The background features a light blue, textured surface with a faint, sketch-like illustration of a city or architectural structures. The top and bottom edges of the image are framed by a dark blue border with a repeating brick pattern.

Totally 3308 species recorded:

368---- Phytoplankton

130---- Zooplankton

Intertidal macrobenthos:

113---Liaoning

414---Northern Shandong

125---South Yellow Sea coast

Shallow sea macrobenthos:

209---Bohai Strait

272---Shangdong

183---Jiangsu

Nekton:

219---North Yellow Sea

225---Shangdong

150 (fishes)---Jiangsu

Table 2. The composition of phytoplankton in Bohai and Yellow Sea.

phyla	number of genus	number of species	main genus	number of species in main genus
Bacillariophyta	71	308	<i>Coscinodiscus</i> spp.	26
Pyrrophyta	11	56	<i>Biddulphia</i> spp.	13
Chrysophyta	1	1	<i>Chaetoceros</i> spp.	49
Chlorophyta	2	2	<i>Rhizosolenia</i> spp.	19
Cyanophyta	1	1	<i>Nitzschia</i> spp.	24
total	86	368	<i>Peridinium</i> spp.	23

Dominant zooplankton species:

Calanus sinicus, *Centropages momurichi*,
C. tenuiremis, *Clanopia thompsoni*,
Labidocera euchaeta, *L. Bipinnata*,
Acartia clausi, *A. Bifilosa*, *A. Pacifica*,
Oithona sinilis, *Sagitta enflata*
almost all are neritic species.

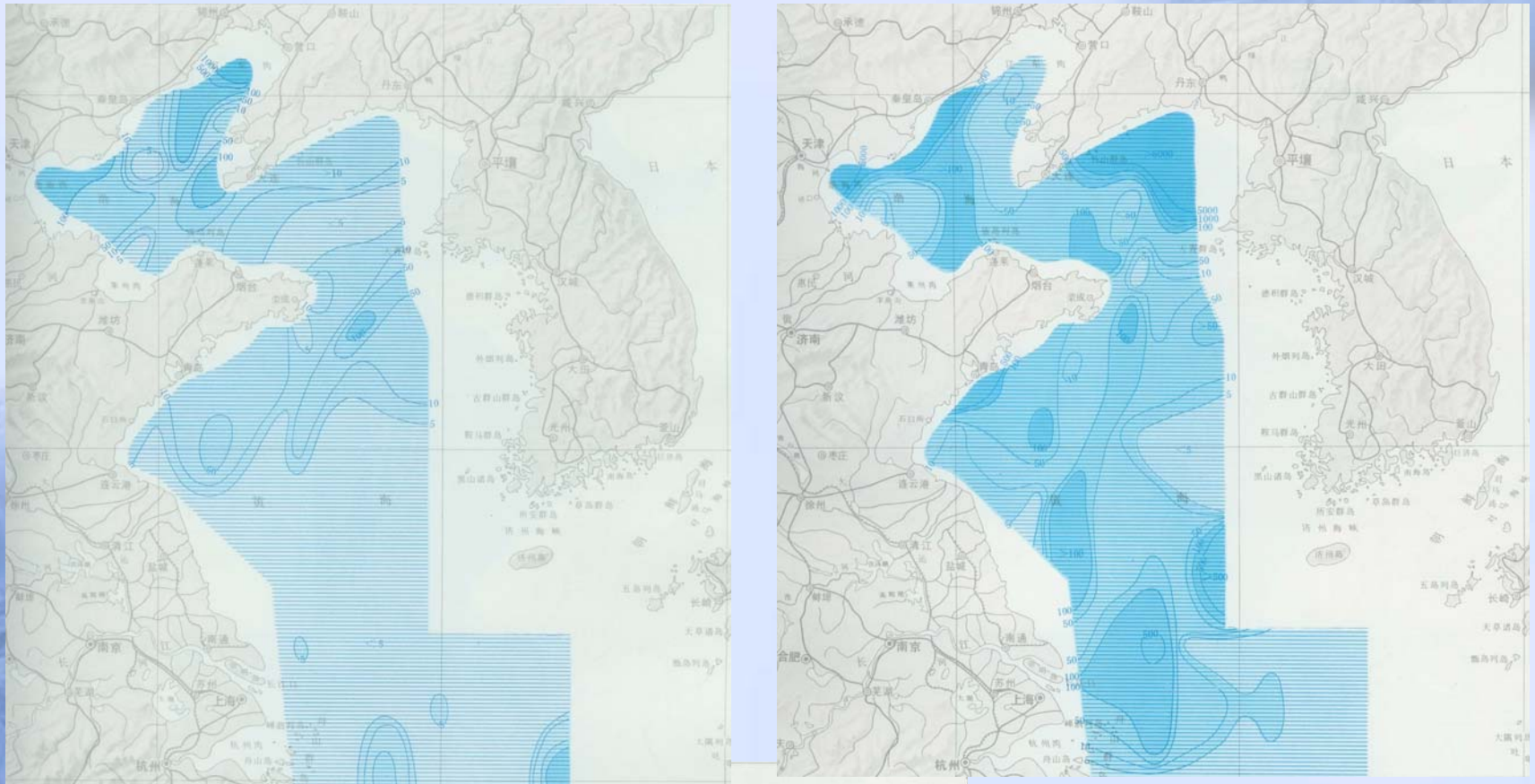
Table 3. The list of key protected marine organisms in Yellow Sea

Name	Level of protection
Chordata	
★ Cetacea	II
★ <i>Diomedea albatrus</i>	I
★ <i>Pelecans p. philippensis</i>	II
★ <i>Phalacrocorax pelagicus</i>	II
★ <i>Ciconia nigra</i>	I
★ <i>Chelonta mydas</i>	II
★ <i>Eretmochetys imbricata</i>	II
★ <i>Lepidochelys olivacea</i>	II
★ <i>Dermockelys corlacea</i>	II
★ <i>Trachidermus fasciatus</i>	
★ <i>Acipenser sinensis</i>	I
★ <i>Psiphurus gladius</i>	I
★ <i>Branchtotoma belcheri tsingtauense</i>	II
Hemichordata	
★ <i>Glassobalanus palybanchioporus</i>	I
★ <i>Saccoglossus hwangiauensis</i>	I

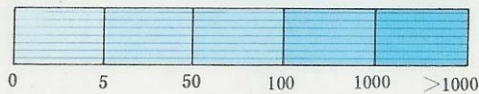
Phytoplankton

- there are 368 phytoplankton species
- most of them are diatom.
- The phytoplankton can be categorized into several ecological types.
 - Brackish species
 - Eurythermal species,
 - Low temperature species
 - Warm water species
 - Tropical species

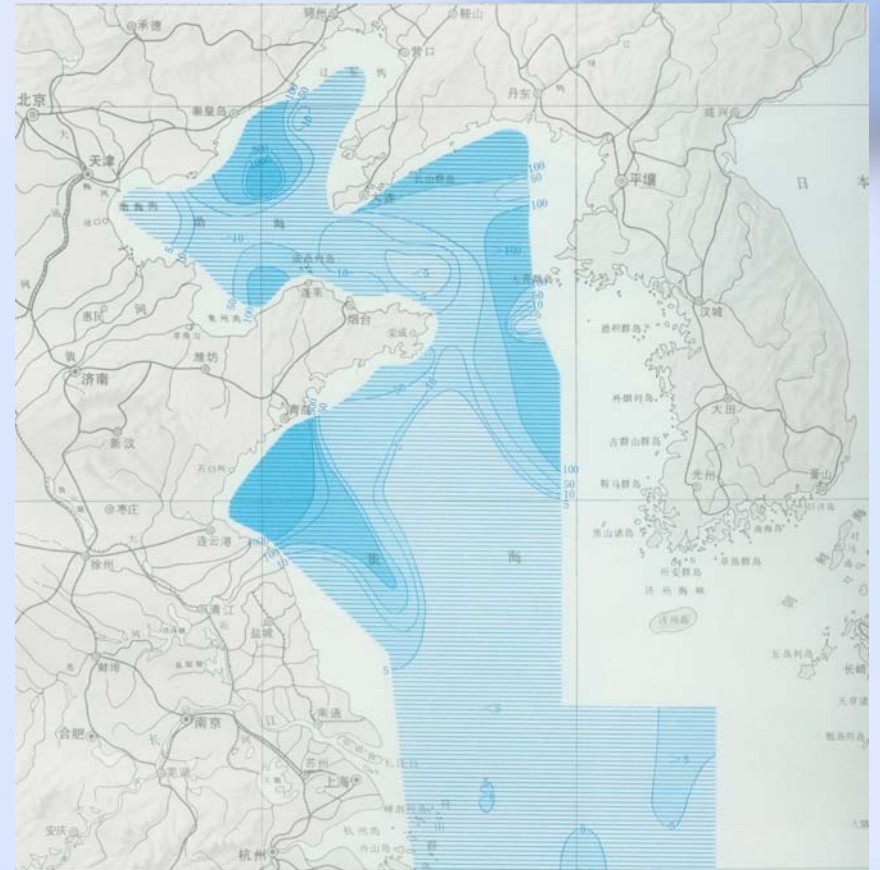
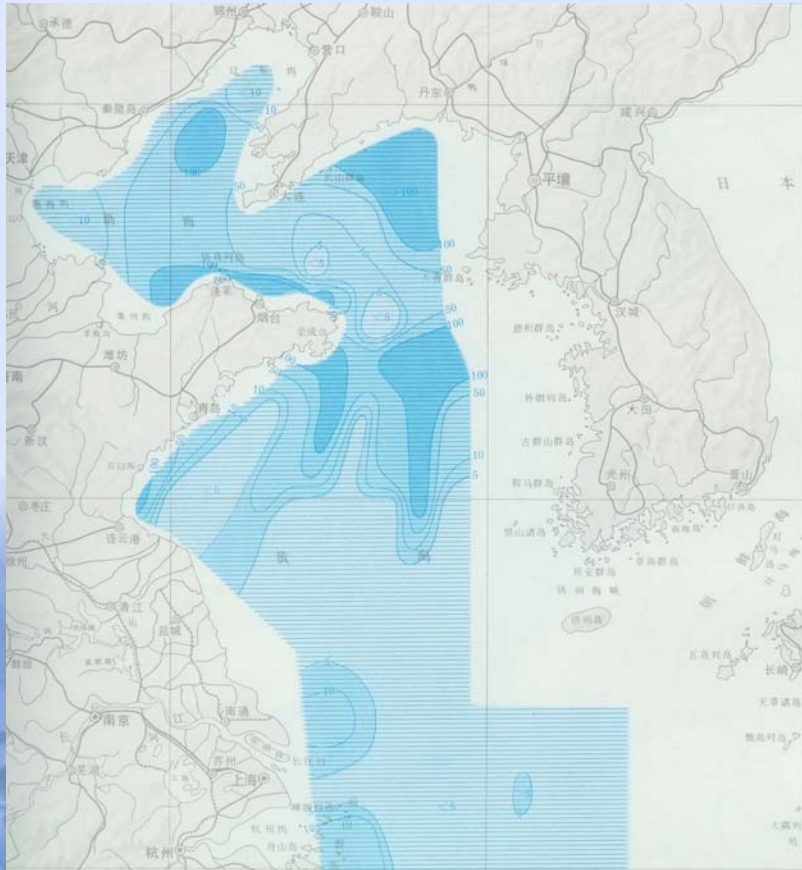
Phytoplankton distribution of Yellow Sea in Spring and Summer



单位： 10^4 个/ m^3 (10^4 cell/ m^3)

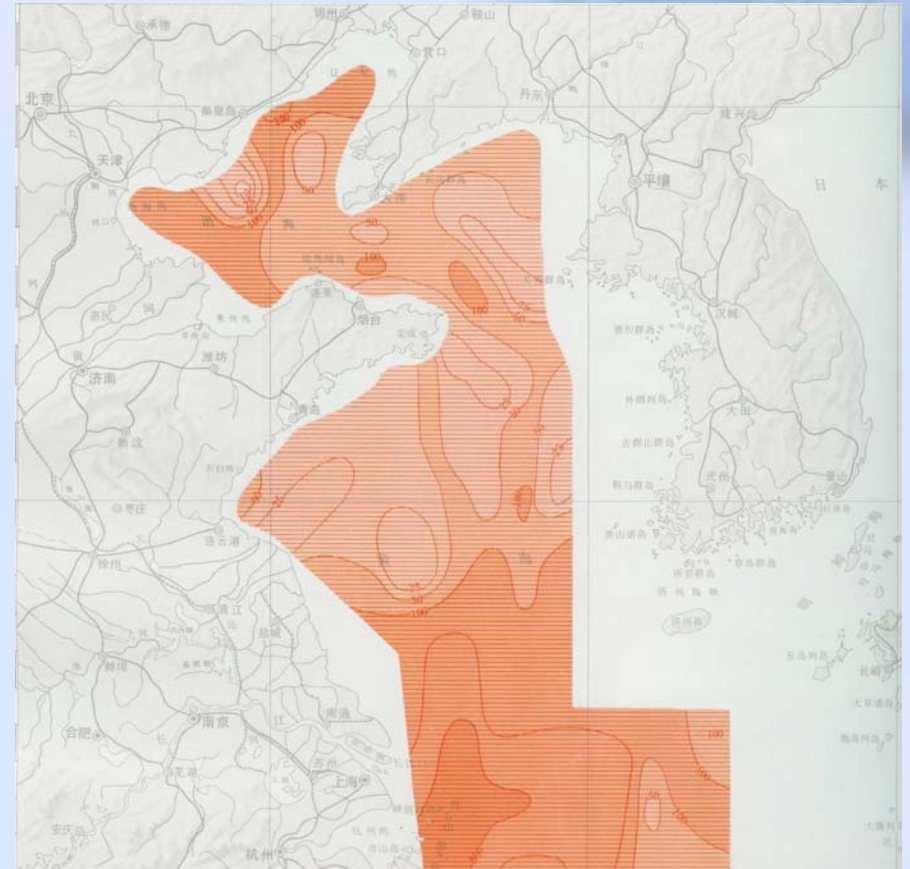
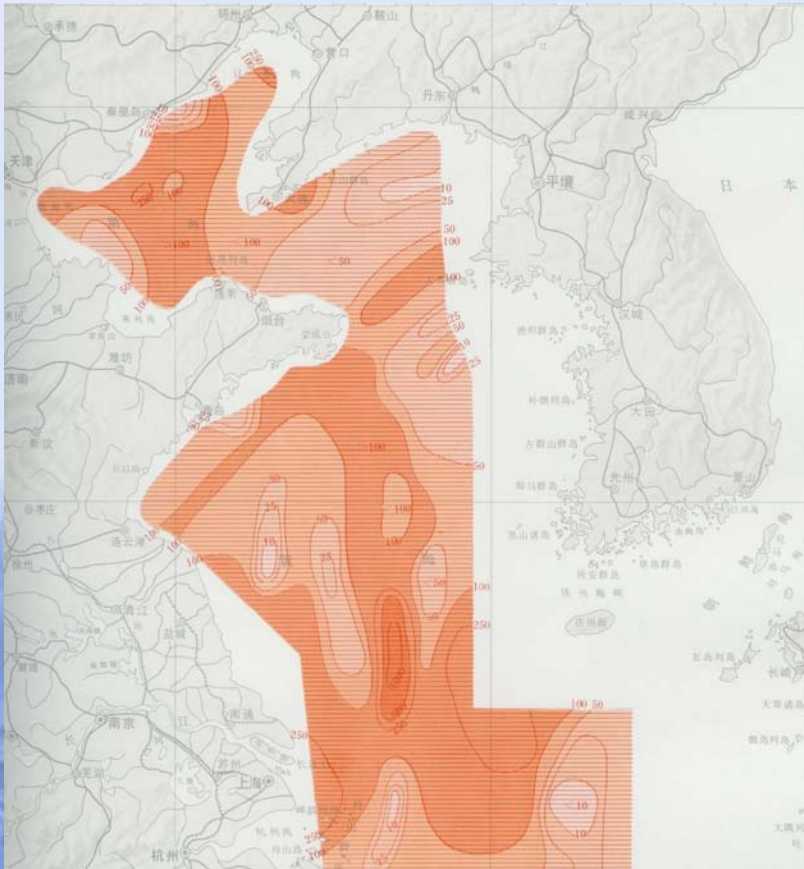


Phytoplankton distribution of Yellow Sea in Fall and Winter

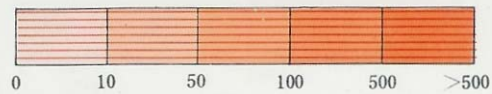


- **Zooplankton:** more than 130 zooplankton species have been recorded in Yellow Sea, including 36 species of hydromedusa, 3 aequoreids, 2 ctenophores, 3 cladoceres, 69 copepods, 2 mysids, 1 amphipods, 4 decapods, 3 chaetognaths, 1 planktonic gastropod, and other planktonic larvae.
- The composition of zooplankton in Yellow Sea is more complex than that in Bohai, yet simpler than that in lower latitude seas.
- The dominant species are almost all neritic, such as *Calanus sinicus*, *Centropages momurichi*, *C. tenuiremis*, *Clanopia thompsoni*, *Labidocera euchaeta*, *L. bipinnata*, *Acartia clausi*, *A. bifilosa*, *A. pacifica*, *Oithona sinilis* and *Sagitta enflata*.
- There are some species of frigid-temperate zone in the deep layer of the middle part of Yellow Sea, such as *Euphausia pacifica* and *Paratemisto gracilipes*. In winter when the Kuroshio Current becomes strong, there may be some warm water species and tropical species in southern Yellow Sea.

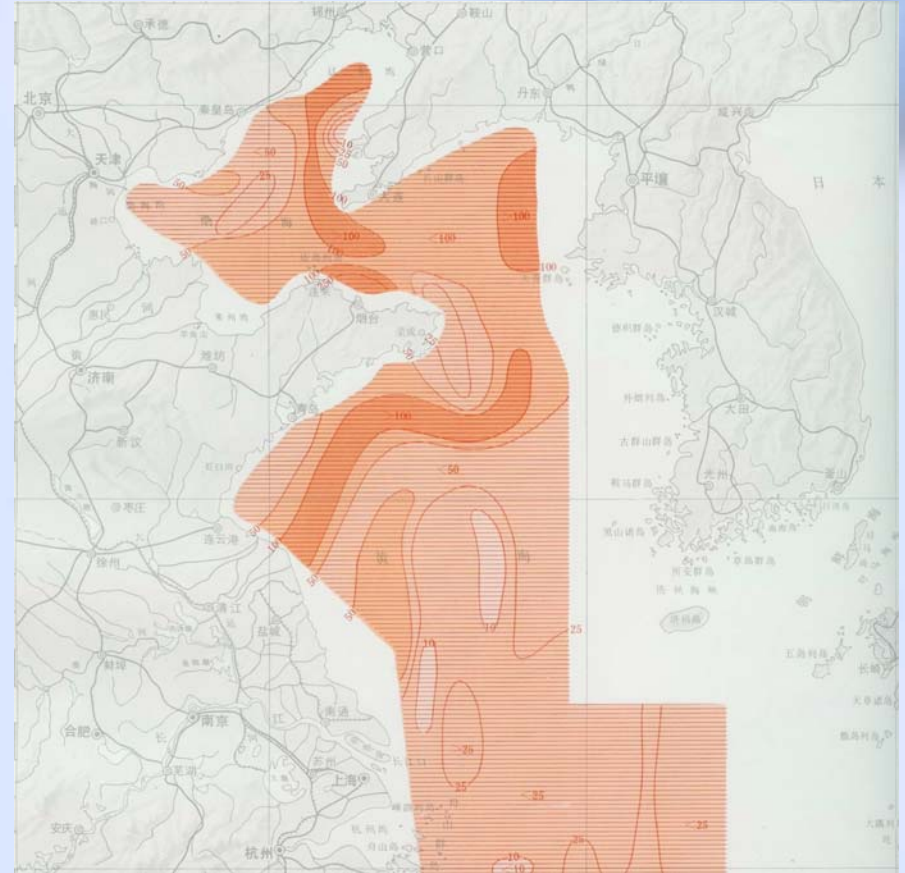
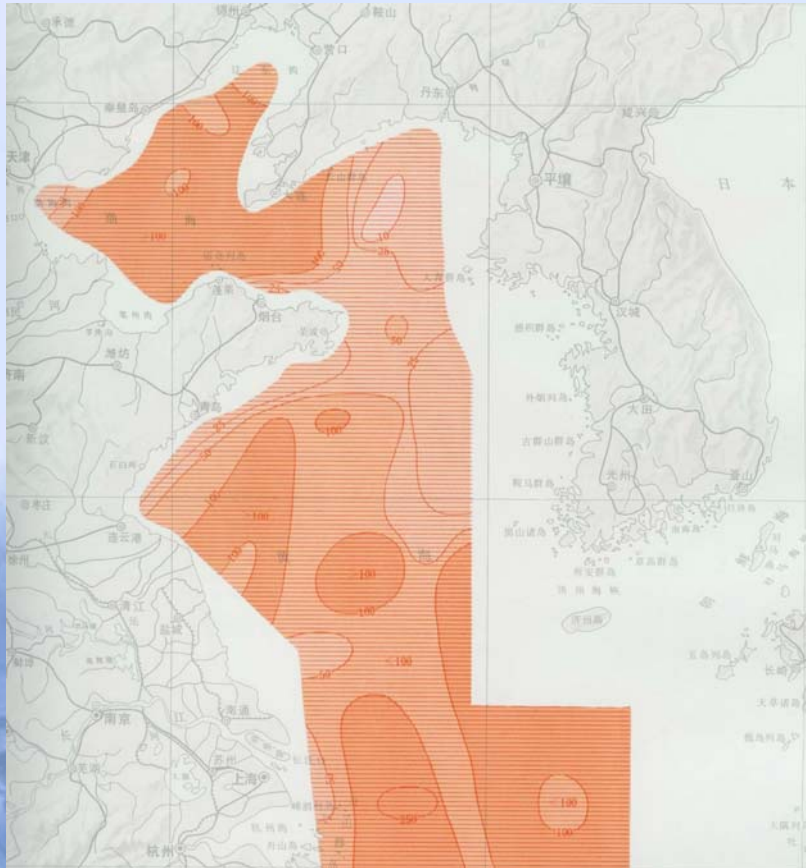
Zooplankton distribution of Yellow Sea in Spring and Summer



单位：mg/m³



Zooplankton distribution of Yellow Sea in Fall and Winter

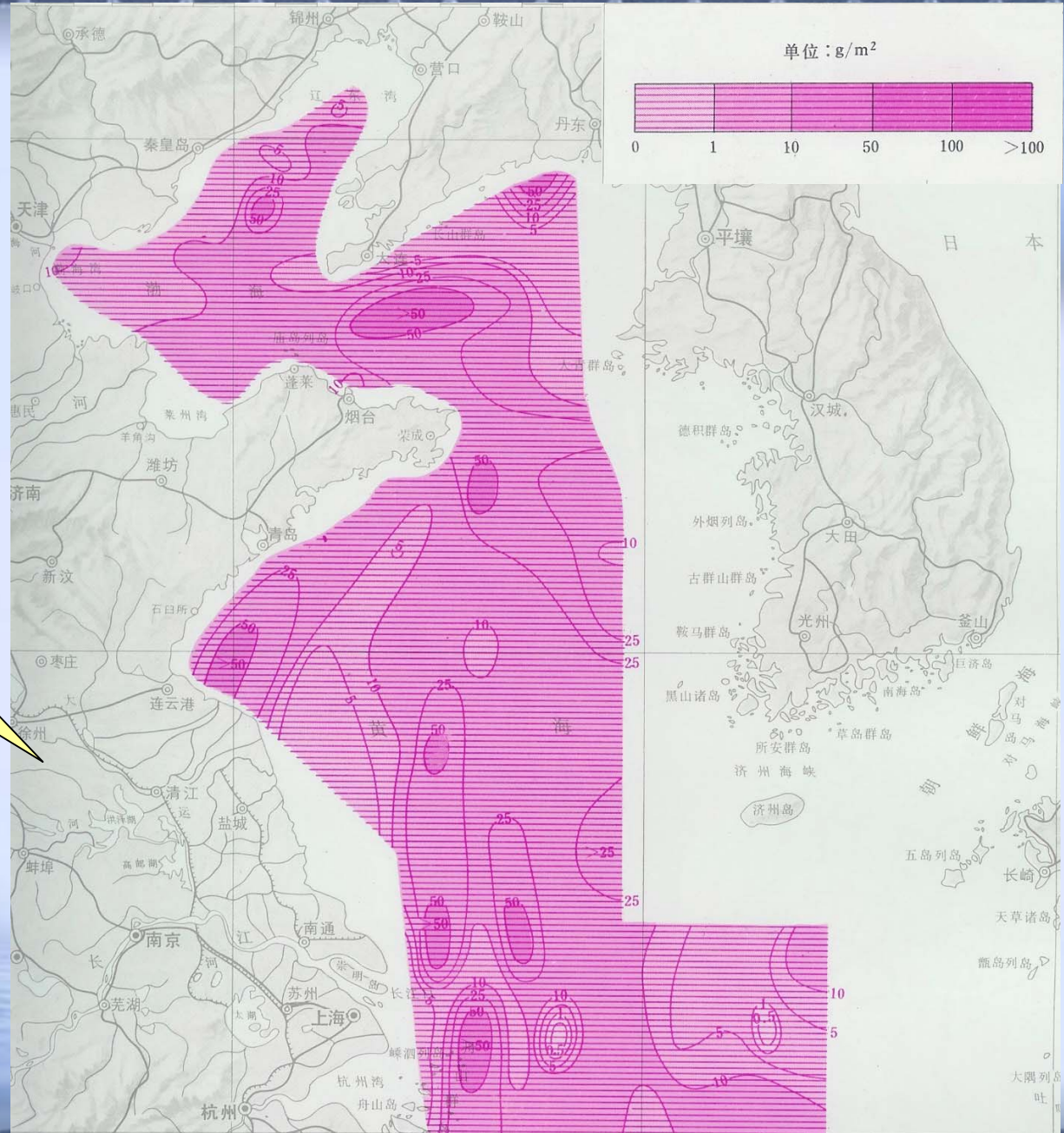


■ Benthos

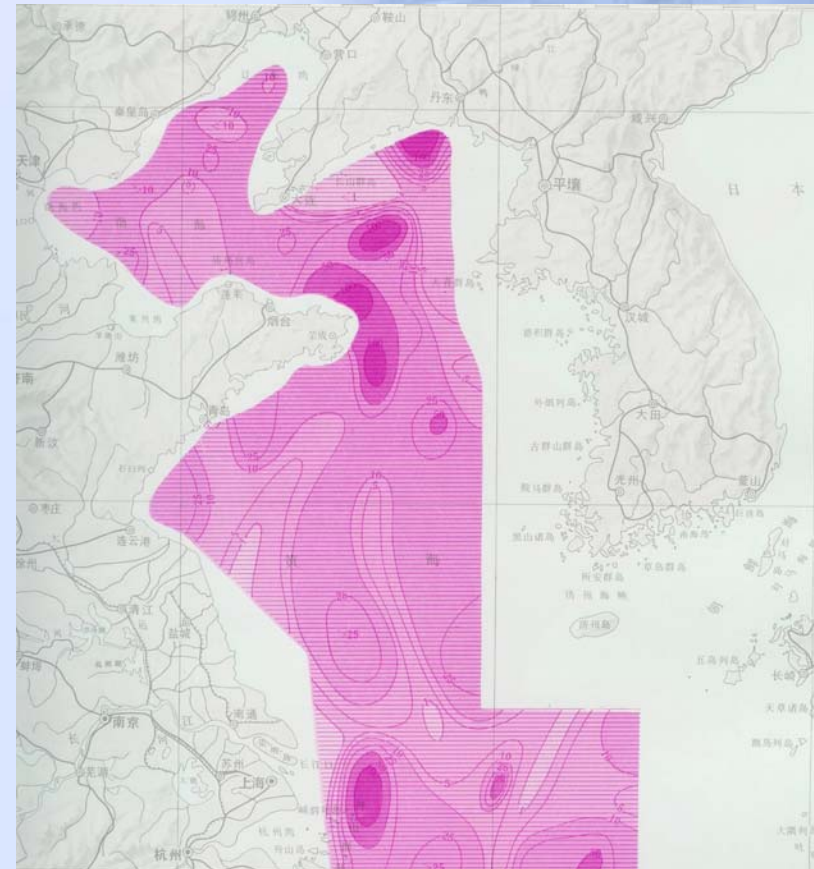
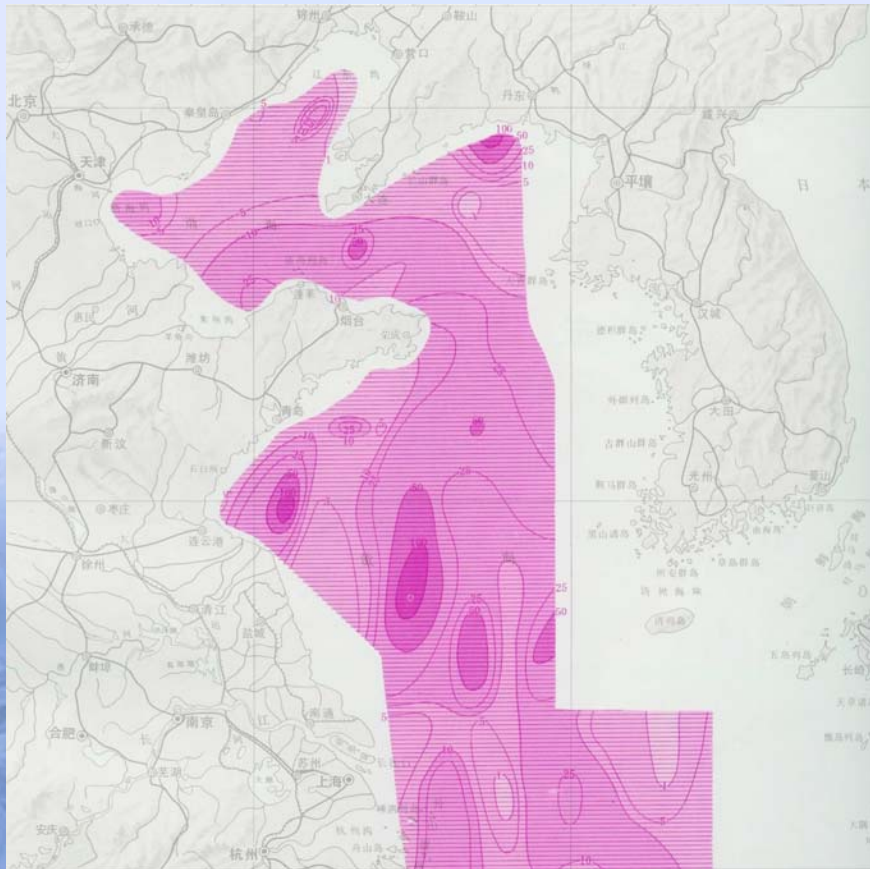
- In the northern Yellow Sea, benthic biomass is 1.71 — 19.07g/m³ with an average of 5.01g/m³ in the shallow waters shallower than 10 m.
- There are 96 benthic species, including 34 molluscs, 16 arthropods, 16 fishes, 14 echinoderms, 6 annelids, 3 chordates, 2 coelenterates and 2 Porifera.
- In shallow sea deeper than 10 m, the average biomass of benthos is 2.28g/m³. There are 160 benthic species here, including 37 fishes, 121 invertebrates and 2 algae.
- Molluscs account for 35% of the total species numbers, echinoderms 26%, arthropods 16%, annelids 12%, coelenterates 3%, molluscoids 2%, protochordates 2%, and some Porifera, nematodes, and nemertines.

- In Bohai Straits, there are 89 benthic animals, including 39 molluscs, 23 crustaceans, 18 echinoderms and others. Algae amount to 120 species, including 75 rhodophytes, 29 phaophytes and 12 chlorophytes.
- In the shallow sea along Shandong Province, there are 272 benthic species, including 106 polychaetes, 74 molluscs, 64 crustaceans, 17 echinoderms, and 11 coelenterates, nemertines, bryoazoans, molluscoids, protochordates and fishes.
- Along northern Jiangsu coast, there are 183 benthic species, including 78 molluscs, 62 crustaceans, 31 annelids and 4 coelenterates. They are composed warm water species and the dominant species are *Scapharca subcrenata*, *Setipinna taty* and *Portunus trituberculatus*.

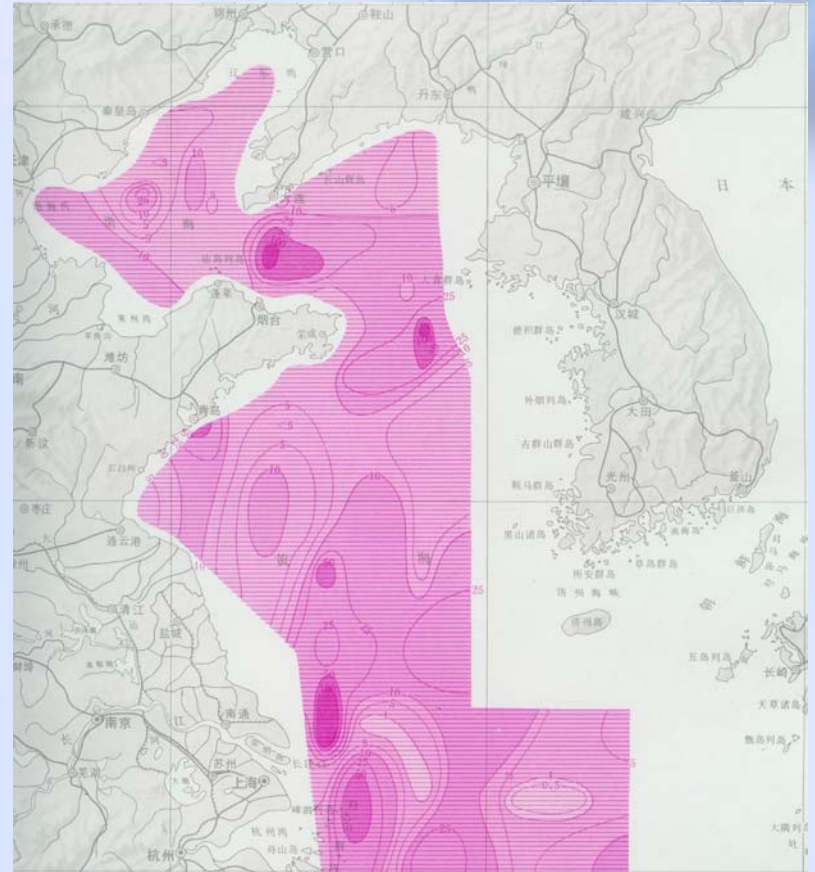
Annual average distribution of total benthos biomass of Yellow Sea



Total benthos distribution of Yellow Sea in Spring and Summer



Total benthos distribution of Yellow Sea in Fall and Winter

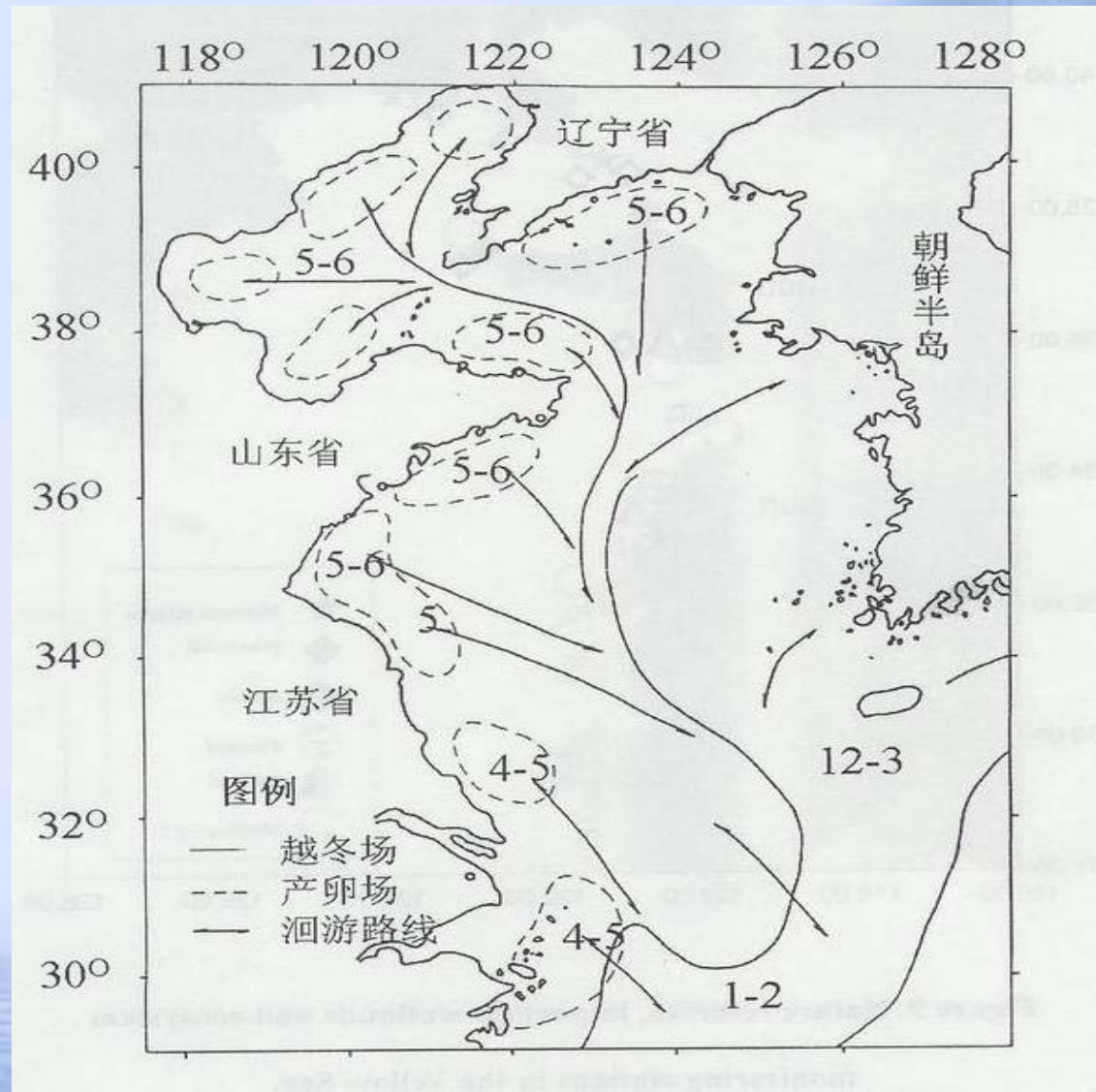


■ Fishery resources

- The fishery resources in the Yellow Sea Marine Ecosystem are diverse and abundant. There are about 300 fish species, 41 crustaceans and 20 cephalopods in this region. Warm-temperate species are more dominated than warm-water species among the fishery species. There are few cold-temperate species in this region.
- (1) The regional species. They are mainly distributed in those shallow waters of estuary and in vicinity of insular and reef, the animals of the regional resources usually move within a limited bound, for instance, seasonally move between deep waters and shallow waters for reproduction, feeding and wintering. Normally, the obvious pattern of the migration is seldom observed. There are a number of species of this group. They are mainly warm-temperate regional species like jellyfish (*Rhopilema esculenta*), Acetes shrimp (*Acetes chinensis*), blue crab (*Portunus trituberculatus*), tongue fish (*Cynoglossus semilaevis*), mullet (*Liza so-iuy*), sea bass (*Lateolabrax japonicus*), skate (*Raja spp.*), goby fish (*Gobiidae*), greenling (*Hexagrammos otakii*), Pacific Ocean perch (*Sebastes fuscescens*), croaker (*Collichthys*), jewfish (*Johnius belengerii*), common asohos (*Sillago sihama*), Pacific herring (*Clupea pallasii*) and Pacific cod (*Gadus macrocephalus*) etc..

- (2) The migratory species. They mainly consist of the warm-temperate and warm-water species conducting long distance migration on a certain pattern and distributing widely. Figure shows the migration patterns of the significant migratory resources. During the spring seasons (March to April), when the water temperature is increasing, the species migrate from the central-southern part of the Yellow Sea and the northern part of the East China Sea to the Bohai Sea and the coastal shallow waters of the Yellow Sea for spawning. After the reproduction peak in May and June, most species leave the shallow waters and disperses in the waters with 20 to 60 m depth for feeding until summer. During autumn seasons when the water temperature is decreasing, the fish school gradually moves to the deeper waters with a depth of 60-80m and higher temperature for wintering. The species diversity of the migratory resources seems less than that of the regional resources, but their biomass is much more abundant. The catches are mainly from the migratory species.
- The main commercial species include Spanish mackerel (*Scomberomorus niphonius*), chub mackerel (*Pneumatophorus japonicus*), pomfret (*Stromateoides sinensis*), Japanese anchovy (*Engraulis japonica*), half fin anchovy (*Setipinna taty*), Chinese herring (*Ilisha elongata*), small yellow croaker (*Pseudosciaena polyactis*), yellow drum (*Nibea albiflora*), penaeid shrimp (*Penaeus chinensis*), southern rough shrimp (*Trachypenaeus curvirostris*) and cuttle fish etc.

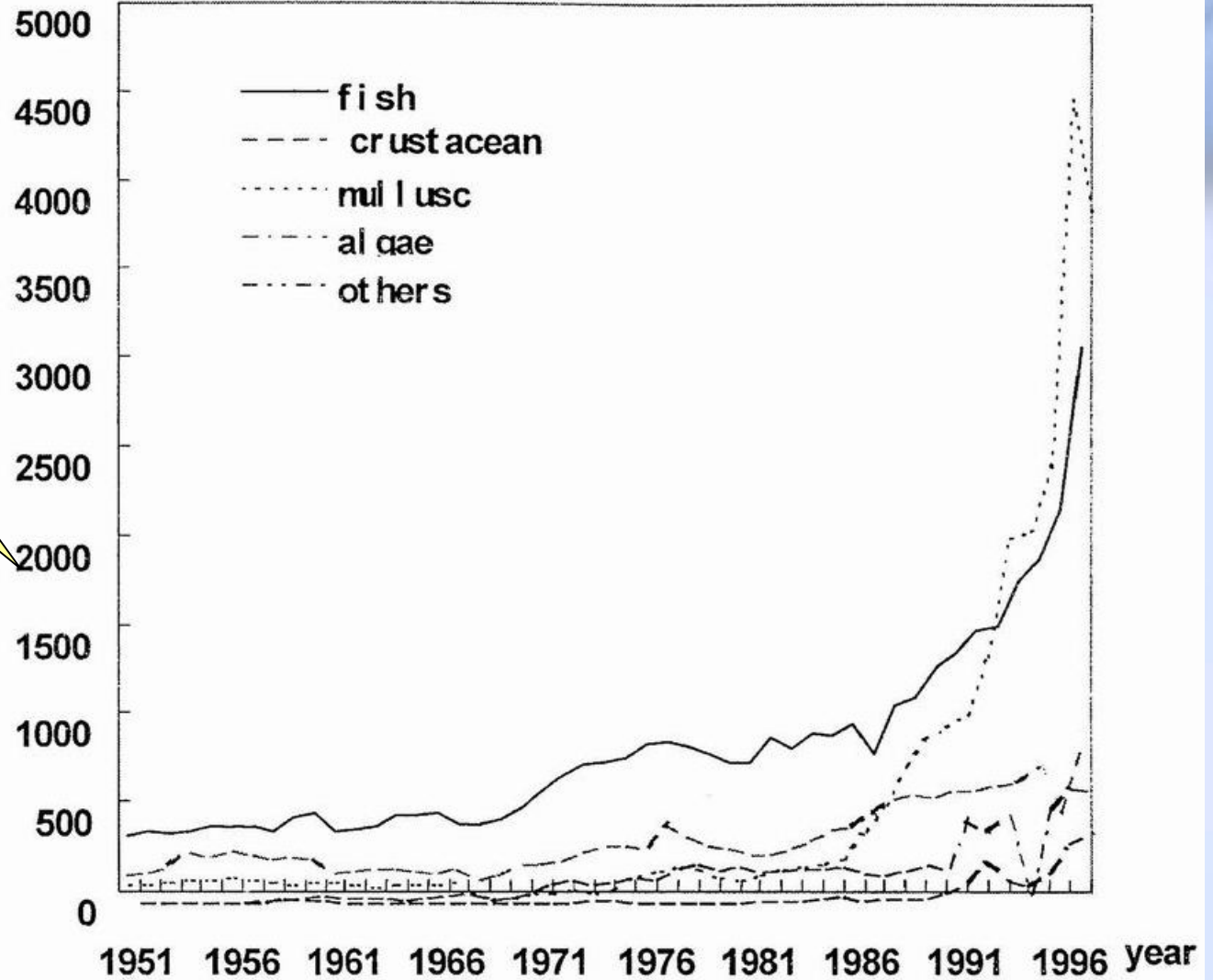
Wintering
and
spawning
migration of
fishery
resource



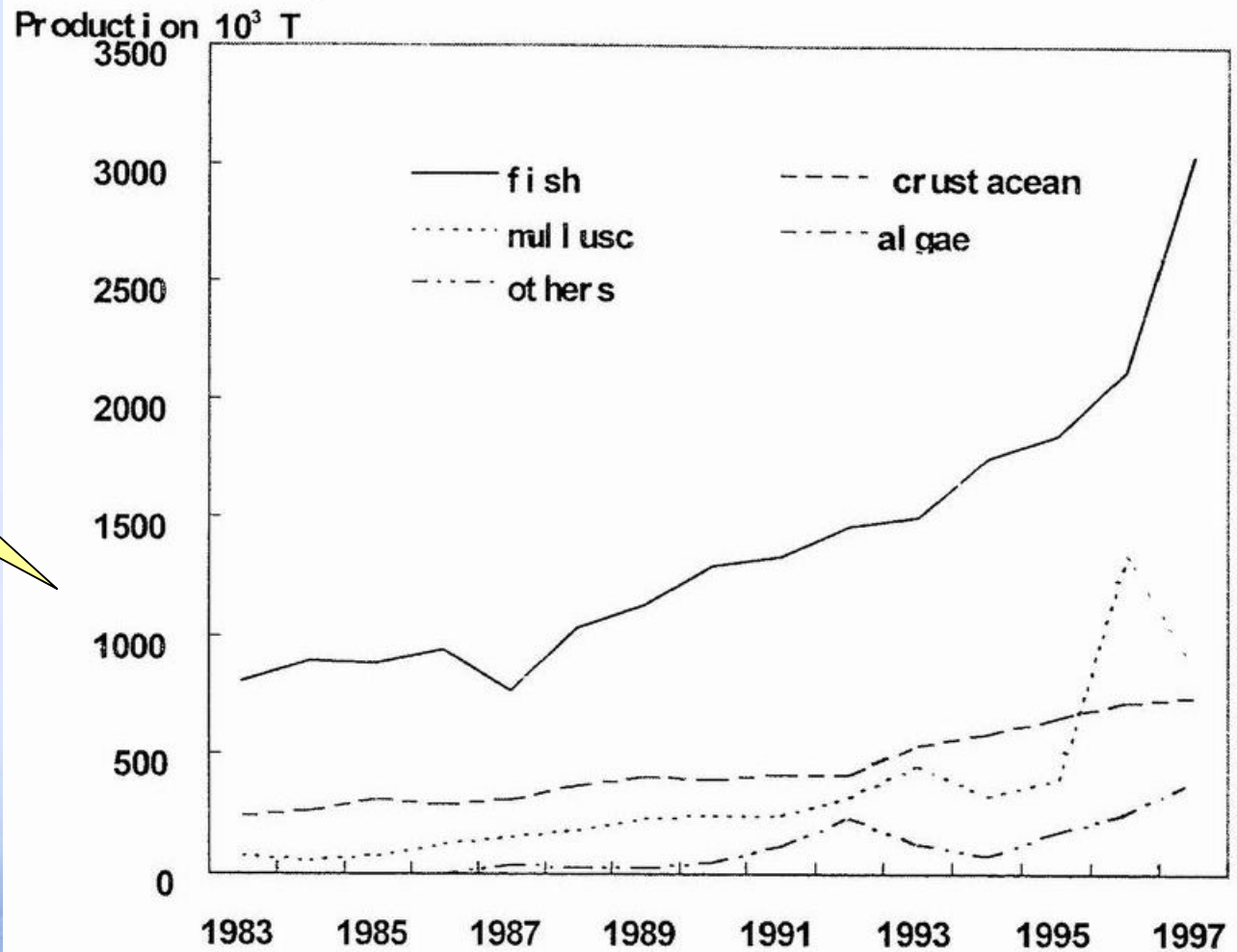
- In the 1950's, the economically important species in the Yellow Sea were small yellow croaker, largehead hairtail (*Trichiurus haumela*) and penaeid shrimp etc.
- In the early 1970's, the stock of Pacific herring outbursts and became a major fishing target with a yearly landing over 1.8 million tons in 1972.
- In the 1980's, the stocks of some other pelagic fish like half fin anchovy, Japanese anchovy, chub mackerel and Spanish mackerel seemed increasing to some extent.
- Since the mid-1980's, the abundance of Japanese anchovy became the largest one among those pelagic species. According to a ten-year survey carried out by R/V "Bei Dou" from Yellow Sea Fisheries Research Institute, the biomass of Japanese anchovy in Yellow Sea annually varied from 2.5 to 4.3 million tons, while cod, hairtail and Penaeid shrimp were seldom found in the catches.
- The recent surveys showed that the abundance of Japanese anchovy is declining, while the biomass of sandlance (*Ammodytes personatus*) is increasing and the stock of small yellow croaker showed a recovery indication.

Annual aquatic production from Yellow Sea

Production 10^3T



Annual
fishing
production
of Yellow
Sea & Bohai
Sea



4. Ecosystem changes

1) Changes

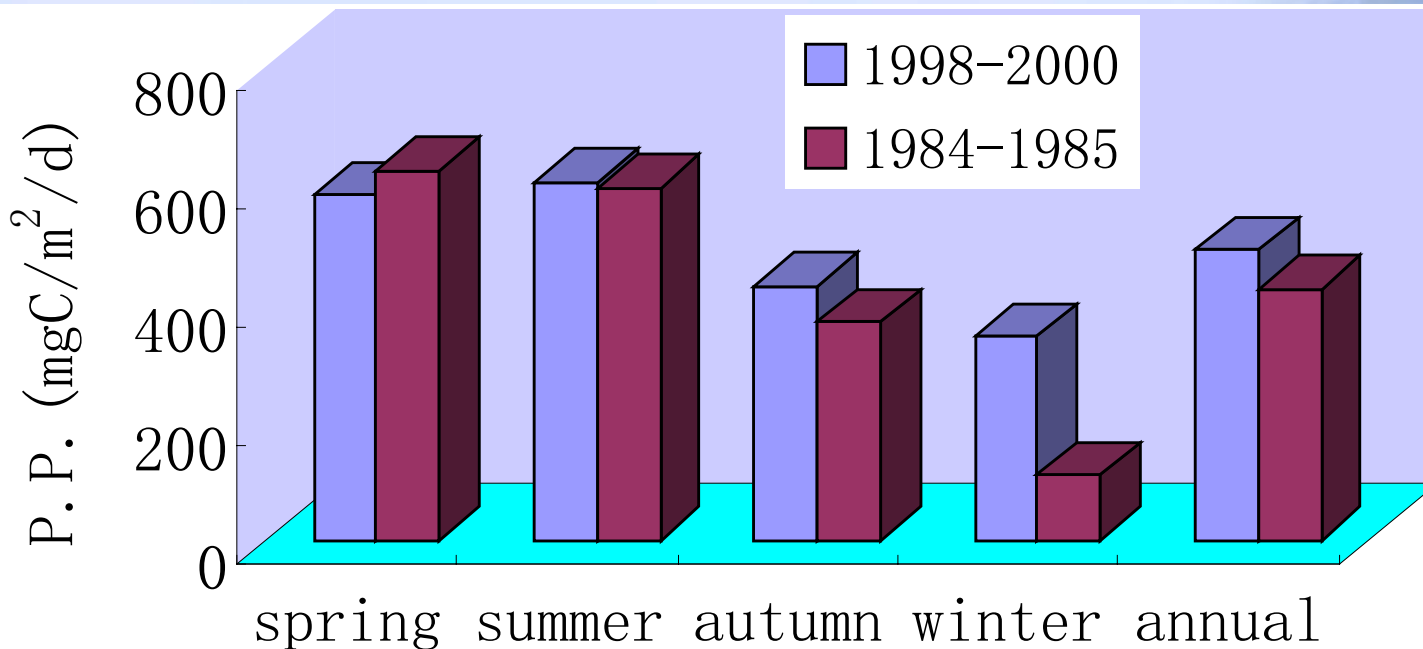
- **Red tide.** It has been found that there are more than 60 red tide species in Yellow Sea. Among them *Noctiluca scintillans*, *Prorocentrum minimum*, *Prorocentrum micans*, *Gonyaulax polyedra*, *Skeletonema costatum*, *Pseudonitzschia pungens*, *Mesodinium rubrum*, *Heterosigma akashiwo*, *Asterionellopsis glacialis* are the main red tide species.
- The red tides that occur at present on Chinese side in Yellow Sea are not too frequent as in adjacent waters --- Bohai and East China Sea,

- At present, red tide will occur more often near estuaries (Yangtze River Estuary), semi-enclosed bays (Jiaozhou Bay and Haizhou Bay), and intensive aquaculture areas. The frequency, area and time of red tide will increase if there are no effective control measures.

The background features a light blue gradient with faint, sketch-like architectural drawings of buildings and structures. A prominent yellow horizontal bar is centered across the middle of the page, containing the title text in a bold, red, serif font. The top and bottom edges of the image are framed by a dark, textured border that resembles a brick or stone pattern.

Primary Productivity

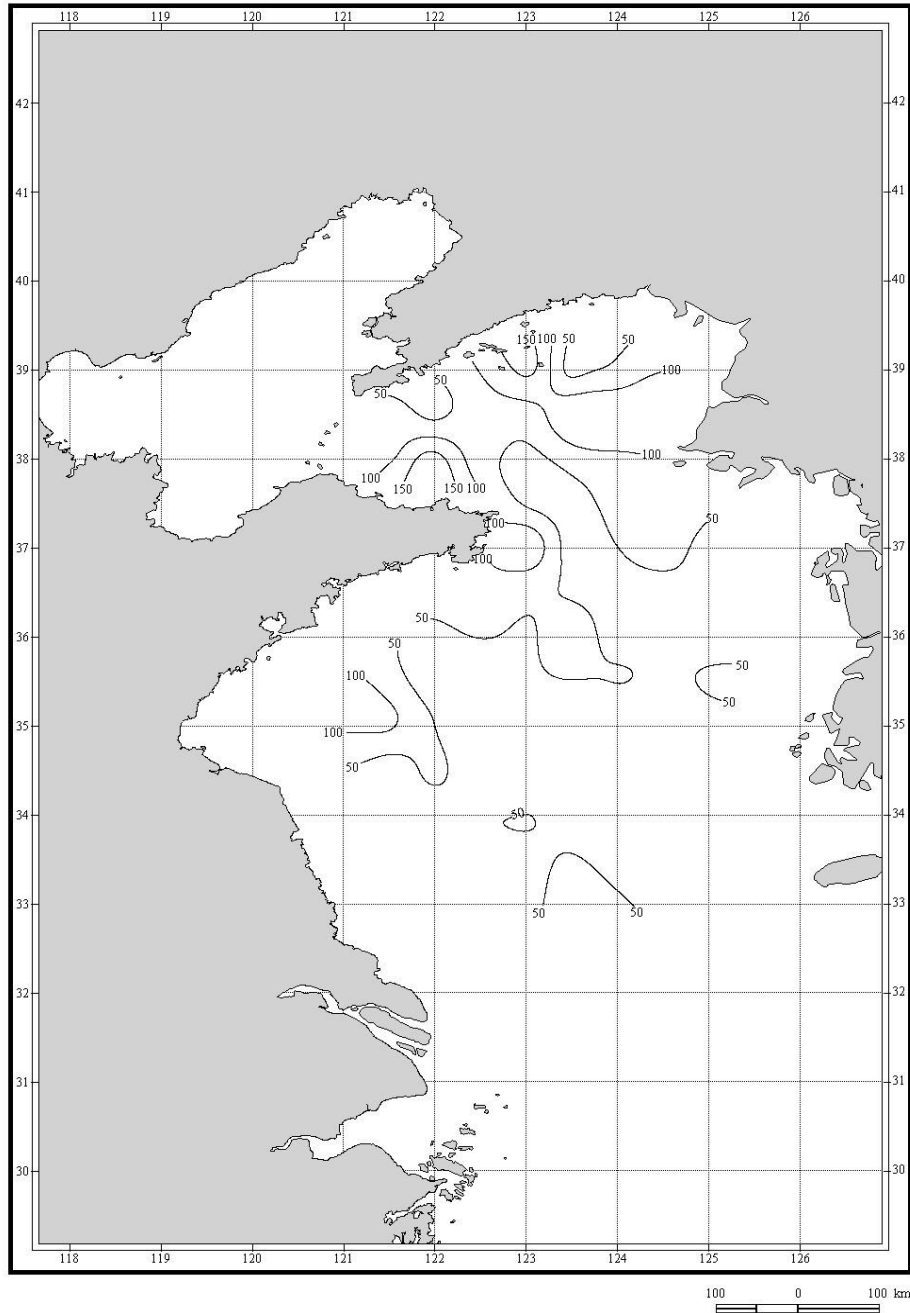
primary productivity



spring	summer	autumn	winter	annual	time
582.67	603.48	428.82	344.20	489.8	1998-2000
623	596	369	111	425	1984-1985

mgC/m³h

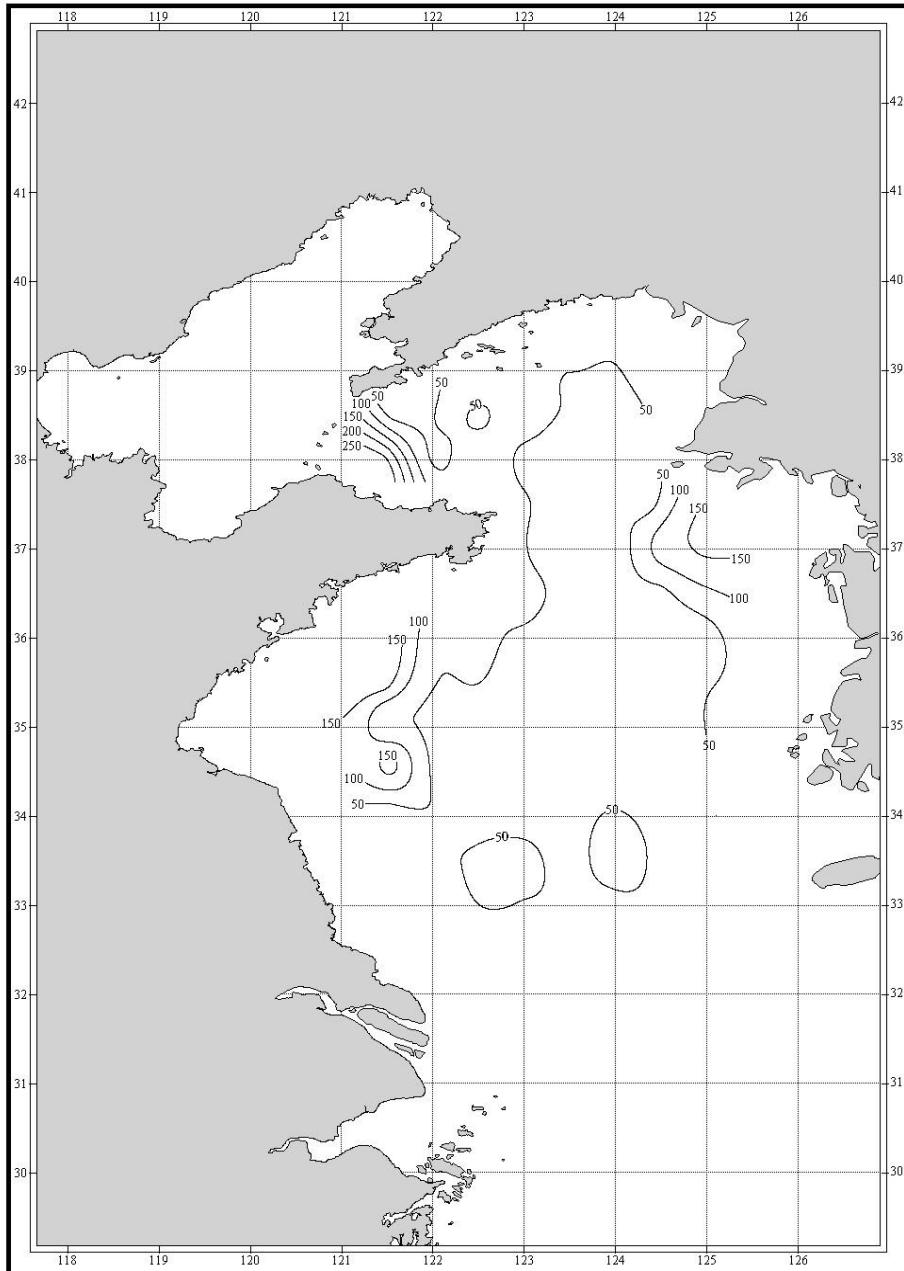
Horizontal distribution of P.P. in Spring during 1998-2000



The area with high primary productivity was in middle of North Yellow Sea and Bohai Strait

单位: $\text{mgC}/\text{m}^3\text{h}$

Horizontal distribution of P.P. in Summer during 1998-2000

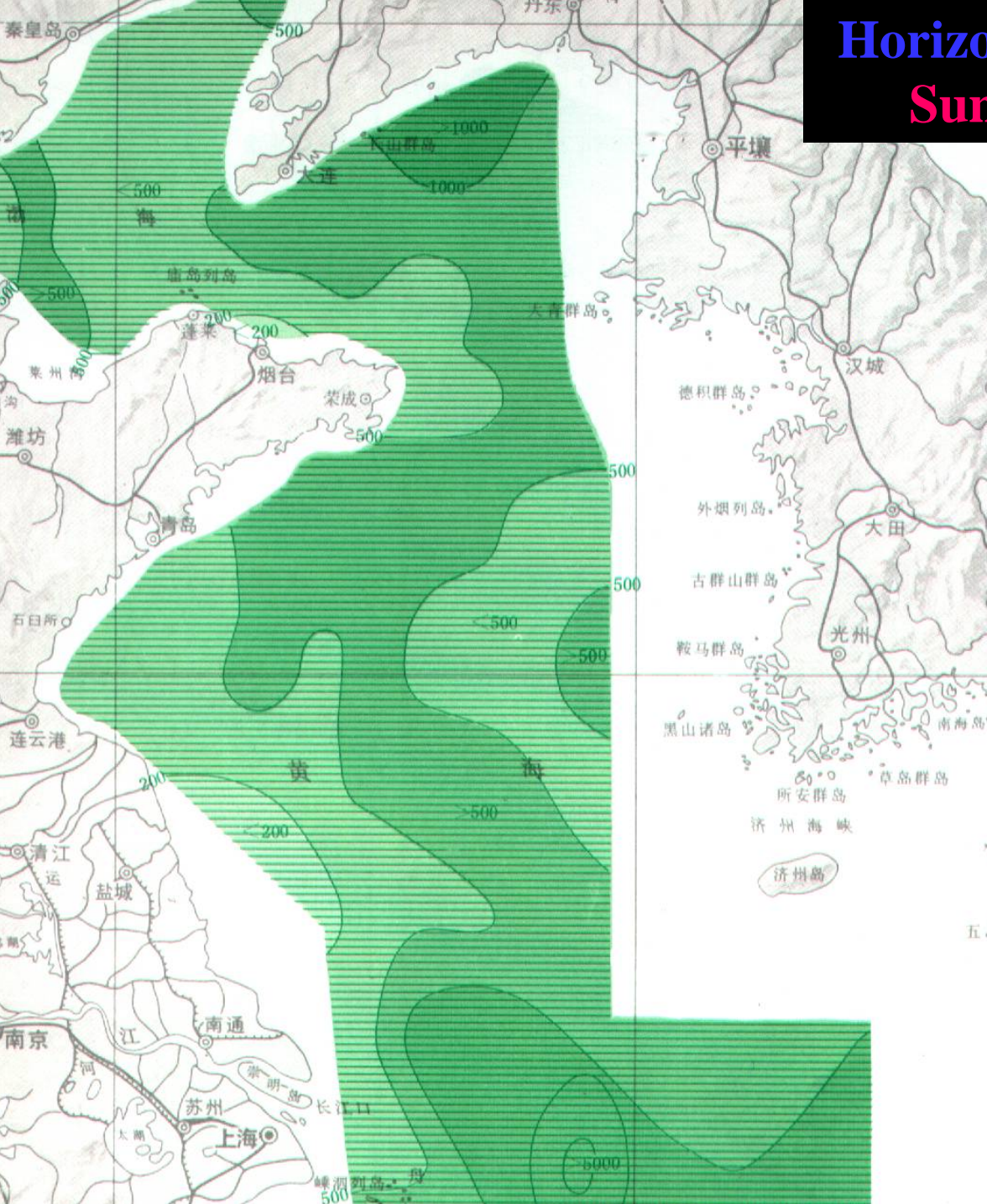


In summer, the high value area was similar with that in spring

调查时间: 2000年8月

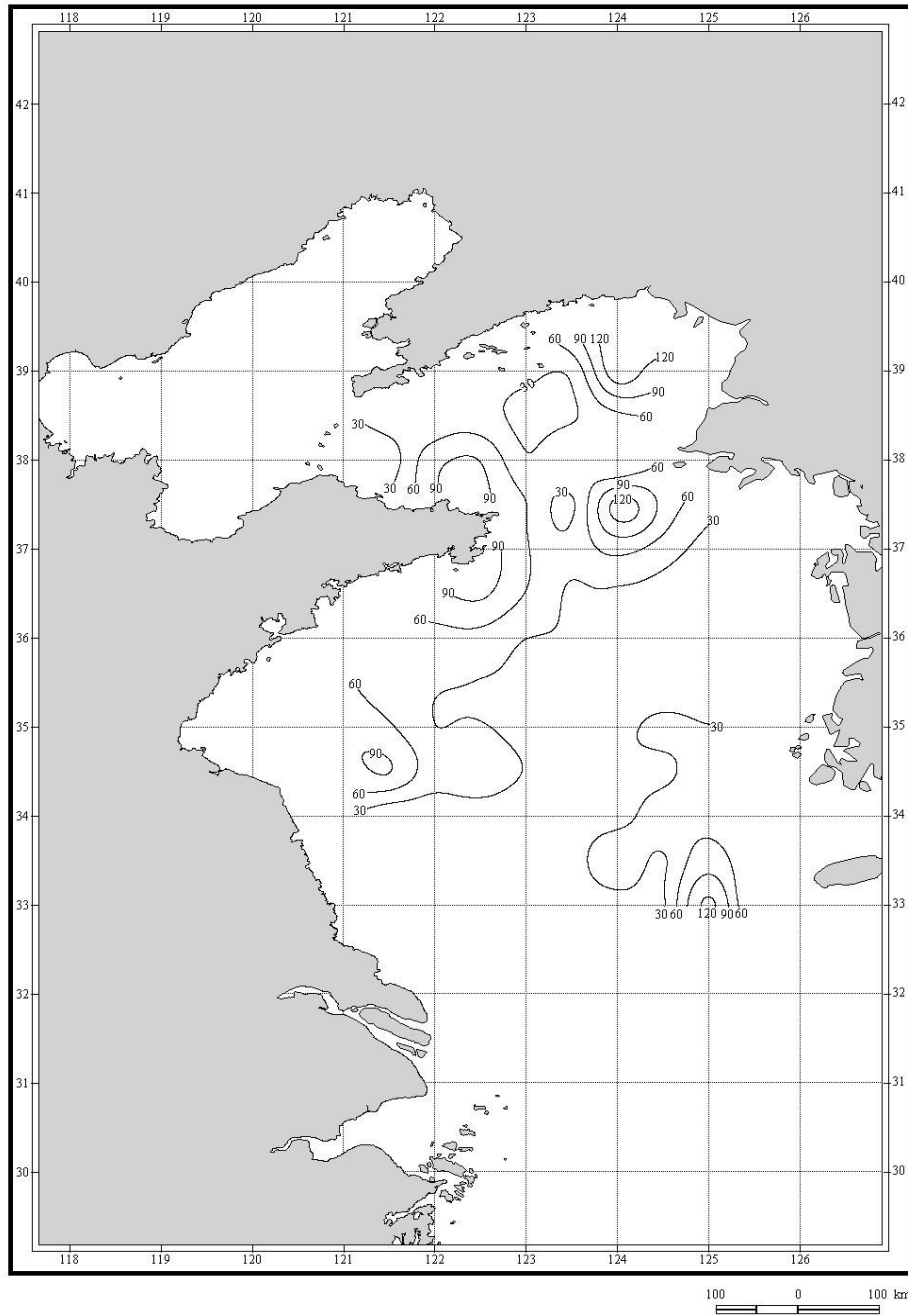
100 0 100 km

Horizontal distribution of P.P. in Summer during 1984-1985



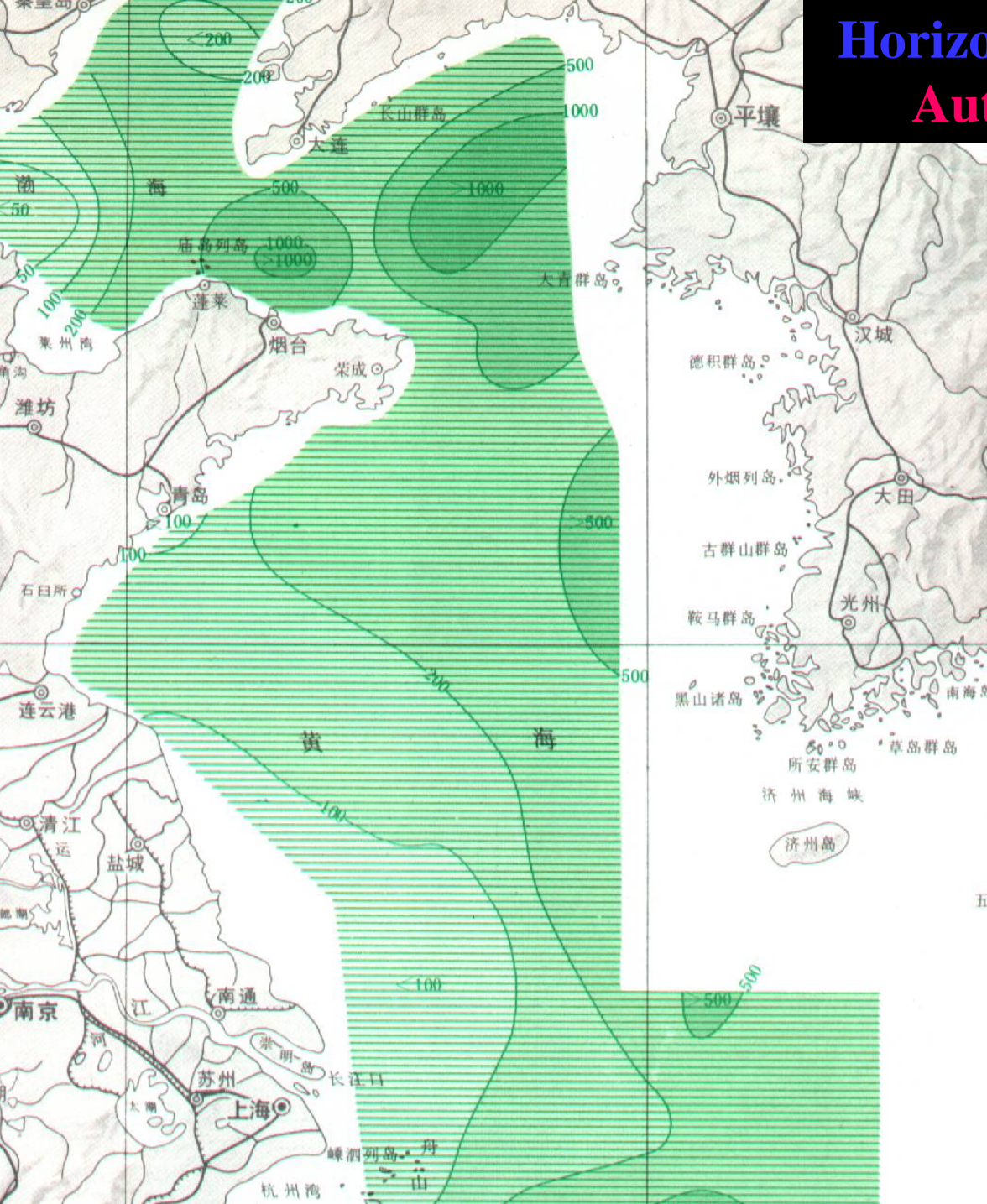
mgC/m²h

Horizontal distribution of P.P. in Autumn during 1998-2000



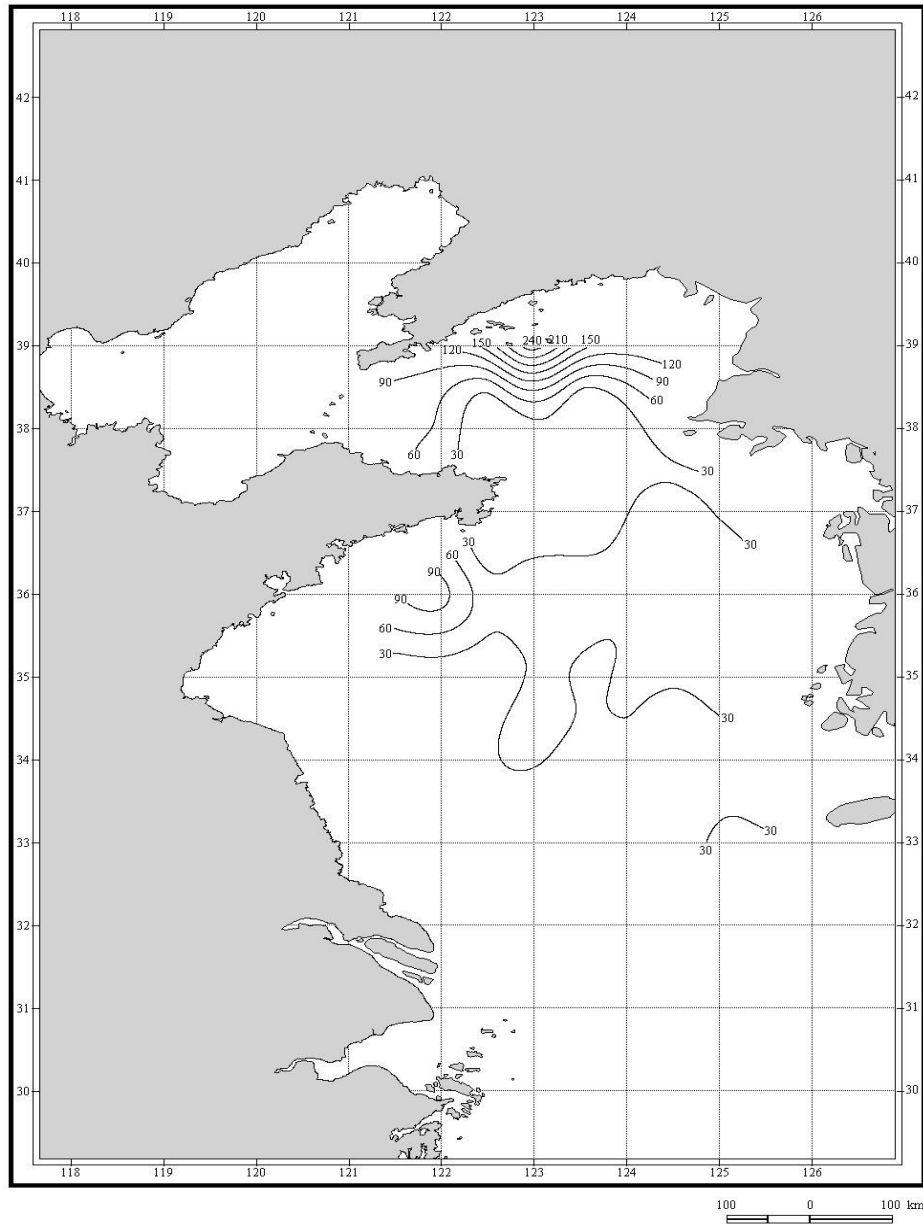
**In autumn, it was in north of
Yellow Sea and east of
Shandong Peninsula**

Horizontal distribution of P.P. in Autumn during 1984-1985



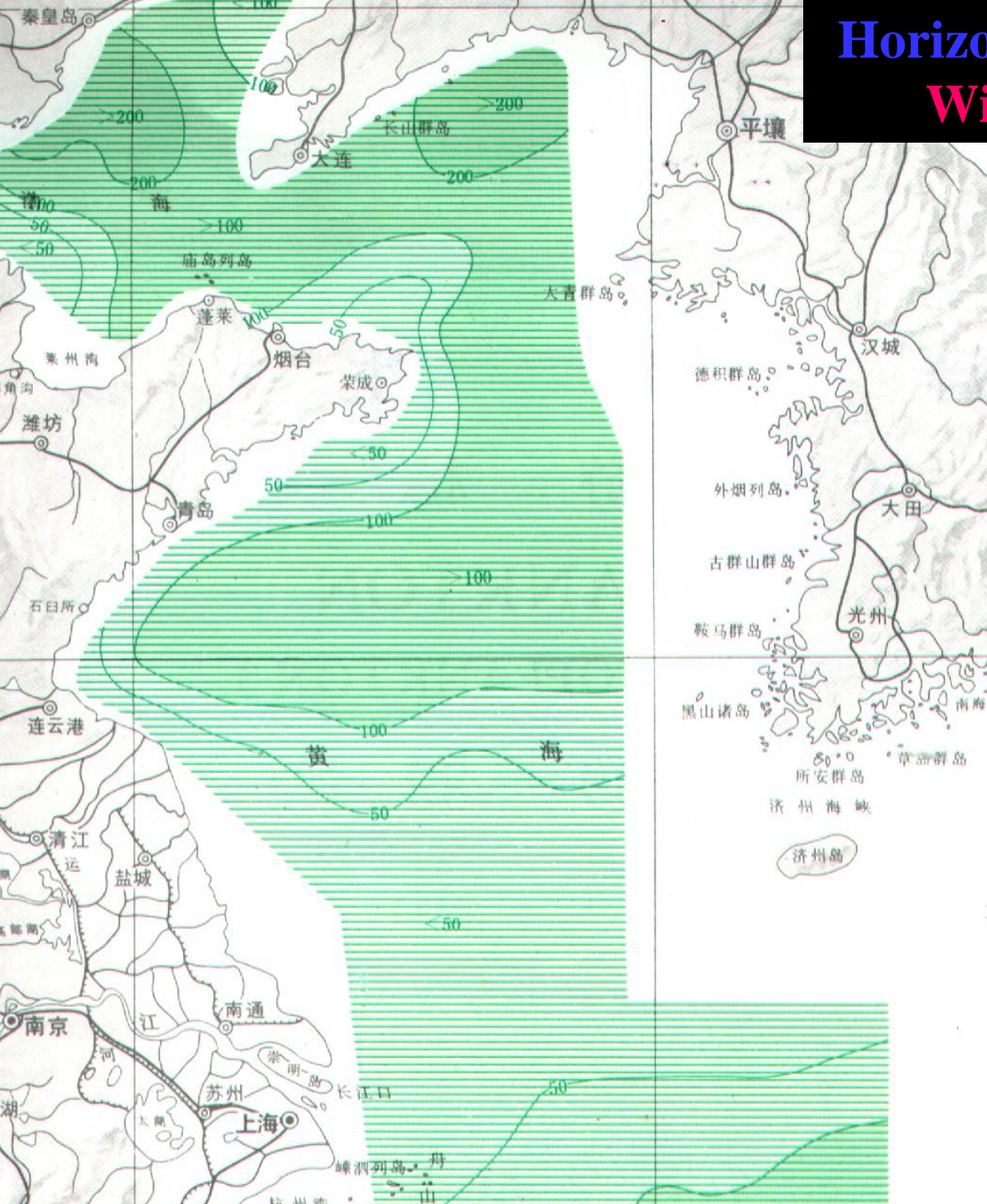
mgC/m³h

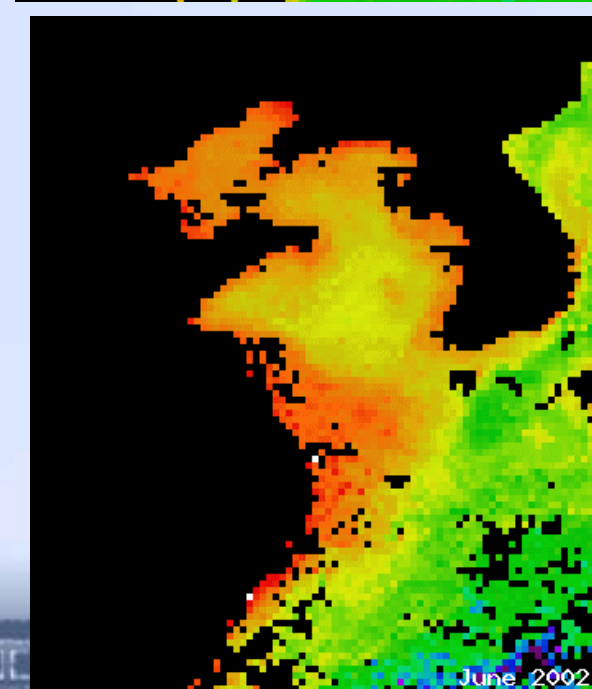
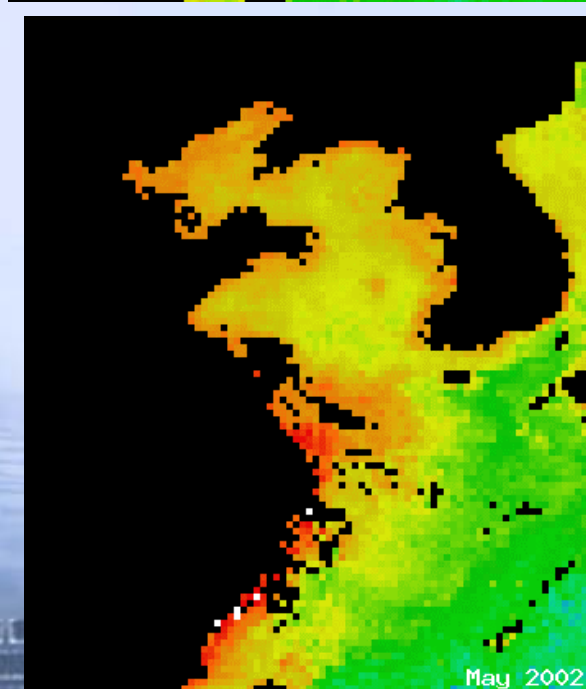
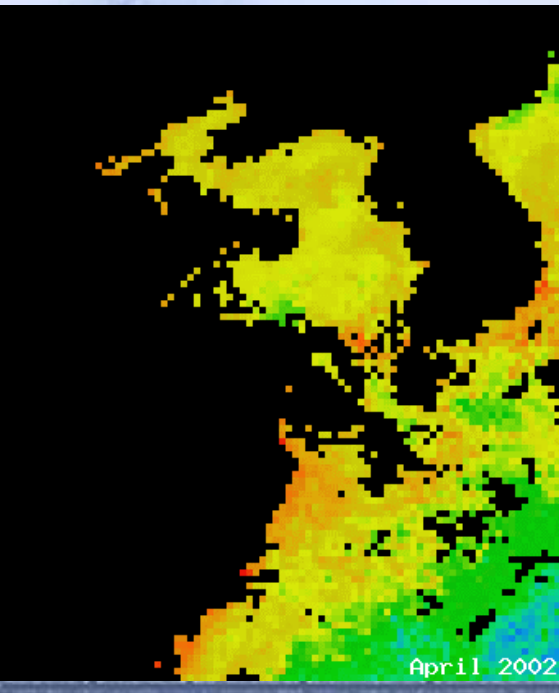
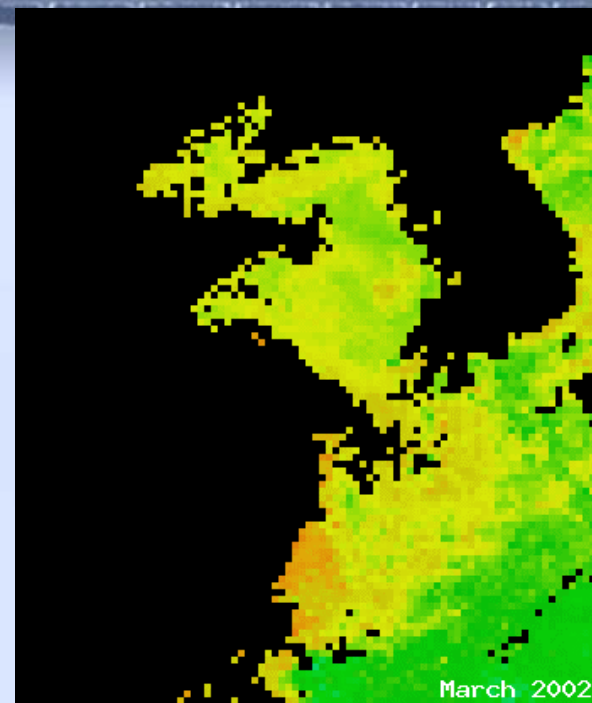
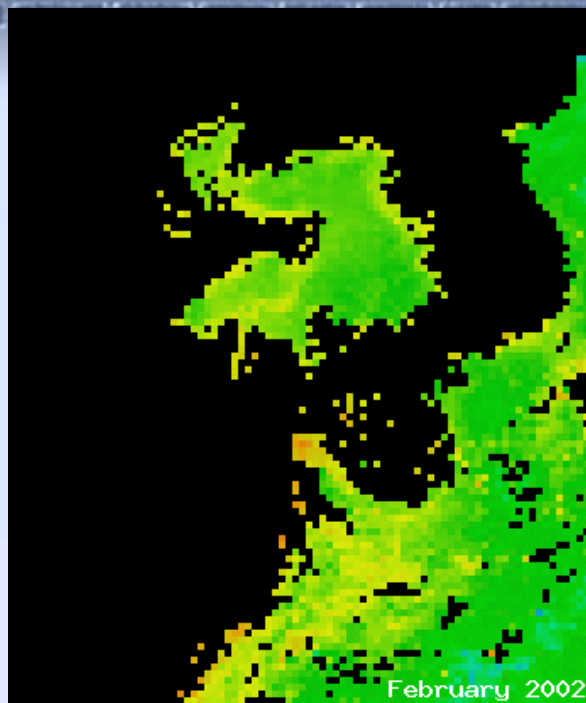
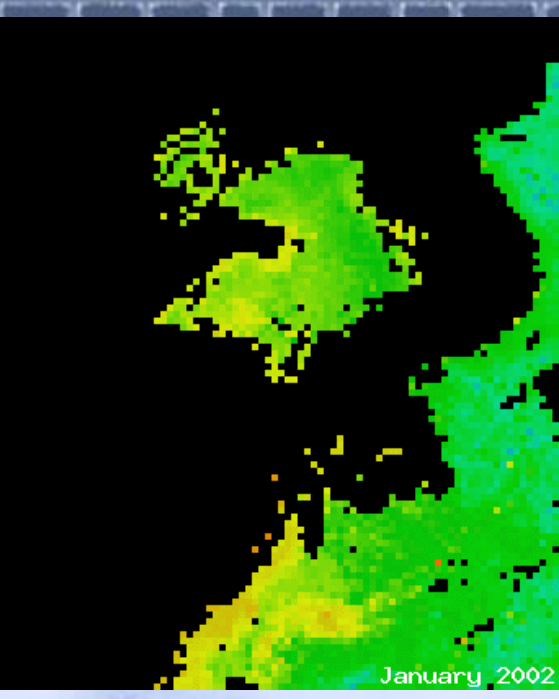
Horizontal distribution of P.P. in Winter during 1998-2000

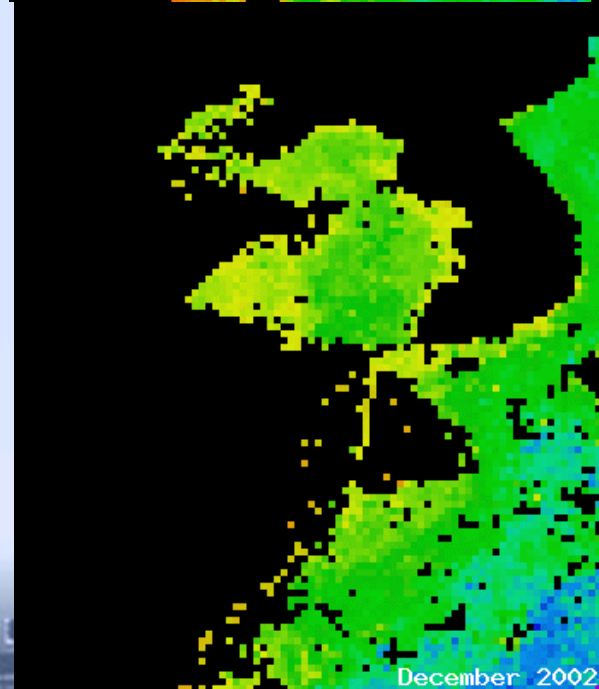
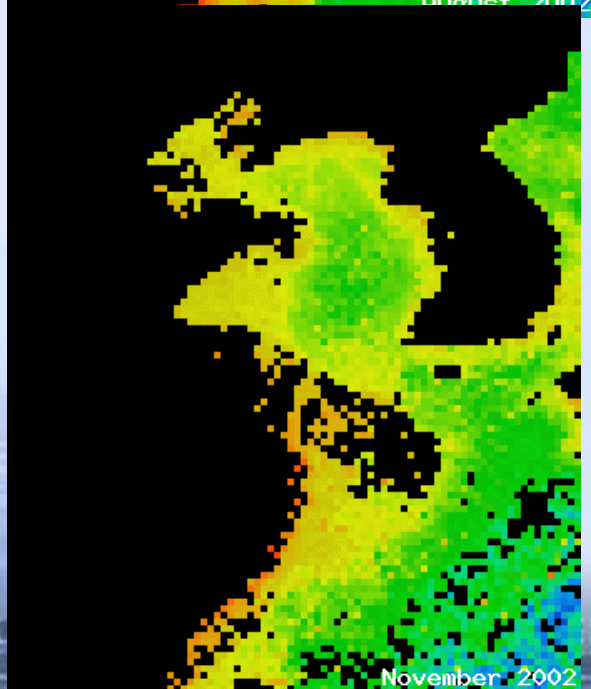
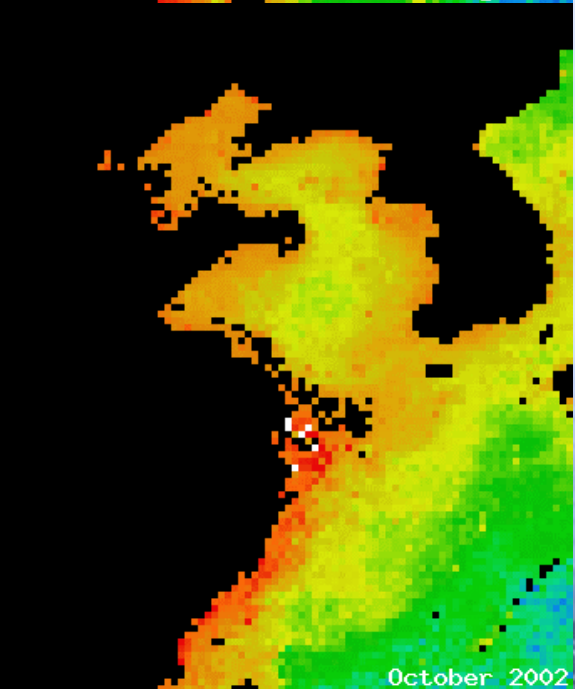
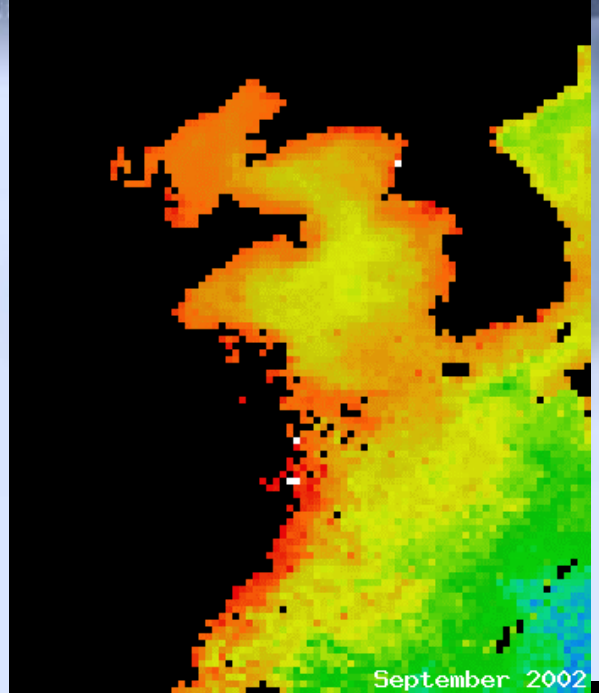
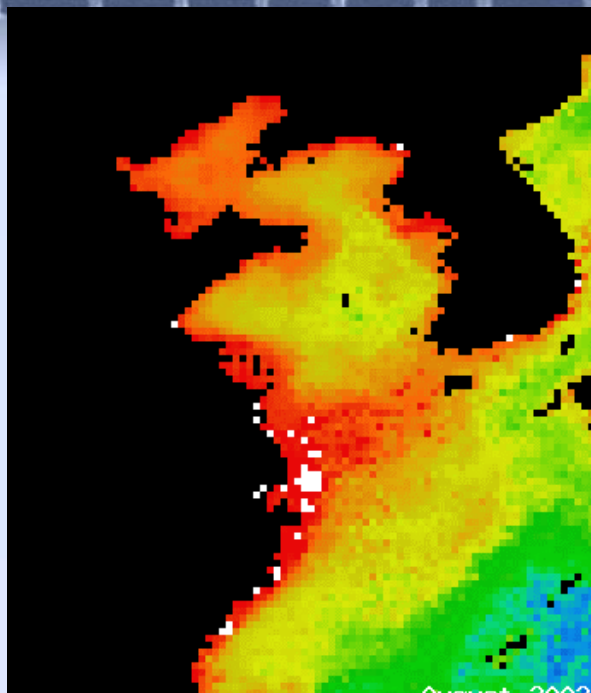
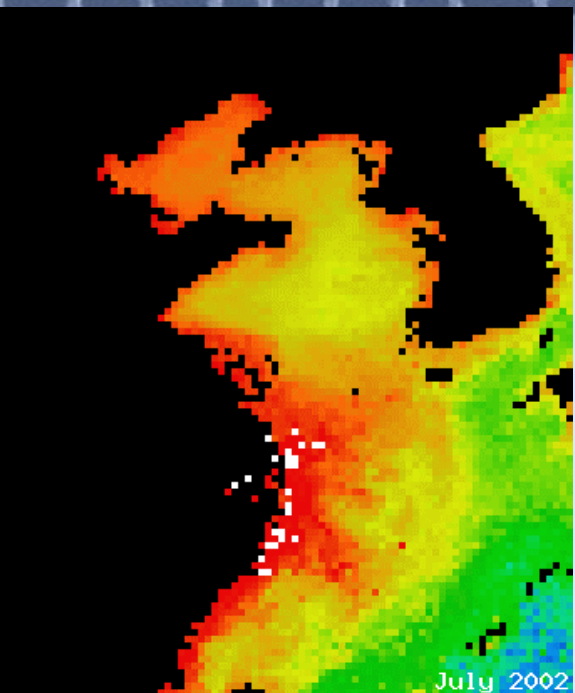


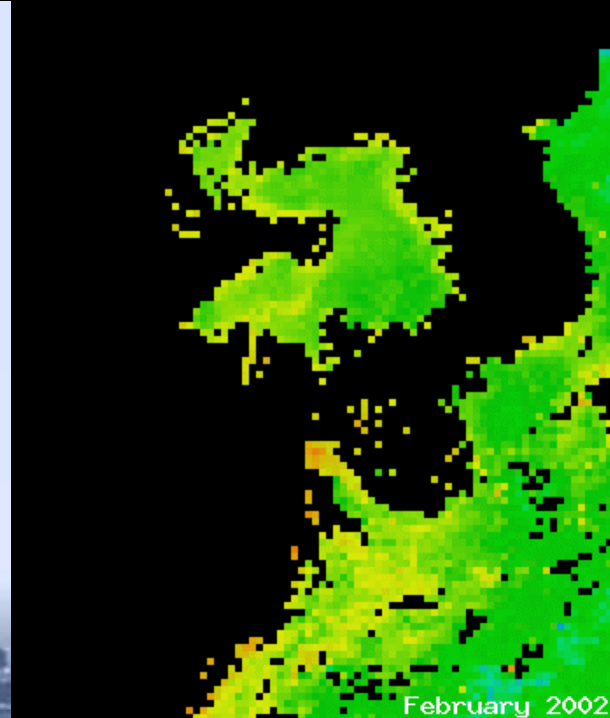
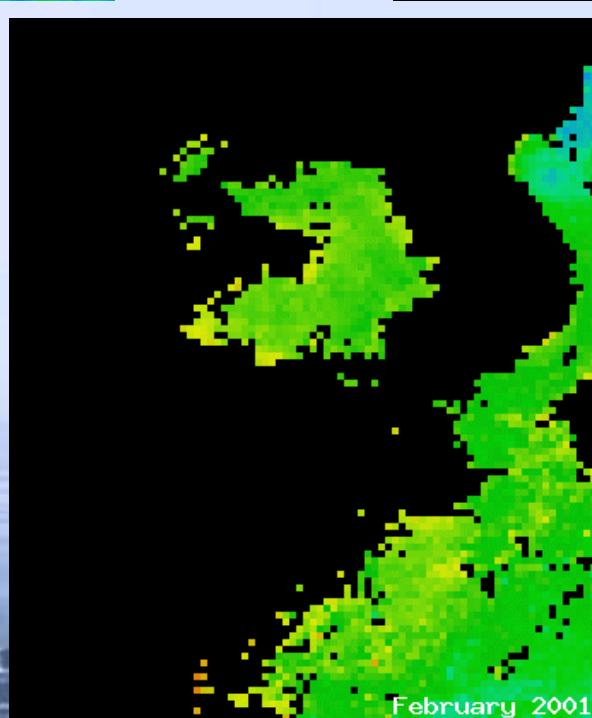
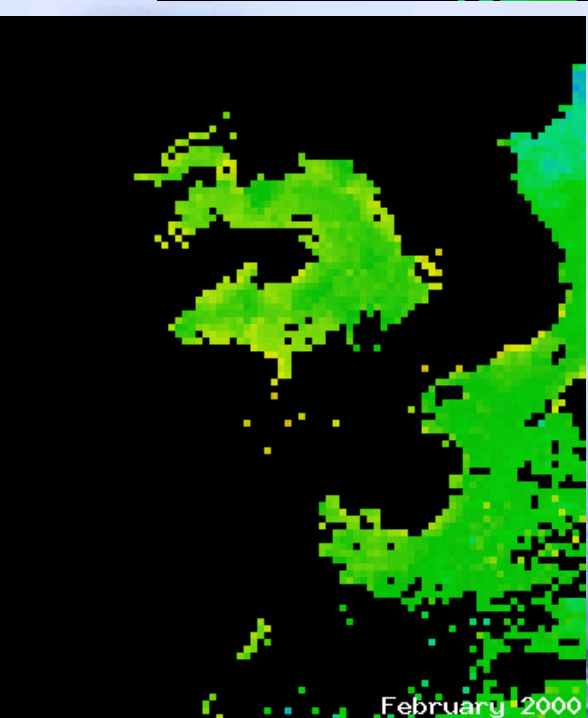
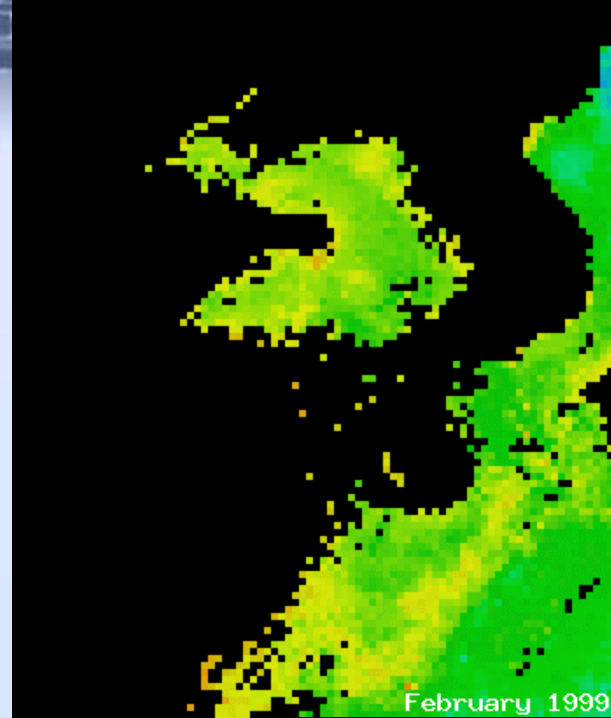
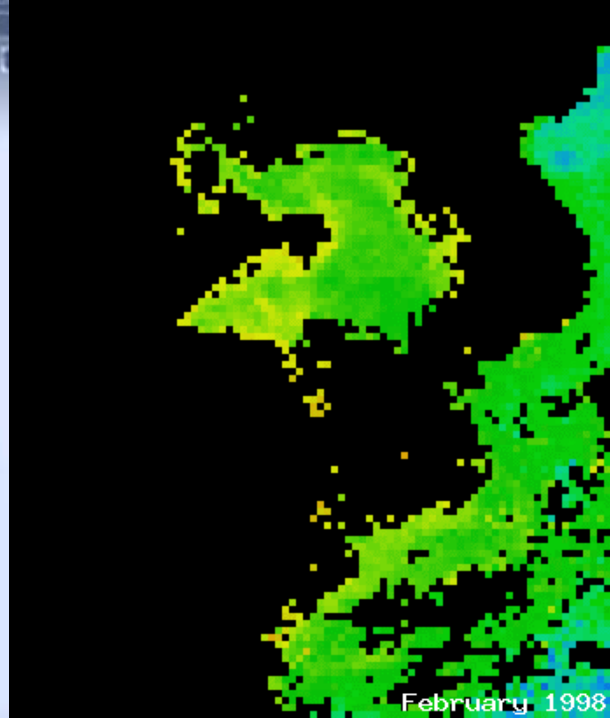
In winter, high value area was in north part again.

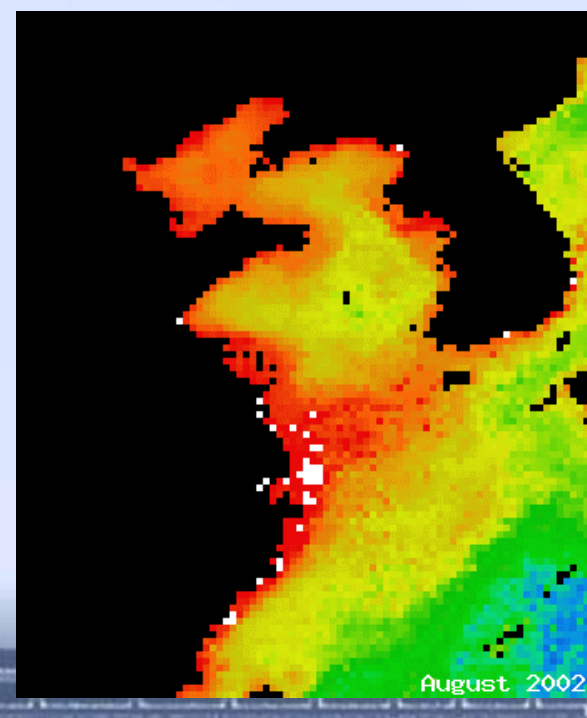
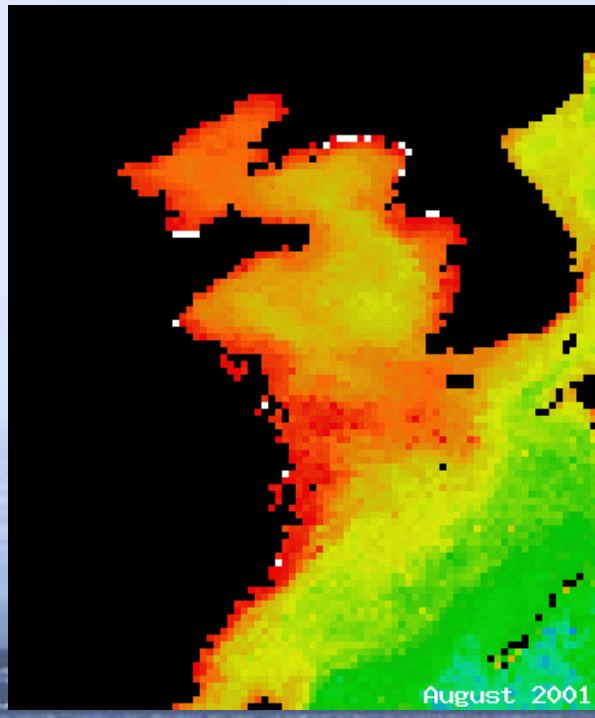
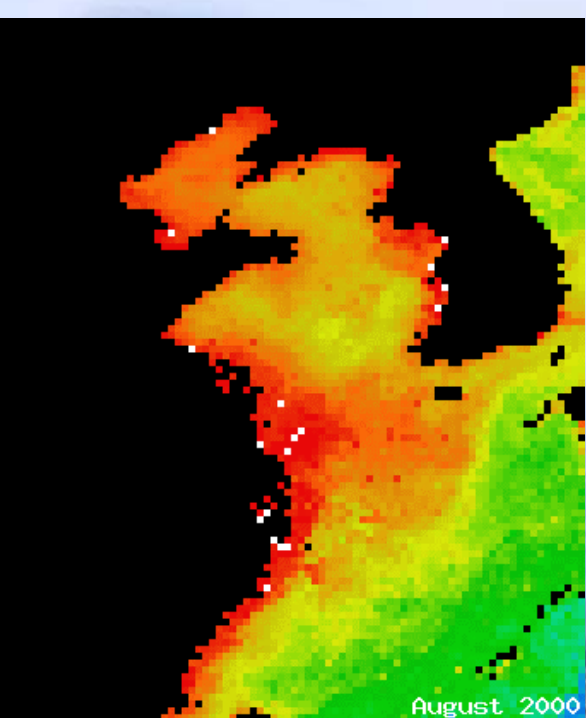
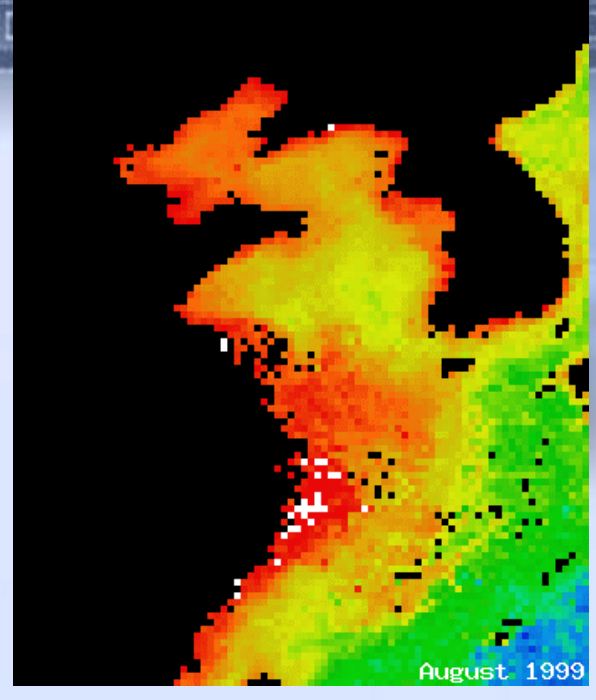
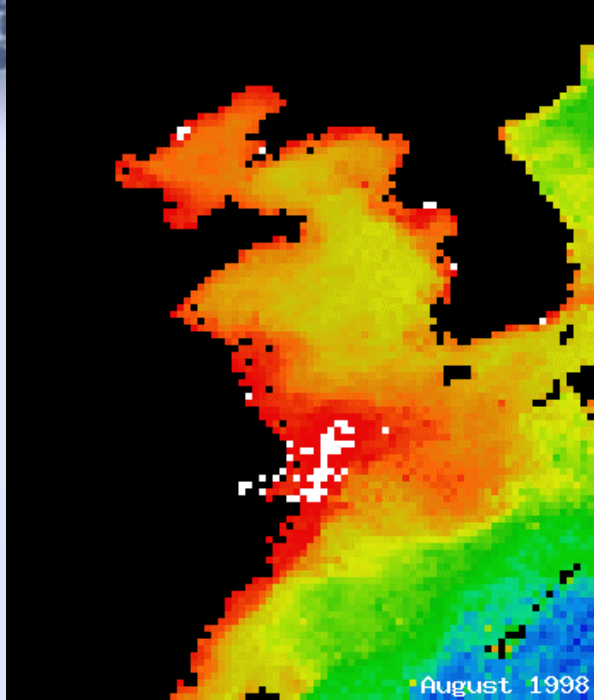
Horizontal distribution of P.P. in Winter during 1984-1985









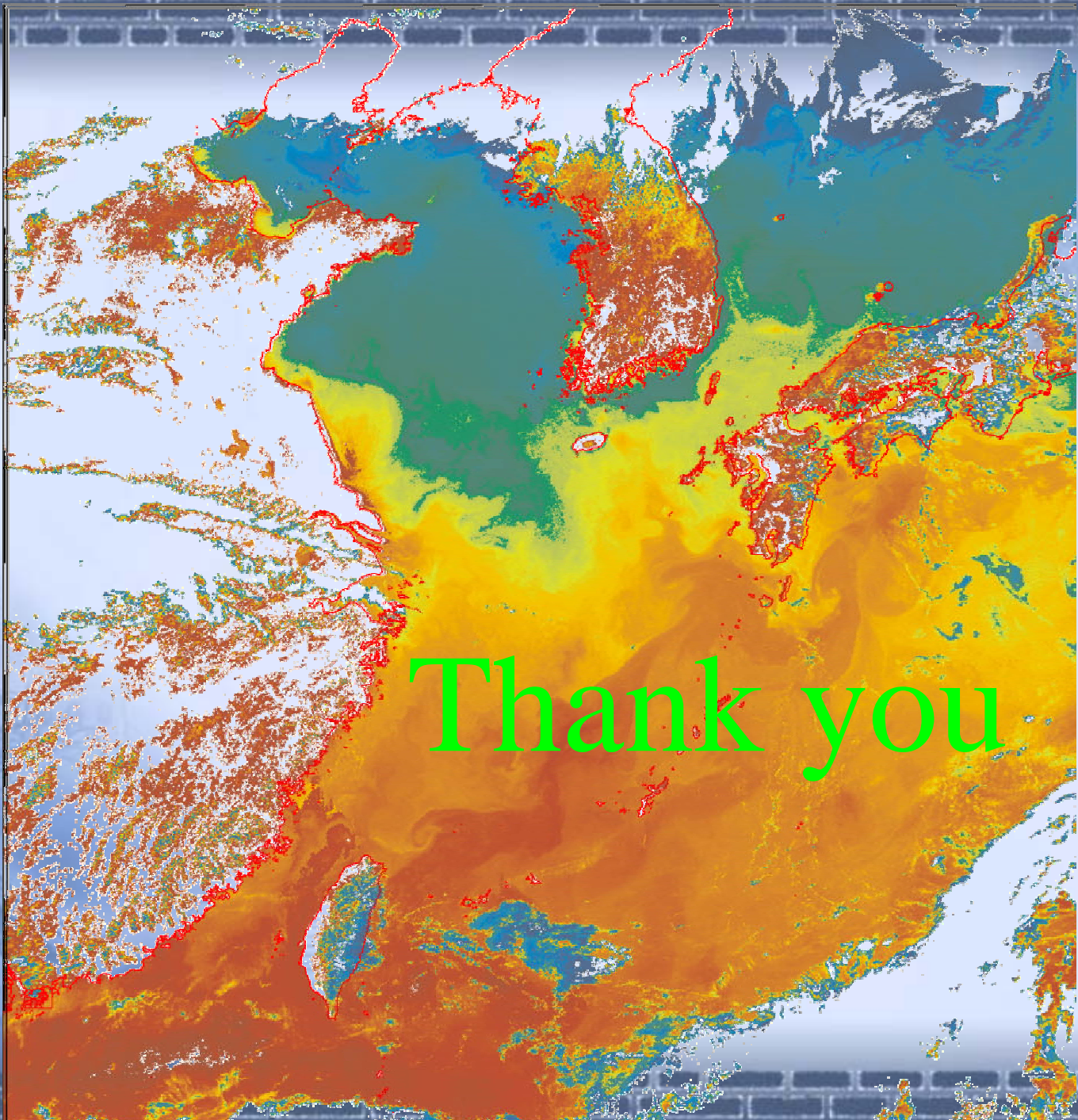


Fishery resource decline and dominant species changes. Under the stress of strong fishing force, as well as of environmental changes over the past decades, the construction of living marine resources has changed a lot in Yellow Sea. The catch for some important commercial species, such as *Pseudosciaena crocea*, *Pseudosciaena polyactis* and *Trichiurus haumela*, decreased sharply; large demersal fishes have been replaced by small pelagic species of lower commercial value in the catch; maturation comes earlier in some species and the size of major spawning field has reduced.

- Along with the increasing discharge of pollutants from the coast and the increasing red tides, the coastal seawaters, which is rich in spawning fields and hatcheries and mariculture activities, is facing more threatens and this will damage the health of Yellow Sea and therefore the fishing and mariculture industries.

- Benthic trawlers dominate in Yellow Sea fishing. It is unreasonable because they harm the juvenile fishes and cannot make the best use of different fishing resources.

- **Degrading Biodiversity.** Marine exploitation threatens Yellow Sea environment health and its biodiversity. As mentioned previously, fish resources has declined, and in some seriously polluted region as in the intertidal zone off Cangkou, Jiaozhou Bay, only pollution-tolerating organisms lives there now. As the economics and population grows in the coastal countries, both industrial and municipal waste water discharge will increase significantly. They, along with marine oiling, shipping, tourism, mining, and engineering, etc., will cause more serious damage to biodiversity in Yellow Sea. As many marine organisms, especially the fishes, are migratory, degrade of biodiversity in one region might harm others even the whole Yellow Sea.



Thank you

